



BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

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TITLE PLCC EQUIPMENTS		SIGN	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
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		GROUP	TBEM	W.O. No	83012
CUSTOMER	MADHYA PRADESH POWER TRANSMISSION CO. LTD.				
CONSULTANT	-----				
PROJECT	400kV SUBSTATION PACKAGE AT BALAGHAT, BADNAWAR, BHOPAL, CHHEGAON AND NAGDA				

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SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing and dispatch of PLCC Equipments complete with accessories as listed under this specification.

This section covers the specific technical requirements of PLCC Equipments. This constitutes minimum technical parameters for the above item as specified by the customer (MPPTCL). The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

The specification comprise of following sections:

- Section-1: Scope, Specific Technical Requirements and Quantities
- Section-2: Equipment Specification
- Section-3: Project Details and General Specification
- Section-4: Guaranteed Technical Particulars

In case of any conflict between various sections, **order of precedence** shall be in the same order as listed above.

Note: The term 'Owner' appearing in this specification shall refer to MPPTCL, the term 'Purchaser' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.

1.1 THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECT

Name of customer: Madhya Pradesh Power Transmission Co. Ltd. (MPPTCL)

Name of consultant: -----

Name of Projects: 400kV Substation Package at Balaghat, Badnawar, Bhopal, Chhegaon and Nagda

Refer Section - 3 for Project Details and General Specifications.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

- | | | |
|-------|---|--|
| 1.2.1 | Mode of transmission | Amplitude modulation Single side band with suppressed carrier or reduced carrier |
| 1.2.2 | Carrier frequency | 40 to 500 kHz range |
| 1.2.3 | Nominal carrier frequency band
In either direction of transmission | 4.0 kHz |
| 1.2.4 | Power output at HF Terminal | 20W/40W/80W |

1.2.5 Supply voltage 48V DC +15/-20%, -10/-15%

1.2.6 Bidder to validate the wattage of its PLC terminals to ensure that the Power output (PEP) at HF terminal shall be as per the specification. Any input, if required, to validate the offered wattage of its PLC terminal shall be arranged by the bidder. No price implication will be entertained on account of increase in wattage of PLC terminal.

1.2.7 The link frequencies shall be arranged by the bidder during contract stage. No manufacturing hold-up is acceptable on account of non-availability of link frequencies from end customer. In absence of tuning frequencies, vendor shall have to program their PLC terminal with dummy set of frequencies during testing and then re-program them at site after availability of actual frequencies.

1.2.8 Transmission Line Details (*Tentative and shall be confirmed during detailed engineering*)

- a) 400kV S/C Line from Kirnapur (Balaghat) to Seoni (~~approx 80km~~)
- b) 400kV S/C Line from Kirnapur (Balaghat) to Bhilai (~~approx 80km~~)
- c) 132kV D/C Line from Kirnapur (Balaghat) to Balaghat (~~approx 80km~~)
- d) 132kV S/C Line from Kirnapur (Balaghat) to Bhanegaon (~~approx 80km~~)
- e) 132kV S/C Line from Kirnapur (Balaghat) to Dongargarh (~~approx 80km~~)
- f) 400kV D/C Line from Badnawar to Rajgarh (~~approx 80km~~)
- g) 400kV D/C Line from Badnawar to Nagda (~~approx 80km~~)
- h) 220kV D/C Line from Badnawar to Badnagar (~~approx 80km~~)
- i) 220kV D/C Line from Badnawar to Ratlam (~~approx 80km~~)

1.3 QUANTITIES

As per Annexure-1

1.4 TYPE TESTS

The offered equipment should have been successfully type tested as per relevant IS/IEC and valid test reports shall be submitted. Bidder shall submit valid reports of type tests for PLCC Equipments carried out within last **five years from 20.11.2013**. If these tests are more than 5 years old (**from 20.11.2013**) or bidder do not have valid test report, the type test shall be repeated with no extra cost to BHEL/MPPTCL.

1.5 INSPECTION & TESTING

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, as per the relevant IEC/IS standards. A detailed test report proving the successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on each PLCC Equipment in accordance with the applicable IEC /IS and the material shall be offered for final inspection to BHEL and MPPTCL in accordance with agreed quality plan with 3 weeks advance information.

Type test reports on identical equipment shall be submitted for approval. In the event of non-acceptability of submitted test reports on technical grounds at the contract stage, the type tests shall be conducted at no additional cost.

Project: 400kV Substation Package at Balaghat, Badnawar,
Bhopal, Chhegaon and Nagda
Customer: Madhya Pradesh Power Transmission Co. Ltd.
Consultant: -----
Technical Specification: PLCC EQUIPMENTS

Bharat Heavy Electricals Limited
Document No. TB-368-510-018

1.6 QUALITY PLAN

The contractor shall carry out contract works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / customer's approval.

1.7 SPECIAL TOOLS AND TACKLES :

The bidder shall include in his proposal the deployment of all special tools and tackles required for supervision of erection, testing, commissioning and maintenance of the equipment. The Special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature. A list of all such devices shall be furnished.

1.8 SERVICES

1.8.1 SUPERVISION OF COMMISSIONING & SITE TESTING

Supervision of commissioning & site testing of PLCC is in the scope of bidder.

1.8.2 FREQUENCY PLANNING

Frequency Planning is in the scope of bidder. The link frequencies shall be arranged by the bidder during contract stage.

A. PLCC Equipments for 400/132/33 kV MPPTCL Kirnapur (Balaghat) Substation

400 kV system

Sl. No.	Description of Items/Works		Unit	Quantity
	Description as per Tender BOQ	Detailed Description		
1	Carrier Cabinet with Protection Coupler	40W, Single Channel PLCC Panel with Protection Coupler	No.	4
2	Carrier Cabinet without Protection Coupler	40W, Single Channel PLCC Panel without Protection Coupler	No.	2
3	Coupling device (LMU)	Coupling Device (Phase to Earth) - Each 2 Nos. Coupling Device (Phase to Earth) shall be complete with all components to be suitable for phase to phase coupling.	No.	4
4	Co-axial Cable	HF Co-axial Cable (125 Ohms Unbalanced)	kM	3
5	EPAX (32/16)	EPAX (32/16)	No.	1
6	Telephone Sets	Telephone Sets (2-wire)	No.	12
7	Telephone Cable (10 Pair Armoured)	Telephone Cable (10 Pair Armoured)	kM	1
8	Telephone Cable (06 Pair Armoured)	Telephone Cable (06 Pair Armoured)	kM	1
9	Services - System Engineering (Including Frequency Planning)	Services - System Engineering (Including Frequency Planning)	Lot	1
10	Services - Supervision of Pre-Commissioning (Panel-wise)	Services - Supervision of Pre-Commissioning (Panel-wise)	Lot	6
11	Services - Supervision of Testing and Commissioning (Link-wise)	Services - Supervision of Testing and Commissioning (Link-wise)	Lot	1
	Maintenance and Testing Equipments			
12	Testing and Maintenance equipment (Print test kit)	Testing & Maintenance Equipment (Print Test Kit)	Set	1
13	Selective Level Meter and Level Oscillator	Selective Level Meter and Level Oscillator	No.	1
14	Mandatory Spares - Carrier Cabinet with Protection Coupler	40W, Single Channel PLCC Panel with Protection Coupler	No.	2

132 kV system

Sl. No.	Description of Items/Works		Unit	Quantity
	Description as per Tender BOQ	Detailed Description		
1	Carrier Cabinet with Protection Coupler	40W, Single Channel PLCC Panel with Protection Coupler	No.	0
2	Carrier Cabinet without Protection Coupler	40W, Single Channel PLCC Panel without Protection Coupler	No.	4
3	Coupling device (LMU)	Coupling Device (Phase to Earth) - Each 2 Nos. Coupling Device (Phase to Earth) shall be complete with all components to be suitable for phase to phase coupling.	No.	8
4	Co-axial Cable	HF Co-axial Cable (125 Ohms Unbalanced)	kM	2
5	Services - System Engineering (Including Frequency Planning)	Services - System Engineering (Including Frequency Planning)	Lot	1
6	Services - Supervision of Pre-Commissioning (Panel-wise)	Services - Supervision of Pre-Commissioning (Panel-wise)	Lot	4
7	Services - Supervision of Testing and Commissioning (Link-wise)	Services - Supervision of Testing and Commissioning (Link-wise)	Lot	2

B. PLCC Equipments for 400/220 kV MPPTCL Badnawar Substation

400 kV system

Sl. No.	Description of Items/Works		Unit	Quantity
	Description as per Tender BOQ	Detailed Description		
1	Carrier Cabinet with Protection Coupler	40W, Single Channel PLCC Panel with Protection Coupler	No.	8
2	Carrier Cabinet without Protection Coupler	40W, Single Channel PLCC Panel without Protection Coupler	No.	2
3	Coupling device (LMU)	Coupling Device (Phase to Earth) - Each 2 Nos. Coupling Device (Phase to Earth) shall be complete with all components to be suitable for phase to phase coupling.	No.	8
4	Co-axial Cable	HF Co-axial Cable (125 Ohms Unbalanced)	kM	3
5	EPAX (32/16)	EPAX (32/16)	No.	1
6	Telephone Sets	Telephone Sets (2-wire)	No.	12
7	Telephone Cable (10 Pair Armoured)	Telephone Cable (10 Pair Armoured)	kM	1
8	Telephone Cable (06 Pair Armoured)	Telephone Cable (06 Pair Armoured)	kM	1
9	Services - System Engineering (Including Frequency Planning)	Services - System Engineering (Including Frequency Planning)	Lot	1
10	Services - Supervision of Pre-Commissioning (Panel-wise)	Services - Supervision of Pre-Commissioning (Panel-wise)	Lot	10
11	Services - Supervision of Testing and Commissioning (Link-wise)	Services - Supervision of Testing and Commissioning (Link-wise)	Lot	2
	Maintenance and Testing Equipments			
12	Testing and Maintenance equipment (Print test kit)	Testing & Maintenance Equipment (Print Test Kit)	Set	1
13	Selective Level Meter and Level Oscillator	Selective Level Meter and Level Oscillator	No.	1
14	Mandatory Spares - Carrier Cabinet with Protection Coupler	40W, Single Channel PLCC Panel with Protection Coupler	No.	2

ANNEXURE-1

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220 kV system

Sl. No.	Description of Items/Works		Unit	Quantity
	Description as per Tender BOQ	Detailed Description		
1	Carrier Cabinet with Protection Coupler	40W, Single Channel PLCC Panel with Protection Coupler	No.	4
2	Carrier Cabinet without Protection Coupler	40W, Single Channel PLCC Panel without Protection Coupler	No.	2
3	Coupling device (LMU)	Coupling Device (Phase to Earth) - Each 2 Nos. Coupling Device (Phase to Earth) shall be complete with all components to be suitable for phase to phase coupling.	No.	8
4	Co-axial Cable	HF Co-axial Cable (125 Ohms Unbalanced)	kM	2
5	Services - System Engineering (Including Frequency Planning)	Services - System Engineering (Including Frequency Planning)	Lot	1
6	Services - Supervision of Pre-Commissioning (Panel-wise)	Services - Supervision of Pre-Commissioning (Panel-wise)	Lot	6
7	Services - Supervision of Testing and Commissioning (Link-wise)	Services - Supervision of Testing and Commissioning (Link-wise)	Lot	2

NOTES:

1. Cut-lengths of HF cable, 10-pair Telephone Cable & 06-pair Telephone Cable shall be as per Section-2.
2. Price of Carrier cabinets shall include all components as specified in Section-2 including jack telephones and 4-wire telephones.
3. The above quantities are subject to change by $\pm 50\%$ at contract stage.

SECTION-2

2.2.3 TECHNICAL SPECIFICATION FOR POWER LINE CARRIER COMMUNICATION EQUIPMENTS i.e CARRIER CABINET, PROTECTION COUPLER & COUPLING DEVICE

1.0 SCOPE :

The scope of this bid covers, design manufacturing and supply of equipment as per Section-1 ~~Volume-II~~. The bidder mentioned in this Section of the Technical Specification means "Original Equipment Manufacturer (OEM)". The purchaser means the "MPPTCL".

In case bidder is not OEM, sole responsibility of offering equipments/materials of manufacturer as per this specification requirement shall rest on the bidder.

2.0 STANDARDS :

2.1 Applicable Standards for the offered equipments /items shall be as per ~~Section-~~ **APPENDIX - A**.
~~Volume-II~~

2.2 If the equipment offered by the Bidders conforms to any other standards, salient points of comparison between the standards adopted and the specific standards shall be clearly brought out in relevant schedule of technical deviation. It will be sole responsibility of Bidders to prove that the salient features of offered equipment are equivalent or better than IS.

2.3 ACCEPTANCE OF OTHER AUTHORITATIVE STANDARDS :

In the preceding paragraph relevant Indian standard / IEC standard bid have been shown. However, the equipment meeting any other authoritative international standard, which ensures equal or better quality than the standards, mentioned shall also be acceptable. Equipment for which Indian Standards are not available, the relevant British standards and IEC recommendations will be applicable. Please attach photocopy of all such standards according to which the equipment has been offered.

3.0 CLIMATIC CONDITIONS :

3.1 Applicable climatic conditions shall be as per Section-3.

3.2 AUXILIARY POWER SUPPLY :

Auxiliary Power Supply for offered EHV equipments shall be as per Section-3.

4. DISCREPANCY IN TECHNICAL PARTICULARS :

Regarding discrepancy in technical particulars stipulation under Section-2 shall be applicable.

5.0 TECHNICAL SPECIFICATION FOR CARRIER CABINETS:

5.1 BASIC DESIGN :

Carrier cabinets shall be multipurpose PLCC terminals suitable for transmission of speech & Superimposed VFT channels for teleindication, telecontrol, teleprinting, tele-metering purposes etc. and for teleprotection purpose over power transmission lines. The PLCC offered shall be IC version, fixed frequency, single channel PLCC terminals working on SSB modulation principle.

Carrier cabinets shall be of latest technology, highly reliable and must have been type tested. Carrier cabinets shall render following services -

- i Telephone communication between the stations.
- ii Carrier links protective relaying.
- iii VFT facilities such as telemetering services, Telecontrol, telex/fax.
- iv Express channel.

While at present it is proposed to provide the carrier link with protection on some links, the equipments to be supplied and installed shall be such that the same can be inserted in the cabinet afterwards if required, without carrying out any modifications in the equipments. The supplier should provide in PLCC cabinet, sharp cut off filter for limiting the speech frequencies transmitted. Hence the Bidders shall clearly mention in his proposal for future development and the extent to which such additional facilities can be added at a later date. This is essential and the Bidder must clearly explain the same.

5.1.1 COMMUNICATION SYSTEM :

Bidders may offer power line carrier equipment according to their standard practice to fulfill the requirement of the specification. The equipment shall be manufactured according to frequency to be indicated by us. Each of the station of the carrier telephony system must be able to transmit and receive simultaneously during conversation, to enable calls in duplex principle.

5.1.2 Bidders may please note that it is mandatory requirement that carrier cabinet of both ends of transmission line shall be identical. In case of Line in Line out (LIL) lines, for matching of carrier cabinet at both ends of transmission lines bidder may offer same type of carrier cabinet as already provided at other end of lines. If in any case bidder offers different type of carrier cabinet than matching of carrier cabinet can be arranged by interchanging of carrier of other end and in this case the commissioning of carrier cabinet (both ends) shall be arranged by bidder without any extra cost to MPPTCL.

5.1.2 FREQUENCIES TO BE ADOPTED :

Frequencies to be employed may be confined to the band 40-500 KHz.

5.2 CARRIER FREQUENCY TRANSMITTER RECEIVER CABINET :

5.2.1 Carrier cabinets shall be made from 14/16 SWG sheet steel. It will be designed for efficient cooling with a cooling fan at the top inside the cabinet. The cabinet shall be suitable for floor mounting type with adequate arrangement for ventilation and provision to avoid dust getting in and to avoid any adverse effects from moisture during rainy season. The cabinet shall be finished with paints coated inside and outside according to standard painting procedure. It shall be Aircraft Grey as per colour shade No. 693 of IS:5 or equivalent BS-381 or matching colour and shade of other authoritative equivalent standard is also acceptable. Colour finish shall be applied as per above colour scheme on the exterior steel works of the cabinet. Exterior shall not be fully glossy. Interior of the cabinet shall be painted with "Egg Shell White". The height of the cabinet shall not be more than 2 meter. Bidder shall match the colour and height of the cabinet as specified. Normally the cable entry shall be from bottom. However, suitable provision shall be made for cable entry from top, which shall be covered by blanking plate at the time of supply.

5.2.2 All individual parts of the equipment shall be accessible from the front to permit testing and repair. The front shall have hinged doors equipped with handles and locks. Necessary testing and indicating devices shall be provided on the front panel to enable checking of important functions and circuits. The whole circuit shall be mounted on one panel, which is hinged at top and bottom of cabinet. This will facilitate approach to back side of the circuit. The cubicle shall be provided with foundation rail and holes for fixing the same on foundation.

5.2.3 10 mm Red LED & Green LED shall be provided on the top of the panel for visual and alarm indications to announce failure of power supply, absence of carrier signal for both receiver and transmitter etc. The audio alarm would be provided for this purpose, which should be audible from 8 meters distance. Three way HF co-axial clamp with terminal shall be provided inside the cubicle at rear side. A suitable Lightning Arrestor should be provided between HF main & earth terminals. One 8 way electrical connector, a three-pin plug with fuse shall be provided for 230V AC, 50 Hz. supply. 24 Nos disconnectable type terminals should be fitted in cabinet for inter connection with Distance Protection Relay. The cubicle shall be fully wired.

5.2.4 Equipment shall operate through 48 V DC supply with voltage variation from +20% to -10% and maximum ripple of 2%. The carrier power supply module shall be provided with a circuit breaker, which shall automatically trip due to over voltage to carrier equipment and / or over modulation. The miniature circuit breaker shall be provided in front of power supply module so that it is easily accessible. This miniature circuit breaker shall be provided with a facility to switch on and to switch off the same mechanically by hand, by pressing and releasing a push button switch. A fuse shall also be provided in series of this miniature circuit breaker, which shall operate in case of failure of the miniature circuit breaker.

5.2.5 Carrier cabinets shall be suitable for operation with private automatic exchange. In addition, two telephone sets shall be provided with each carrier set (one Jack telephone and one four wire telephone), for testing purposes and for carrying out emergency conversion without the help of the associated automatic exchange. It should have also facility to connect 2 wire telephone. Built in indicating meter and oscillator shall be provided on the panel with a selector switch to indicate voltage & current value and all-important signal levels (DC, VF, IF & HF). A built in "PLC

EQUALIZER" shall be provided to overcome effect of amplitude distortion due to mismatch etc. A supervision module with necessary circuitry shall be provided to monitor Transmitter, Receiver and Power Supply. The carrier set shall be provided with relay for blocking all other signals when the tripping signal is being transmitted to give more power for the transmission of the tripping signal.

5.2.6 Interfacing data modules should be supplied along with each Carrier Cabinet. The Bidders shall clearly confirm that prices for these interfacing modules are included in the offered price of Carrier Cabinet. It shall be possible to test the equipment locally by a dummy load. It is preferable that equipment is provided with facility to test transmitter and receiver locally by connecting them back-to-back. Built-in AGC Test for HF level variation of +14 dB/- 45 dB may be necessary. The local testing facility provided shall be described in detail by all the Bidders.

5.2.7 All the test points with standard values, indications etc. shall be provided in front of the cabinet and shall be easily accessible. The equipment shall be suitable for co-axial impedance of 75/125 ohm unbalanced or 150 ohm balanced. This should be programmable. Carrier Terminal shall be provided with 4 wire and jack telephone and 125-ohm load in loose. The equipment shall be provided with a nameplate indicating make, serial no., order no. with date, Transmit & Receive frequency and Station Direction.

5.2.8 Carrier cabinets offered shall have compandors as a built-in feature. If required the purchaser shall have the facility of disabling the same. The offered PLCC terminals shall be provided with the following built in features:

1. HF hybrid so that adjacent channel working is possible.
2. Necessary transit band pass filter for transit interconnection of teleoperation channels.
3. It should have remote subscriber facility to extend the subscriber of an EPAX to a remote end through PLCC.

5.2.9 PLC terminals shall be fully coordinated to match the existing equipment. Because of strict requirements of high speed of operation, security, reliability and efficient operation of protection channel along with the carrier terminal, Bidders shall ensure complete coordination between the PLC and protection equipment as specified in Clause 6. It shall therefore be necessary to have a provision of mounting the protection coupler in the same rack of PLC terminal without any mismatch or necessity of any wiring or any intermediate coordination unit. The PLC terminal shall use amplitude modulation with suppressed carrier, single side band, multipurpose, 4KHz and shall be site programmable for Audio frequency, Carrier Frequency, Pilot Frequency and the transit band pass filters. Please furnish ranges. The equipment shall be suitable for duplex working and shall use the latest technology using Digital Signal Processor. Further, the PLCC equipments shall employ the latest SMT technology.

5.2.10 Protection coupler to be supplied can be mounted in the same PLCC cabinet and necessary wiring should of standard type. In future, if any VFT is to be procured by the purchaser, the same could be mounted in the same carrier cabinet with standard wiring. PLCC terminal shall conform to the latest IEC 495. Carrier cabinets shall

conform to the voltage withstand and electromagnetic compatibility test as per the latest IEC standards.

Each PLCC channel shall be suitable for the following:

- a. Nominal bandwidth shall be 300 - 3600 Hz and shall be suitable for transmission of facsimile messages at 2400 baud.
- b. One speech channel 300 - 2000 Hz plus a band of 2160 -3600 Hz for the transmission of data. Data signaling rates of 50, 200,300,600,1200 baud shall be possible. The speech band and data band should be programmable either for speech or data over entire 4KHz bandwidth.
- c. Three 600-baud channels or one 2400-baud channel for full band of 300-3600 Hz.
- d. Protection couplers shall be based on frequency shift or coded signal principle for transmission / reception of protection signals. This has been described in detail in subsequent clauses.

5.2.11 PLC equipment may be required to be expanded by addition of channels to a link (i.e. upgrade to 2 or 4 channels as appropriate). The PLC equipment shall be modular in construction and shall permit such upgrading to be carried out even at a later date. The Bidder shall describe how the single channel equipment will be upgraded to more channels. The PLC terminal shall use multiple modulation/demodulation techniques (preferably 3 stage modulation) so as to have better selectivity and overall frequency response. The equipment shall be suitable for use with E&M signaling between telephone exchanges at both the ends of the line. Signaling shall be done by shifting the pilot frequency so that a separate band for signaling is not required. The output power of PLC equipment at coaxial terminal shall be 40 watts which can be adjusted if required at site to 20 watts. PLC equipment shall be designed to operate over a frequency band of 40 to 500 KHz. The spacing between transmitter and receiver shall be as follows for single channel as well as twin channel operation:

- i. Transmitter to adjacent transmitter \geq 8KHz
- ii. Transmitter to its own receiver \geq 4KHz

5.2.12 The return loss within the nominal carrier frequency band in the transmit direction shall not be less than 2dB. The maximum permissible level of spurious emission shall meet the requirements of IEC- 495. The generation of carrier frequencies shall be fully synthesized. It shall be possible to select any carrier frequency at site within the whole carrier frequency range in discrete steps of 4KHz. Carrier frequency stability shall be $\pm 10 \times 10^{-6}$ (5Hz). Further, there should be a synchronization between transmitter and receiver. Bidder shall describe how the synchronization is achieved between the PLC terminals.

5.2.13 Preferably the Krone type terminal strip in addition to conventional terminal strips should be provided for inter connection along with krone tool so as to have firm / tight connection.

5.3 Transmitter:

5.3.1 The transmitter shall have 2 wire/4wire interface. The nominal level of 2 wires shall be 0 dBr across 600 Ohms balanced impedance. The input level range shall be adjustable from -16dBr to -6dBr. Nominal input level for 4wire should be -3.5dBr across 600 Ohms balanced impedance. The input level range shall be adjustable from -20dBr to 10dBr. The AF band shall have the programming facility so that it can be programmed at site for any of the following bands:

- 300-2000 Hz
- 300-2200 Hz
- 300-2400 Hz
- 300-3400 Hz

The data band shall be adjusted accordingly for the following bands:

- 2160-3600 Hz
- 2400-3600 Hz
- 2640-3600 Hz

5.3.2 Care should be taken to use components used in the power amplifiers of adequate capacity.

5.4 RECEIVER:

5.4.1 The receiver shall have 2-wire/ 4-wire interfaces. The nominal output level for 2 wires should be -7dBr across 600 Ohms balanced. It shall be possible to adjust this level from -16dBr to +6dBr. The nominal output level for 4 wire shall be -3.5dBr across 600 Ohms balanced and shall be adjustable from -20dBr to + 10dBr.

5.4.2 The near and far end cross talk should be ≤ -50 dBm Op. The group delay distortion shall conform to IEC- 495. The compander shall be a built in function and shall have the characteristics as per ITU-T. Automatic gain control shall be provided so that AF output should remain constant within + 0.5 dB for a +14/-45dB variation in the RF input level. The local loop test facility shall be provided so that the equipment can be tested locally. The remote loop test facility shall be provided so that equalization can be done at site from one end by looping back the signal at the other end without the need of an engineer at the other end.

5.5 SUPERVISION AND ALARM:

5.5.1 The supervision facility shall be provided for supervising the PLC terminal so that it can automatically check the functioning of the PLC terminal and in case of any failure of module or any other condition affecting the correct operation of

individual components shall be displayed on the front panel with suitable error code. Alarm shall be given under following conditions:

- loss of transmitter signal
- loss of receiver signal
- high SNR in speech and telecontrol channels
- loss of auxiliary supply
- excessive impulse interference

A green LED to show healthy ness of 48V DC supply should be provided next to Alarm LED.

5.6 GENERAL REQUIRMENTS:

5.6.1 All cabinets having PLC terminal shall be provided with lamps of sufficient wattage for interior illumination with switch. The PLC terminal shall be suitable for remote subscriber application. The PLC terminal should have in built test meter for carrying out tests at site. It should have a facility to generate at least two tones of different frequency apart from 1 KHz tone.

5.6.2 The power supply of the offered PLCC carrier set shall be based on SMPS technique which ensures that in the event of a short circuit the power supply is switched off and hence there will be no damage to power supply circuit. It should also have over voltage protection.

5.6.3 For ease of maintenance, power amplifier unit should be supplied in one card. This unit should not be combined with filter & RF hybrid. In case of failure of power amplifier the same could be replaced by new one without disturbing filter and RF hybrid.

5.6.4 Specific confirmation regarding supply of following accessories with each Carrier Cabinet may please be positively indicated.

- i. Compander & expander print.
- ii. Test Meter Print.
- iii. Jack telephone hand set.
- iv. Transit band pass filter.
- v. 4 wire & 2 wire table telephone set with push button.
- vi. Dummy load with switch, so that, we can connect coaxial cable to carrier cabinet, or a dummy load representing the line to the cabinet. The switch provided for switching Dummy load / line should be of very good quality as it is being facility very frequency.
- vii. Print puller
- viii. Suitable lock with key for carrier cabinet
- ix. Exhaust fan
- x. A frequency tone generator of 1KHz and two tone generator of different frequency for measurement of various level of voice and

data signal and also for sending the calling signal at the other end. Therefore, above arrangement or any other equivalent arrangement for this facility during testing will be accepted.

5.6.5 Under clause 5.6.4, the essential accessories for carrier cabinet has been listed. However, it is desired and it would be obligatory on the part of the Bidder to include any such accessory also (i.e. over & above listed under clause 5.6.4) which may be necessary for proper and trouble free functioning of the carrier cabinet. Details of such additional accessory, if any, may be furnished. It may be noted that no additional cost shall be permitted for such additional accessory required for proper functioning of equipment. In nut shell cost of all such accessories described above should be included in the price of main equipment and this price only shall be mentioned in formats of price Schedule. ~~available at Section #~~

6.0 TECHNICAL SPECIFICATION FOR PROTECTION COUPLERS:

6.1 BASIC DESIGN:

6.1.1 Bidders shall offer voice frequency transmission equipment which shall work on frequency shift or coded signal principle for transmission /reception of protection signals.

6.1.2 Bidders shall take cognizance of our following requirement;

- (i) The equipment shall be immune to a field strength of 10V/m expected to be caused by portable radio transmitters in the range of 20-1000 MHz.
- (ii) The voice frequency transmission equipment shall not only be insensitive to corona noise but shall also remain unaffected by impulse type of noise generated by electrical discharge and by opening and closing of circuit breakers, isolators & earth switches etc. In their offers,, bidders shall clearly explain as to what measures have been taken to make the equipment insensitive to corona noise, white noise and to impulse noise of an amplitude *larger than* the wanted signal and submit full field test and laboratory test reports. The guarantee on design data shall not be acceptable.
- (iii) Equipment shall be unaffected by spurious tripping signals. Bidders shall substantiate their claim.
- (iv) Offered Protection Couplers shall be suitable for transmission / reception of minimum four protection signals.
- (v) Overall PLC, VFT and transmission path for permissible trip / block shall be one cycle or 20 ms or less and for direct tripping, it shall be 30ms or less.

6.1.3 Protection couplers are to be used together with the PLC equipment, as such it shall comprise of modules which are directly plugged into reserved slots of PLC terminal so as to avoid any wiring / mismatch between PLC terminal and protection coupler. In a nutshell, the Protection Coupler shall be housed in PLC Cabinet and will not be acceptable in a separate cabinet. Protection couplers shall be suitable for at least one command for each of permissive tripping, blocking as well as direct trip signals.

6.1.4 Protection couplers shall be designed in accordance with IEC 834-1 and shall be complete with test and inter connection unit and counters. The offered couplers shall be suitable for transmission of four commands to take care of protection of double circuit lines and shall also be suitable for transmission/reception of four commands. The offered couplers may ensure very high reliability during fault conditions and shall not tend to operate due to spurious signals which may generate in electrical system. Loop testing facility shall be provided in each AF coupler. Bidders must explain the design with complete details and should justify reliability of their equipments.

6.1.5 The trip signal frequency should fall within the teleprotection band without any necessity of separate band for protection commands. Whenever the protection coupler receives the command, it shall disconnect the speech. This interruption will continue for a short period of the teleprotection command after which the normal operation of the carrier equipment will be restored. During transmission of teleprotection signals or when a fault has been detected by the protective relays the entire output power of the carrier set will be made available for transmission of teleprotection signals.

6.1.6 Protection couplers designed using logic circuitry to provide total transmission time for teleprotection signals shall not exceed 20 ms for permissive trip and 30 ms for direct trip. Protection coupler designed using logic circuitry to provide Transmission time of less than 20 ms for both direct and permissive trips is also acceptable. The protection coupler shall use microprocessor techniques with digital signal processing to meet the stringent requirements for command transmission over PLC links even under adverse channel conditions. Digital counters shall be provided for counting of transmitted and received commands. For each code, 6 No disconnectable type terminals may be fitted in cabinet for inter connection with Distance Protection Relay.

6.2 TEST FACILITIES:

Protection couplers shall be constructed such that operational reliability of protection channels may be checked over the carrier link by means of local and remote loop test. It shall be possible to carry out the above test from either end of the carrier link. During healthy condition of the transmission line the loop test shall not initiate a tripping command. In the event of a system fault, while loop test is in progress, protection signal shall over ride the test signal. While the loop test is in progress no false tripping command shall be generated. The remote loop test shall be initiated either automatically after a particular time interval or manually by means of test buttons.

7.0 TECHNICAL SPECIFICATION FOR COUPLING DEVICES :

7.1 BASIC DESIGN:

7.1.1 Coupling devices shall be housed in a weather proof non corrosive box and should be suitable for outdoor mounting on the pedestal support of coupling capacitor / CVT. Offered coupling devices should be suitable for phase to phase coupling arrangements. Coupling devices shall be interposed between the coupling capacitor/CVT and coaxial line to the PLC terminal. Coupling devices in conjunction

with the coupling capacitor/CVT shall ensure efficient transmission of carrier frequency signals between the carrier frequency connection and power line. In addition safety of personnel and protection of low voltage parts and installation, against the effects of power frequency voltage and transient over voltage shall be ensured. The complete coupling devices suitable for phase to phase coupling should be housed in two weather proof boxes. One box should contain high pass filter module, a drain coil, a surge arrestor and an external earth switch. The other box should contain high pass filter module with balancing / hybrid transformer, a drain coil, surge arrestor and a external earth switch. Apart from above an additional separate earth switch suitable for mounting on pedestal shall be supplied with each box of coupling device.

7.1.2 Coupling device shall be compact and modular in nature. In our system we have coupling capacitor/CVT of different capacitance value. Coupling devices offered should be site programmable type so that it is suitable for operation with coupling capacitor / CVT of different capacitance value without carrying out any modification at site and without any cost implications. This may please be confirmed.

7.1.3 Coupling devices shall comply with the latest issue of IS & IEC. Coupling device including the drainage coil, surge arrestor and earthing switch shall conform to type tests and shall be subjected to routine tests as per latest IS & IEC. Bidders shall furnish along with his offer copies of all type and routine tests conducted earlier on similar coupling device in accordance with relevant standards.

7.1.4 Coupling devices in conjunction with coupling capacitor / CVT shall form an electronic filter of high pass type and shall have following features:-

- a. It shall match characteristic impedance of 132/220/400KV HT line to impedance of the carrier frequency connection (i.e. coaxial cable).
- b. It shall be possible to change coaxial cable side impedance simply by changing the straps at site. It should be suitable for 125ohm unbalanced, 75ohms unbalanced or 150ohm balanced as per site requirement.
- c. It shall be possible to tune coupling device by changing strapings at site to use with any coupling capacitor having different values.
- d. It shall be possible to use it as phase to ground device and phase to phase device with balancing /hybrid transformers.
- e. Power frequency currents derived by the CVT may be drained to the earth by drain coil of suitable rating.
- f. Voltage surges coming from the power line at the terminals of the coupling device shall be limited by a non-linear surge arrestor of suitable rating in the primary side. The surge arrestor of very good quality should be used, ~~and offer with good quality surge arrestor shall be preferred.~~ The details of surge arrestor giving constructional features, design etc. shall be furnished.

- g. For direct and efficient earthing of its primary terminals, the coupling device shall be equipped with an earthing switch. The coupling device shall be designed such that it shall not be possible to remove the cover before the earthing switch is operated to the earthed position. Further, an additional earth switch shall be available for earthing of CVT-HT terminals, when the coupling filter units are removed from circuit for maintenance / replacement. The design shall take due regard of requirements for safety in accordance with the Indian Electricity Rules.

7.1.5 Two numbers phase to earth type coupling filters shall be used to achieve in, secure phase to phase coupling. Connection between secondary of the two phase to earth type coupling device shall be through a balancing/hybrid transformer such that reliable communication shall be ensured even when one of the coupled phase is earthed or open circuited on the line side.

7.1.6 Coupling device shall conform to latest IS/IEC-481 and shall have the following carrier frequency characteristics.

a.	Nominal line side Impedance	Characteristic impedance of 400/220/132KV line.
b.	Nominal equipment side Impedance	125/75 Ohms (unbalanced) or 150 Ohm balanced
c.	Composite loss	Not more than 2 dB
d.	Return Loss	Not less than 12 dB
e.	Bandwidth	Shall suit the frequency plan
f.	Nominal peak envelope power (For inter- modulation product 80 dB down)	Not less than 650Watt

7.1.7 Coupling devices shall withstand an insulation voltage of 10KV RMS 50Hz for one minute and impulse withstand voltage (1.2/50 micro secs) of 10KV Peak.

7.1.8 All the elements of coupling devices shall be housed in a weather proof non corrosive box. The general arrangement, weight and dimensional details of box shall be furnished. Bidders shall submit detailed drawing indicating general arrangement, interconnection and all other details for approval.

7.1.9 Coupling device shall have at least two terminals for carrier equipment connection. Bidder shall confirm that such a parallel connection to coupling device directly will not result in any additional attenuation.

8.0 TESTS:

8.1 TYPE TEST:

All the equipment offered, shall be fully type tested as per relevant Indian Standards or any Equivalent International Standard. In case the equipment of the type and design offered, has already been type tested, Bidder shall invariably furnish type test reports from the reputed and approved national/international laboratory/

Government approved test houses to prove that specifications of equipments offered conform to the relevant standard. Test certificates shall clearly indicate the type and model number etc., so that relevant details of offered equipments could be verified. While submitting bids the model and type etc., shall be clearly indicated. Type test reports so furnished should not pertain to the period earlier than five years from the date of opening of Bid. In case the type tests were carried out earlier than five years, the manufacturer will have to conduct these tests before commencement of supply. For any change in the design/type already type tested and the design/type offered against this bid, the Purchaser reserves the right to demand repetition of same or all type tests without any extra cost.

8.2 ACCEPTANCE AND ROUTINE TESTS:

9.2.1 The manufacturer shall carry out all acceptance and routine tests as stipulated in the relevant Indian Standards or Equivalent International Standards in presence of Purchaser's representative.

8.2.2 Immediately after finalization of the program of type/ acceptance/routine testing, the manufacturer shall give advance intimation to the Purchaser, to enable him to depute his representative for witnessing the tests.

9.0 INSPECTION :

- i. The Purchaser shall have access at all times to the works and all other places of manufacture, where the Carrier Cabinet with Protection Coupler are being manufactured and the Bidder shall provide all facilities for unrestricted inspection of the Bidder's works, raw materials, manufacture of all the accessories and for conducting necessary tests as detailed herein. Purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. Supplier shall submit the routine test certificates of bought out items and raw material, at the time of routine testing of the fully assembled Wave Traps.
- ii. The successful Bidder shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of equipment of the various stages, so that arrangements could be made for inspection.
- iii. No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested. Successful Bidder shall within 30 days of placement of order, submit list of bought out accessories and the names of sub-suppliers.
- iv. The acceptance of any quantity of the equipment shall in no way relieve the successful bidder of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipment are later found to be defective.
- v. In case for any reasons inspection is not completed or equipment is not found to be complete with all accessories as per confirmation given with the letter of inspection call, purchaser will reserve the right to recover the

complete cost of deputation of inspecting team to the works of the manufacturer.

10.0 QUALITY ASSURANCE PLAN :

10.1 The Bidder must establish that they are following a proper quality assurance programme for manufacture of Carrier Cabinet, Protection Coupler & LMU. The Bidder shall invariably furnish following information along with his offer. Information shall be separately given for individual type of equipment offered.

- i) Statement giving list of important raw materials, names of sub supplier for the raw material, list of standards according to which the raw material are tested, list of tests normally carried out on raw material in presence of Bidder's representative and copies of test certificates.
- ii) Information and copies of test certificates as mentioned in (i) above in respect of bought out items.
- iii) List of manufacturing facilities available.
- iv) Levels of automation achieved and list of areas where manual processing exists.
- v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
- vi) Special features provided in the equipment to make it maintenance free.
- vii) List of testing equipment available with the Bidder for final testing of equipment specified and test plant limitations, if any, vis-à-vis type test, acceptance and routine tests specified in the relevant Indian Standards or equivalent international standard. These limitations shall be very clearly brought out in schedule of deviations from specified test equipments.

10.2 The successful Bidder shall submit following information to the Purchaser.

- i) List of raw materials as well as bought out accessories and the names of sub supplier selected from the lists furnished along with offer.
- ii) Type test certificate of the raw material and bought out accessories.
- iii) Quality Assurance Plan (QAP) with hold points by Purchaser's inspection. The quality assurance plans and hold points shall be discussed between the Purchaser and Bidder before the QAP is finalized.

10.3 The successful Bidder shall submit the routine test certificates of bought out items and for raw material at the time of routine testing of the fully assembled equipment.

11.0 DOCUMENTATION :

11.1 All drawings shall conform to the latest version of International Standards Organization (ISO) 'A' series of drawing sheet/Indian Standards Specification IS-11065. All drawings shall be in ink and suitable for micro testing. All dimensions and data shall be in SI Units.

12.0 LIST OF DRAWINGS AND DOCUMENTS:

12.1 The Bidder shall furnish four sets of following drawings along with his offer.

- a) General outline and assembly drawings of the equipment showing front & side elevation and plan views and all accessories, external features with detailed dimensions, net & shipping weights, size of lifting lugs, quantity of insulating oil .
- b) Sectional views showing General Constructional Features, lifting lugs, etc.
- c) Name plate drawing with terminal markings & connection diagram.
- d) Schematic drawing.
- e) Dimensional drawing of terminal clamps and connectors showing material composition, permissible temperature rise, current carrying capability etc.
- f) Type Test reports
- g) Test reports, literature, pamphlets of the bought out items.

12.2 The successful Bidder shall within two weeks from signing of contract, submit four sets of all the above drawings for Purchaser's approval. The Purchaser shall communicate his comments/approval on the drawings to the Bidder within reasonable time. The Bidder shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of Purchaser's comments. After receipt of Purchaser's approval, the Bidder shall within three weeks submit 20 prints and two good quality reproducible (Soft copy) of the approved drawings for Purchaser's use.

12.3 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Bidder's risk.

12.4 The bidder shall submit nicely printed and bound volumes of operation, maintenance and erection manuals in English Language, for each type and rating of equipment supplied for distribution, along with the equipments. The manual shall contain all the drawings and information required for erection, operation and maintenance of the equipments. The manual shall also contain a set of all the approved drawings and type test reports etc.

12.5 Approval of drawings by Purchaser shall not relieve the Bidder of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall

have the power to reject any work or material, which in his judgment is not in full accordance therewith.

13.0 ENGRAVING, PACKING AND FORWARDING :

13.1 The details such as order no. and date, year of manufacture and "MPPTCL" should be engraved on each and every equipment. The equipment shall be packed in crates suitable for vertical/horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The Bidder shall be responsible for any damage during transit, due to improper and inadequate packing and handling. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Bidder shall supply, any material, found short inside the packing cases without any extra cost.

13.2 Each consignment shall be accompanied by a detailed packing list containing the following information:

- a) Name of the consignee.
- b) Details of consignment.
- c) Destination
- d) Total weight of consignment.
- e) Handling and unpacking instructions.
- f) Bill of material indicating contents of each package.

13.3 The Bidder shall ensure that the packing list and bill of material is approved by the Purchaser before despatch.

14.0 SCHEDULE

Schedules, questionnaire and annexure attached with this specification are the integral part of the specification and shall be submitted duly filled in by the Bidders alongwith the offer. Bill of material for each equipment shall be submitted by the bidder separately. Makes of the equipment shall be clearly indicated. Bidders may please note that a general mention that the components shall be of reputed make will not be acceptable.

15.0 COMPLETENESS OF EQUIPMENT AND BOUGHT OUT ITEMS

15.1 Bid shall be complete in all respects and shall include all minor component, accessories, small wiring etc., not specifically mentioned in the Schedule, specifications etc; but essential for the completeness of the system. Bidders shall not be eligible for extra charges in respect of such minor components, accessories, small wiring etc., though not included specifically in this specification but requires for satisfactory operation of equipment offered.

15.2 Bidders must furnish following information along with technical Bid.

15.2.1 Complete details of all the accessories which will be supplied

15.2.2 It is obligatory on the part of bidders to ensure that supply of all accessories along with Main equipment are simultaneously delivered to avoid any holdups. Responsibility for obtaining timely supplies of bought out items will rest on the bidders and only on this basis, delivery period will be offered in the Bid.

15.2.3 It may be noted that in case of damages/shortages due to improper packing or any other negligence, replenishment shall be arranged within one month's time. For bought out items, responsibility for guarantee and obtaining immediate replacement in case any defects are noticed and also in case defective supply of any item is reported, will rest on the bidders.

16.0 SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS AND TECHNICAL QUESTIONNAIRE :

Bidders shall furnish Guaranteed Technical Particulars and Technical Questionnaire for offered equipments in the format provided in Section- 4.

17.0 GUARANTEE FOR SUPPLY OF SPARES FOR 10 YEARS OPERATION :

As specified in the bid document, the bidder has to furnish an undertaking that the spares required for satisfactory operation of offered goods shall be made available at reasonable cost over a minimum period of 10 years from the date of commissioning of goods in purchaser's system. In the absence of such an undertaking, the offer will be treated as non-responsive.

18.0 Please ensure the Bid document containing number of pages has been properly page numbered and signed by the bidder. All Bid documents including Schedules and Annexure should be indexed properly and index of the document should be enclosed/placed at the beginning of the document.

APPENDIX-A(I)
**PRINCIPAL PARAMETERS FOR CARRIER CABINETS (SINGLE CHANNEL/
TWIN CHANNEL)**

1	Mode of transmission	Amplitude Modulation single side band with suppressed carrier
2	Carrier frequency range	40 to 500KHz
3	Nominal carrier frequency bandwidth	4kHz for Single Channel terminal 8kHz for Twin Channel terminal
4	Oscillator for generating carriers	Crystal controlled oscillator with frequency divider
5	Frequency stability	Less than ± 5 Hz
6	Effectively transmitted speech frequency band	300-2000Hz or 300-2400Hz
7	Available band for super imposed signals	Depends on the speech cut off frequency
8	Signaling frequency	3780 ± 30 Hz (options available)
9	HF Power Output	20 40 Watt PEP for single channel Adjustable at site.
10	Nominal impedance	
i.	Carrier frequency side	75/125 Ohms unbalanced
ii.	V.F. side	600 Ohms
11	Return loss	
i	Within the nominal Carrier frequency band at the line output.	≥ 20 dB
ii	Within the effectively transmitted frequency band at AF input/output points	≥ 20 dB
12	Relative VF levels across 600 Ohms (Balanced)	
i	4 Wire transmit	-3.5dBr
ii	4 Wire receive	-3.5dBr
iii	2 Wire transmit	0dBr
iv	2 Wire receive	-7dBr
13	Details of power supply required.	48V DC + 20% -15%
14	Power Consumption	100Watts approx. for single channel
15	Spurious emissions	As per IEC 495
16	Receiver Sensitivity	-24dBm referred to the Test Tone level at the RF I/P
17	Automatic volume control	AF O/P level remains within ± 0.5 dB for a +14/-26dB variation of RF I/P level
18	Signal to Noise ratio over carrier channel	<40dB
19	Permissible limit for variation of overall loss of speech channel relative to 800Hz for back to back operation of one pair of terminals	As per IEC 495
20	Frequency difference between voice frequency transmitted and received in a pair of PLCC terminal	0Hz

APPENDIX-A(II)

PRINCIPAL PARAMETERS FOR PROTECTION COUPLER

- 1) The equipment shall be immune to a field strength of 10V/m expected to be caused by portable radio transmitters in the range of 20-1000 MHz.
- 2) The voice frequency transmission equipment shall not only be insensitive to corona noise but shall also remain unaffected by impulse type of noise generated by electrical discharge and by opening and closing of circuit breakers, isolators & earth switches etc. In their offers,, bidders shall clearly explain as to what measures have been taken to make the equipment insensitive to corona noise, white noise and to impulse noise of an amplitude *larger than* the wanted signal and submit full field test and laboratory test reports. The guarantee on design data shall not be acceptable.
- 3) Equipment shall be unaffected by spurious tripping signals. Bidders shall substantiate their claim.
- 4) Offered Protection Couplers shall be suitable for transmission / reception of minimum four protection signals.
- 5) Overall PLC, VFT and transmission path for permissible trip / block shall be one cycle or 20 ms or less and for direct tripping, it shall be 30ms or less.

APPENDIX-A(III)**PRINCIPAL PARAMETERS FOR COUPLING DEVICE**

1	Maximum temperature limit for satisfactory operation of coupling device mounted outdoor	50°C (satisfactory operation up to 65 Deg.C)
2	Nominal primary side Impedance	240/320 Ohms (Phase to Ground)
3	Nominal secondary side impedance	75/125 Ohms Unbalanced, 150 ohms balanced
4	Composite loss within passband.	Not more than 2dB
5	Return loss within passband	Not less than 12dB
6	Available bandwidth	4400 pF:78-500KHz 6600 pF:70-500KHz 8800 pF:52-500KHz
7	Nominal peak envelope power	
i	At 50KHz	≤400Watts
ii.	At 100KHz	≤1000Watts
8	Power frequency impedance between primary terminal and earth terminals of coupling device	Less than 20 Ohms
9	One minute power frequency insulation level between primary and secondary terminals of coupling device	10KV rms
10	Impulse(1.2/50 micro sec) withstand Level between primary and secondary terminals of coupling device	10KV peak
11	DRAIN COIL:	
A	Continuous current	≤1.5 A (rms)
B	Short time current for 0.2sec	50A
c	Inductance of drain coil with tolerance(at 50Hz)	Primary of Matching transformer acts as a Drainage Coil, 0.2 to 0.7m H.
d	Impedance at mains freq.	≤1.5Ω
15	SURGE ARRESTOR :	
a	Power frequency spark over voltage	Min 1300 volts rms
b	Type of construction	Non linear resistor type
c	Maximum permissible short time current (2.2 micro sec)	As per IS:3070 (Part-I)
d	Impulse spark over voltage 1.2/50 μsec	As per IS:3070 (Part-I)
e	Rated voltage	As per IS:3070 (Part-I)
f	Power frequency discharge current for 0.2 sec	50A
16	EARTHING SWITCH :	
a.	Rated voltage	Withstand voltage is 10KV
b.	Rated current	≥200A rms continuous
c.	Short time current	16kA, 1 sec.

SCHEDULE-I (A)**DESCRIPTION OF EQUIPMENT FOR SCHEDULE FOR RATES AND PRICES
TO BE FURNISHED IN VOLUME-VI**

SNo	Particulars of equipment/item	Qty.
A	Carrier Cabinet with Protection Coupler (Single Channel)	As per Price Schedule
	Carrier Cabinet with Protection Coupler meeting all technical requirements as described in the specification .	
B	Carrier Cabinet without Protection Coupler (Single Channel)	
	Carrier Cabinet without Protection Coupler meeting all technical requirements as described in the specification .	
C	Coupling Device (LMU)	
	Coupling Device (LMU) for phase to phase coupling meeting all technical requirements of the specification .	

Note : 1. The above description of the equipment is given for the purpose of offering the prices and to mention description of equipment in invoice for claiming payment.

2. The quantity of above equipments has been mentioned in ~~Volume-VI~~ Section-1

2.2.4 TECHNICAL SPECIFICATION FOR EXCHANGES, TELEPHONE SETS

1.0 SCOPE :

The scope of this bid covers, design manufacturing and supply of equipment as per Section ~~1 Volume II~~. The bidder mentioned in this Section of the Technical Specification means "Original Equipment Manufacturer (OEM)". The purchaser means the "MPPTCL".

In case bidder is not OEM, sole responsibility of offering equipments/materials of manufacturer as per this specification requirement shall rest on the bidder.

2.0 STANDARDS:

2.1 The specifications of above equipments / Materials shall conform to the requirement of the latest issue of relevant Indian Standards/ International Electromechanical Commission (IS/ IEC) except as detailed out for each equipment in subsequent paras.

The EPAX / Telephone sets shall have approval of Telecom Engineering Center or Department of Telecom of India. The equipments / materials having equivalent International standards are also acceptable. Equipment meeting any other authoritative standard which ensures an equal or better quality than the standard mentioned above, is also acceptable. The photocopy of such standards duly signed by the bidder will have to be furnished.

2.2 When the equipment/materials offered by the Bidder conforms to other standards, salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule. Four copies of such standards with authentic translation in English shall be furnished along with the offer.

2.3 In this bid, the Bidders will have to furnish confirmation in regard to compliance of our entire technical requirement. The bid should clearly describe various technical particulars of the equipments/ materials as per details given in this specification. ~~Based on above information all details required in Schedule II to Schedule XII should be furnished so that we may be able to examine whether the Bid submitted is technically acceptable or not. Also all details and confirmation required as per Schedule II to XII will form part of technical bid.~~

3.0 CLIMATIC CONDITIONS :

3.1 Applicable climatic conditions shall be as per ~~Section I, Volume II~~ SECTION-3.

3.2 AUXILIARY POWER SUPPLY :

Auxiliary Power Supply for offered EHV equipments shall be as per Section ~~2~~ ³ .
~~Volume-II~~.

4. DISCREPANCY IN TECHNICAL PARTICULARS :

Regarding discrepancy in technical particulars stipulation under Section ~~2~~ ² .
~~Volume-II~~ shall be applicable.

5.0 TECHNICAL SPECIFICATION FOR ELECTRONIC PRIVATE AUTOMATIC EXCHANGE (EPAX) :

5.1 Basic Design:

5.1.1 The Bidder shall offer the latest digital based Microprocessor EPAX suitable for direct connection to the Power Line Carrier Communication (PLCC) terminals without the need of any four wire interconnecting device. The EPAX shall employ stored programmed technique and utilize Time Division Multiplexing. The EPAX shall be suitable for internal communication between the local subscribers as well as for selective communication over tie lines.

5.1.2 The special features of the EPAX shall be as follows :

- a. EPAX shall be of latest microprocessor based design which employs Pulse Code Modulation/Time Division Multiplexing principle and shall have high traffic handling capacity (fully non blocking type).
- b. Self checking diagnostics facility as a built in feature of the EPAX shall be preferred.
- c. The design of the software structure should be very flexible. Using any standard telephone instrument, the following programming shall be done at site without requirement of any additional testing equipments:
 - Modification of local subscriber number
 - Modification of subscriber priority
 - Modification of subscriber facilities i.e. Access to Tie lines and Follow Me
 - Modification of Tie line number
 - Modification of Tie line groups
 - Modification of Exchange number
 - Allocation of Alternate route
 - Transit call barring
- d. Built-in main distribution frame with Protective devices such as surge arresters and fuses for all limbs of subscriber lines and tie lines to

protect the sophisticated electronic circuitry of the exchange from damage due to external surges/spikes may be provided.

- e. The EPAX may be suitable for easy expansion if required at a later date.

5.1.3 EPAXs should be equipped with 16 subscriber lines and 8 trunk lines (PLCC directions E&M trunks) for 16/8 line exchange and 32 subscriber lines and 16 trunk lines for 32/16 line exchange and both EPAX should be wired for 48 subscriber lines & 24 trunk lines (E&M trunks).

5.1.4 The EPAX shall have facility to expand either the number of subscriber lines or tie lines if required, at a later date. The EPAX should be microprocessor based and be programmable at site. The software shall support E & M signaling.

5.1.5 The EPAX shall be fully automatic and should function without the help of an operator. The site programming facility with telephone or operator console shall be provided.

5.1.6 The exchange shall be self protecting against transients in the input DC supply and against failure of any component or cable in the entire communication system. The additional central processing unit (CPU) and Power Supply Unit (PSU) of exchange should also be supplied extra with each exchange for more reliability. In the event of one of main CPU or PSU card failure, the additional CPU / PSU card can be used to minimize any break down time. The EPAX shall be supplied with Krone type MDF with protection for both the subscriber and tie (PLCC)lines. All the lines shall be provided with surge arrestors and fuses for protection from transients. The krone type protective units shall be housed in a suitable wall mounted junction box & krone insertion tool shall be supplied for erection / maintenance of EPAX without any extra cost.

5.1.7 The EPAX shall have the following facilities:

- a) Follow me / call forward
- b) Call transfer & Conference
- c) Automatic alternate route selection (hunting)
- d) Ring when free
- e) Line Lock out
- f) Either party release
- g) Real time clock
- h) Call pickup facility
- i) Audible and visual alarm on all fault conditions & with auto restart facility.
- j) The priority facility should be such that it should work in trunk busy condition as well as subscriber (local) busy condition i.e. by applying the priority button / priority code the subscriber will come in conversation with the called party (subscriber / Trunk).
- k) Reset button (to reset the EPAX in case of hang condition)

5.1.8 The EPAX shall be self-contained and provide its own ringing current and tones. Visual display with LED's shall be available on each line and trunk card to display call status. Visual and audible alarms shall be provided on all fault conditions based on the self diagnostic routines will be preferred. The exchange shall be housed in a sheet steel cabinet and shall be sturdy, impact resistant, dust, and damp proof. The EPAX shall operate on 48V DC +15% -10% supply. The loop resistance for subscriber lines is 1200 ohms maximum and for tie lines 1500 ohms maximum. The exchange should be housed in with cooling fan.

5.1.9 The system software shall be posted on flash memory as per the latest International standards for fast and reliable operations. The EPAX shall also support a minimum dialing of .16 digits at a time and a maximum of 20 digits.

5.1.10 The EPAX should be provided with universal ports/slots for peripheral cards so that any combination of subscribers and trunks can be selected by the user by inserting suitable interface cards. It may please be noted that subscriber & trunk cards are equipped for maximum of 8 subscribers & 8 trunk per card.

5.1.11 The EPAX shall support the system software to work as an exclusive PLCC exchange. The EPAX shall work in conjunction with the existing EPAXs of other makes in the grid.

5.1.12 The exchange should have facility to adjust the transmitter and receiver voice and data level on trunks so that proper audible communication could be established with out-stationed subscriber.

5.1.13 The offer EPAX should support Telephone billing software. EPAX should be equipped with Operator Console so that programming done at site may be viewed on the screen of the Operator Console.

5.1.14 The EPAX must have been EMI/ EMC tested as per IEC-495. The exchange should be approved by TEC. A copy of certificate of TEC approval for the type of exchange offered must be enclosed.

6.0 TECHNICAL SPECIFICATION FOR TELEPHONE SET :

6.1 Basic Design :

The specification covers supply of ordinary push button telephone set. The Technical requirement of telephones are as follows:

6.1.1 The ordinary electronic push button telephone should be of desk top type and shall have approval of Telecom Engineering Center or Department of Telecom of India. In this connection, a photo copy of documentary evidence must be submitted along with the bid. In absence of documentary evidence the offer shall be non-responsive. The telephone shall support dialing on 2 wire loop mode and should be compatible for operation with all type of electronic exchanges being used by DOT of all technologies (indigenous & foreign). The telephone instrument must be suitable for climatic conditions stated in ~~Clause no. 3 of Section 3, mentioned above~~. The instrument should be sturdy and should have good appearance. The instruments

should be supplied in different pleasant colours based on our approval. The telephone shall be provided with following features:

- i. Tone / pulse switchable
- ii. User selectable dialing mode operation like Tone/DTMF.
- iii. Automatic last number redial facility up to maximum of 32 digits
- iv. Ringer indication with ringer volume control.
- v. Electronic speech circuitry with regulated speech levels.
- vi. Pause insertion for intermediate tones.
- vii. Automatic gain control for long line attenuation.
- viii. Good quality of transmitter transducers.
- ix. Extreme temperature resistant components for operation reliability.
- x. Digit pulses during dialing are muted.

6.1.2 Apart from above, telephones offered should meet following specifications

- i System voltage 48V DC \pm 10%
- ii Pulse rate 10 PPS
- iii Break-make ratio 66:33/60:40
- iv Inter-digit pause 800 m sec(minimum)

6.1.3 The push button telephone, should be supplied complete in all respect. Any accessory/ feature which is not specifically mentioned but is considered necessary for satisfactory operation of the equipment have to be included and the instrument incorporating such facility shall be supplied without any extra cost. The telephone sets shall be procured preferably from reputed and experienced manufacturer of telephones.

7.0 Acceptance And Routine Tests:

7.1 The manufacturer shall carry out all acceptance and routine tests as stipulated in the relevant Indian Standards or Equivalent International Standards in presence of Purchaser's representative.

7.2 Immediately after finalisation of the programme of type/ acceptance/routine testing, the manufacturer shall give advance intimation to the Purchaser, to enable him to depute his representative for witnessing the tests.

8.0 INSPECTION:

- (i) The Purchaser shall have access at all times to the works and all other places of manufacture, where the equipments are being manufactured and the Bidder shall provide all facilities for unrestricted inspection of the Bidder's works, raw materials, manufacture of all the accessories and for conducting necessary tests as detailed herein.

- (ii) The successful Bidder shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages, so that arrangements could be made for inspection.
- (iii) No material shall be despatched from the works of manufacturer unless the material has been satisfactorily inspected and tested.
- (iv) The acceptance of any quantity of the equipment shall in no way relieve the successful bidder of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipments are later found to be defective.

9.0 QUALITY ASSURANCE PROGRAMME :

9.1 The Bidder must establish that they are following a proper quality assurance programme for manufacture of equipments. The Bidder shall invariably furnish following information along with his offer. Information shall be separately given for individual type of equipment offered.

- i) Statement giving list of important raw materials, names of sub supplier for the raw material, list of standards according to which the raw material are tested, list of tests normally carried out on raw material in presence of Bidder's representative and copies of test certificates.
- ii) Information and copies of test certificates as mentioned in (i) above in respect of bought out items.
- iii) List of manufacturing facilities available.
- iv) Levels of automation achieved and list of areas where manual processing exists.
- v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
- vi) Special features provided in the equipment to make it maintenance free.
- vii) List of testing equipment available with the Bidder for final testing of equipment specified and test plant limitations, if any, vis-à-vis type test, acceptance and routine tests specified in the relevant Indian Standards or equivalent international standard. These limitations shall be very clearly brought out in schedule of deviations from specified test equipments.

9.2 The successful Bidder shall within 30 days of placement of order, submit following information to the Purchaser.

- i) List of raw materials as well as bought out accessories and the names of sub supplier selected from the lists furnished along with offer.
- ii) Type test certificate of the raw material and bought out accessories.

- iii) Quality Assurance Plan (QAP) with hold points by Purchaser's inspection. The quality assurance plans and hold points shall be discussed between the Purchaser and Bidder before the QAP is finalised.

9.3 The successful Bidder shall submit the routine test certificates of bought out items and for raw material at the time of routine testing of the fully assembled equipment.

10.0 DOCUMENTATION :

10.1 All drawings shall conform to latest version of International Standards Organization (ISO)'A' series of drawing sheet/Indian Standards Specification IS-11065. All drawings shall be in ink and suitable for micro testing. All dimensions and data shall be in S.I. Units.

11.0 LIST OF DRAWINGS AND DOCUMENTS :

11.1 The Bidder shall furnish four sets of following drawings along with his offer.

- a) General outline and assembly drawings of the equipment.
- b) Sectional views showing General Constructional Features.
- c) Name plate.
- d) Schematic drawing.
- e) Type Test reports
- g) Test reports, literature, pamphlets of the bought out items.

11.2 The successful Bidder shall within two weeks from signing of contract, submit four sets of all the above drawings for Purchaser's approval. The Purchaser shall communicate his comments/approval on the drawings to the Bidder within reasonable time. The Bidder shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of Purchaser's comments. After receipt of Purchaser's approval, the Bidder shall within three weeks submit 4 prints and two good quality reproducible (Soft Copy in CD) of the approved drawings for Purchaser's use.

11.3 The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Bidder's risk.

11.4 The successful Bidder shall furnish nicely printed and bound volumes of operation, maintenance and erection manuals in English Language, for each type and rating of equipment alongwith the equipments. The manual shall contain all the drawings and information required for erection, operation and maintenance of the equipments. The manual shall also contain a set of all the approved drawings and type test reports etc.

11.5 Approval of drawings by Purchaser shall not relieve the Bidder of his responsibility and liability for ensuring correctness and correct interpretation of the

latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall have the power to reject any work or material, which in his judgment is not in full accordance therewith.

12.0 ENGRAVING, PACKING AND FORWARDING :

12.1 The details such as order no. and date, year of manufacture and "MPPTCL" should be engraved on each and every equipment. The equipment shall be packed in crates suitable for vertical/horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The Bidder shall be responsible for any damage during transit, due to improper and inadequate packing and handling. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Bidder shall supply, any material, found short inside the packing cases without any extra cost.

12.2 Each consignment shall be accompanied by a detailed packing list containing the following information:

- a) Name of the consignee.
- b) Details of consignment.
- c) Destination
- d) Total weight of consignment.
- e) Handling and unpacking instructions.
- f) Bill of material indicating contents of each package.

12.3 The Bidder shall ensure that the packing list and bill of material is approved by the Purchaser before despatch

13.0 SCHEDULE

Schedules, questionnaire and annexure attached with this specification are the integral part of the specification and shall be submitted duly filled in by the Bidders alongwith the offer. Bill of material for each equipment shall be submitted by the bidder separately. Makes of the equipment shall be clearly indicated. Bidders may please note that a general mention that the components shall be of reputed make will not be acceptable.

14.0 COMPLETENESS OF EQUIPMENT/MATERIAL AND BOUGHT OUT ITEMS

14.1 Bid shall be complete in all respects and shall include all minor component, accessories, small wiring etc., not specifically mentioned in the Schedule, specifications etc; but essential for the completeness of the system. Bidders shall not be eligible for extra charges in respect of such minor components, accessories, small wiring etc., though not included specifically in this specification but requires for satisfactory operation of equipment offered.

14.2 Bidders must furnish following information along with technical Bid.

14.2.1 Complete details of all the accessories which will be supplied

14.2.2 It is obligatory on the part of bidders to ensure that supply of all accessories along with Main equipment are simultaneously delivered to avoid any holdups. Responsibility for obtaining timely supplies of bought out items will rest on the bidders and only on this basis, delivery period will be offered in the Bid.

14.2.3 It may be noted that in case of damages/shortages due to improper packing or any other negligence ,replenishment shall be arranged within one months time. For bought out items, responsibility for guarantee and obtaining immediate replacement in case any defects are noticed and also in case defective supply of any item is reported, will rest on the bidders.

15.0 SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS AND TECHNICAL QUESTIONNAIRE:

It is obligatory on the part of bidders to furnish Guaranteed Technical and Technical Questionnaire for offered equipments in the format provided under Section-4 ~~4~~ duly filled in complete in all respects.

16.0 GUARANTEE FOR SUPPLY OF SPARES FOR 10 YEARS OPERATION:

As specified in the bid document, the bidder has to furnish an undertaking that the spares required for satisfactory operation of offered goods shall be made available at reasonable cost over a minimum period of 10 years from the date of commissioning of goods in purchaser's system. In the absence of such an undertaking, the offer will be treated as non-responsive.

17.0 Please ensure the Bid document containing number of pages has been properly page numbered and signed by the bidder. All Bid documents including Schedules and Annexure should be indexed properly and index of the document should be enclosed/placed at the beginning of the document.

SCHEDULE-I(A)

**DESCRIPTION OF EQUIPMENT FOR SCHEDULE FOR RATES AND PRICES
TO BE FURNISHED IN VOLUME-VI**

SNo	Particulars of equipment/item	Qty.
A	Epax & Telephone sets	As per Price Schedule Section-I Vol.-II,
1	32/16 LINES ELECTRONIC PRIVATE AUTOMATIC EXCHANGE (EPAX) meeting all technical requirements of the specification.	
2	16/8 LINES ELECTRONIC PRIVATE AUTOMATIC EXCHANGE (EPAX) meeting all technical requirements of the specification	
3	Telephone sets meeting all technical requirement of the specification	

Note : 1. The above description of the equipment is given for the purpose of offering the prices and to mention description of equipment in invoice for claiming payment.

2. The quantity of above equipments has been mentioned in ~~Volume-II~~ Section-1 .

2.2.5 TECHNICAL SPECIFICATION FOR HF COAXIAL CABLE & TELEPHONE CABLES

1.0 SCOPE :

The scope of this bid covers, design manufacturing and supply of equipment as per Section ~~4.1~~. The bidder mentioned in this Section of the Technical Specification means "Original Equipment Manufacturer (OEM)". The purchaser means the "MPPTCL".

In case bidder is not OEM, sole responsibility of offering equipments/materials of manufacturer as per this specification requirement shall rest on the bidder.

2.0 STANDARDS :

2.1 Applicable Standards for the offered equipments /items shall be as per Section-~~2~~ **2** .
~~Volume-1~~

2.2 If the equipment offered by the Bidders conforms to any other standards, salient points of comparison between the standards adopted and the specific standards shall be clearly brought out in relevant schedule of technical deviation. It will be sole responsibility of Bidders to prove that the salient features of offered equipment are equivalent or better than IS.

2.3 ACCEPTANCE OF OTHER AUTHORITATIVE STANDARDS :

In the preceding paragraph relevant Indian standard / IEC standard bid have been shown. However, the equipment meeting any other authoritative international standard, which ensures equal or better quality than the standards, mentioned shall also be acceptable. Equipment for which Indian Standards are not available, the relevant British standards and IEC recommendations will be applicable. Please attach photocopy of all such standards according to which the equipment has been offered.

3.0 CLIMATIC CONDITIONS :

3.1 Applicable climatic conditions shall be as per ~~Section-1, Volume-1~~ **Section-3** .

3.2 AUXILIARY POWER SUPPLY :

Auxiliary Power Supply for offered EHV equipments shall be as per Section ~~3~~ **3** .
~~Volume-1~~

4. DISCREPANCY IN TECHNICAL PARTICULARS :

Regarding discrepancy in technical particulars stipulation under Section ~~2~~ **2** .
~~Volume-1~~ shall be applicable.

5.0 TECHNICAL SPECIFICATION OF HF COAXIAL CABLE

5.1 Basic Design :

5.1.1 The Coaxial cable or HF cable shall be used for connections between the line matching unit and the transmitter receiver set. The insulation of the cable shall be of very high quality to minimise leakage at the carrier frequencies. The cable shall be screened by means of tinned braided copper and armoured with G.I. wire & finally overall PVC sheathed. The capacitance of the cable shall be low so as to minimize the attenuation in the carrier frequency range. The size, details of insulation etc. shall be furnished in the bid. The cable length may be laid in ducts or directly imbedded in ground. Thus the cable offered should be suitable to be laid in duct or imbedded in ground. The characteristic impedance of the cable shall be 125 ohm. The impedance of the cable shall match with the output impedance of the PLC terminals and the impedance of the coupling unit over the entire frequency range of 40- 500 KHz. The attenuation per kilometer for high frequency range of 40-500 KHz should be furnished. The dimensions and materials used for conductors, insulation, copper braiding, inner PV sheath(Jacket), PVC tape, G.I. wire & final PVC sheath shall be as indicated below. The conductor material should use highly annealed electrolytic tinned copper. The insulation material should be of high quality and should not deteriorate even if imbedded in ground for 10 years or more. There should be no action of chemical and moisture on it. The outer covering of the cable should be free from attack by termites.

5.1.2 The cable shall be designed to withstand a test voltage of 4 KV between the conductor and outer sheath for one minute. The voltage withstand test and the test to ascertain the attenuation figures offered shall be carried out at the manufacturer's work.

5.1.3 The HF cable shall be supplied in non-returnable wooden drums having lengths between 500 Meters and 525 meters. Please note that, non standard length are not acceptable & same should not be supplied. A quantity variation of $\pm 2\%$ on total ordered quantity will only be acceptable.

5.1.4 A drawing showing constructional details indicating dimension and other details of each component used for manufacturing the cable is enclosed along with this specification. In order to clarify the Bidders regarding our exact requirement and also for the purpose of submitting various technical details of the cables, the following additional information is furnished.

- i. As far as possible characteristic impedance of the cable should be 125 ohm. However, a variation of $\pm 5\%$ on 125 ohm shall be permitted.
- ii. Minimum diameter of the bare copper conductor should be 0.8mm.
- iii. The bare copper conductor should be wrapped with PE thread of 1.6mm diameter.
- iv. Over the bare copper conductor wrapped with PE thread, extruded tube of PE with minimum wall thickness of 1.75mm should be provided, diameter of extruded tube should be approximately 7.6mm.
- v. Over PE tube single braid of tinned copper wire(diameter 0.2mm)of size 24x8x0.2(i.e 24 spindle with 8 wire per spindle and diameter of each wire

should be 0.2mm) with 50mm lay shall be applied. Diameter over braiding should be approximately 8.5mm.

- vi. Over the copper braiding a PVC/Melinex tape of thickness 0.15/0.025mm shall be applied.
- vii. A PVC inner jacket with nominal wall thickness of 1.2mm shall be applied over PVC/Melinex tape.
- viii. After PVC inner jacket tape, lap armouring of GI wire of diameter 0.5mm of size 48x1x0.5 with 100mm lay approximately shall be provided.
- ix. A PVC/Melinex tape of thickness 0.15/0.025mm shall be applied over armouring.
- x. Finally outer jacket of PVC with wall thickness of 1.4mm shall be provided. Over all diameter of cable shall be about 16mm (17mm max).
- xi. On the above basis, please furnish drawing, showing complete constructional details of the cable and also thickness of various sheath/tape used for the cable shall be specified keeping in view of our minimum requirements as furnished above.

6.0 TECHNICAL SPECIFICATION OF TELEPHONE CABLE:

6.1 Basic Design for 2 Pair, 6 Pair, 10 Pair PVC Unarmoured and 10 Pair PVC Armoured Telephone Cable.

The multicore telephone cables suitable for overhead and underground system are required for Purchaser's departmental telephone system. The telephone cable shall generally conform to specification No.G/WIR-06/02 with latest amendment. The cable shall be manufactured as per following specifications.

6.1.1 Requirement and Size of Cables:

2 Pair, 6 Pair and 10 Pair PVC unarmoured cable required should be suitable for over head system and 10 pair PVC armoured telephone cable suitable for under ground system. In case of armoured cable armouring and outer sheath should be provided as per IS-1554.

6.1.2 Type of Conductor, Insulation of Conductor and Twining:

- (a) The conductor must consists of bright clean and scale free solid wire (round) of annealed high conductivity tinned copper. The surface of the conductor shall be smooth and untarnished.
- (b) The diameter of conductor should be 0.60mm.
- (c) Maximum average resistance of conductor at 20 degree centigrade should be 64 ohm /km.
- (d) The conductor must be insulated with PVC. The minimum thickness of insulation should be 0.2+0.05 mm-0.02mm. The cable insulation must be flame retardant and shall not support own combustion and must be self extinguishing. PVC used must be high resistant to ageing and fading of colours. The insulation shall be applied by extrusion process and shall form a compact homogenous body uniformly enclosing the copper conductor. It shall be possible to strip the insulation readily from the copper conductor without damaging them.
- (e) Two insulated conductors must be uniformly twisted together to form a pair. The lays of the twists of the pairs must be different for all pairs so that cross talk is kept to a minimum.

6.1.3 Identifications, Sheathing & other requirements:

- (a) The conductors should be laid such that each pair can be identified easily. The colour should be readily identifiable under the normal lightning conditions. The range of pigment used for colouring PVC shall be such that the colour should not fade out. The colour code must be clearly mentioned in offer and lapping of PVC tape should be applied.
- (b) All insulated cores are first twisted in to pairs. All the 10 pair / 6 pair / 2 pair should be bunched to form a unit. The cable thus formed shall be tightly lapped with a PVC tape of 0.13 mm thickness with a 30% overlap. Alternatively, the cable shall be lapped with polythene terephthalate tape of 0.013 mm thickness, having an overlap of not less than 30% or two such tapes may be applied over breaking joint. Finally an outer sheathing of PVC of thickness of 0.65mm for 6 pair and 2 pair and 0.75 mm for 10 pair unarmoured PVC cable shall be provided. For 10 pair armoured PVC cable, minimum thickness of outer sheath should be 1.4mm. The armouring should be done with wire / strip as per IS 1554.
- (c) The telephone cable shall be supplied in non returnable wooden drums having lengths between 500 meters and 525 meters or 1000 meters and 1050 meters. Please note that non standard length should not be supplied. A quantity variation of $\pm 2\%$ on total ordered quantity will only be acceptable.

7.0 GUARANTEED TECHNICAL PARTICULARS :-

It is obligatory on the part of bidders to furnish guarantee technical particulars and technical questionnaire of offered cables in the format provided under Section-III duly filled in complete in all respects.

8.0 TESTS :

8.1 Type Test :

All the cables offered, shall be fully type tested as per relevant Indian Standards or any Equivalent International Standard during the last five years from the date of bid opening. In case the equipment of the type and design offered has already been type tested, the Bidder shall furnish four sets of the type test reports along with the offer. The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of Purchaser's representatives. For this purpose, the Bidder may quote unit rates for carrying out each type test. This will not be considered for price evaluations. For any change in the design/type already type tested and the design/type offered against this bid, the Purchaser reserves the right to demand repetition of same or all type tests without any extra cost. Non compliance of this requirement will make the bid non responsive.

8.2 Acceptance And Routine Tests:

8.2.1 The manufacturer shall carry out all acceptance and routine tests as stipulated in the relevant Indian Standards or Equivalent International Standards in presence of Purchaser's representative.

8.2.2 Immediately after finalisation of the programme of type/ acceptance/routine testing, the manufacturer shall give advance intimation to the Purchaser, to enable him to depute his representative for witnessing the tests.

9.0 INSPECTION:

- (i) The Purchaser shall have access at all times to the works and all other places of manufacture, where the cables are being manufactured and the Bidder shall provide all facilities for unrestricted inspection of the Bidder's works, raw materials, manufacture of all the accessories and for conducting necessary tests as detailed herein.
- (ii) The successful Bidder shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of cables in its various stages, so that arrangements could be made for inspection.
- (iii) No material shall be despatched from the works of manufacturer unless the material has been satisfactorily inspected and tested.
- (iv) The acceptance of any quantity of the cables shall in no way relieve the successful bidder of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such cables are later found to be defective.

10.0 QUALITY ASSURANCE PROGRAMME :

10.1 The Bidder must establish that they are following a proper quality assurance programme for manufacture of cables. The Bidder shall invariably furnish following information along with his offer. Information shall be separately given for individual type of cable offered.

- i) Statement giving list of important raw materials, names of sub supplier for the raw material, list of standards according to which the raw material are tested, list of tests normally carried out on raw material in presence of Bidder's representative and copies of test certificates.
- ii) Information and copies of test certificates as mentioned in (i) above in respect of bought out items.
- iii) List of manufacturing facilities available.
- iv) Levels of automation achieved and list of areas where manual processing exists.
- v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
- vi) Special features provided to make it maintenance free.

- vii) List of testing equipment available with the Bidder for final testing of cable specified and test plant limitations, if any, vis-à-vis type test, acceptance and routine tests specified in the relevant Indian Standards or equivalent international standard. These limitations shall be very clearly brought out in schedule of deviations from specified test equipments.

10.2 The successful Bidder shall within 30 days of placement of order, submit following information to the Purchaser.

- i) List of raw materials as well as bought out accessories and the names of sub supplier selected from the lists furnished along with offer.
- ii) Type test certificate of the raw material and bought out accessories.
- iii) Quality Assurance Plan (QAP) with hold points by Purchaser's inspection. The quality assurance plans and hold points shall be discussed between the Purchaser and Bidder before the QAP is finalised.

10.3 The successful Bidder shall submit the routine test certificates of bought out items and for raw material at the time of routine testing of the fully assembled equipment.

11.0 DOCUMENTATION :

11.1 All drawings shall conform to latest version of International Standards Organization (ISO) 'A' series of drawing sheet/Indian Standards Specification IS-11065. All drawings shall be in ink and suitable for micro testing. All dimensions and data shall be in S.I.Units.

12.0 LIST OF DRAWINGS AND DOCUMENTS :

12.1 The Bidder shall furnish four sets of following drawings along with his offer.

- a) General outline drawings.
- b) Sectional views showing General Constructional Features.
- c) Marking on the cables
- d) Type Test reports
- e) Test reports, literature, pamphlets of the bought out items.

12.2 The successful Bidder shall within two weeks from signing of contract, submit four sets of all the above drawings for Purchaser's approval. The Purchaser shall communicate his comments/approval on the drawings to the Bidder within reasonable time. The Bidder shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of Purchaser's comments. After receipt of Purchaser's approval, the Bidder shall within three weeks submit 4 prints and two good quality reproducible (Soft Copy in CD) of the approved drawings for Purchaser's use.

12.3 The manufacturing of the cables shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of

the Purchaser. All manufacturing work in connection with the cable prior to the approval of the drawing shall be at the Bidder's risk.

12.4 The successful Bidder shall furnish nicely printed and bound volumes of manuals in English Language, for each type and rating of equipment/materials alongwith the equipments.

12.5 Approval of drawings by Purchaser shall not relieve the Bidder of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and Purchaser shall have the power to reject any work or material, which in his judgment is not in full accordance therewith.

13.0 ENGRAVING, PACKING AND FORWARDING :

13.1 The details such as order no. and date, year of manufacture and " MPPTCL" should be engraved on each and every cable. The cable shall be packed in crates suitable for vertical/horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The Bidder shall be responsible for any damage during transit, due to improper and inadequate packing and handling. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Bidder shall supply, any material, found short inside the packing cases without any extra cost.

13.2 Each consignment shall be accompanied by a detailed packing list containing the following information:

- a) Name of the consignee.
- b) Details of consignment.
- c) Destination
- d) Total weight of consignment.
- e) Handling and unpacking instructions.
- f) Bill of material indicating contents of each package.

13.3 The Bidder shall ensure that the packing list and bill of material is approved by the Purchaser before despatch.

14.0 SCHEDULE

Schedules, questionnaire and annexures attached with this specification are the integral part of the specification and shall be submitted duly filled in by the Bidders alongwith the offer. Bill of material for each equipments shall be submitted by the bidder separately. Makes of the equipment shall be clearly indicated. Bidders may please note that a general mention that the components shall be of reputed make, will not be acceptable.

15.0 COMPLETENESS OF EQUIPMENT AND BOUGHT OUT ITEMS

15.1 Bid shall be complete in all respects and shall include all minor component, accessories, small wiring etc., not specifically mentioned in the Schedule, specifications etc; but essential for the completeness of the system. Bidders shall not be eligible for extra charges in respect of such minor components, accessories, small wiring etc., though not included specifically in this specification but requires for satisfactory operation of equipment offered.

15.2 Bidders must furnish following information along with technical Bid.

15.2.1 Complete details of all the accessories which will be supplied

15.2.2 It is obligatory on the part of bidders to ensure that supply of all accessories along with Main equipment are simultaneously delivered to avoid any holdups. Responsibility for obtaining timely supplies of bought out items will rest on the bidders and only on this basis, delivery period will be offered in the Bid.

15.2.3 It may be noted that in case of damages/shortages due to improper packing or any other negligence ,replenishment shall be arranged within one months time. For bought out items, responsibility for guarantee and obtaining immediate replacement in case any defects are noticed and also in case defective supply of any item is reported, will rest on the bidders.

16.0 GUARANTEE FOR SUPPLY OF SPARES FOR 10 YEARS OPERATION:

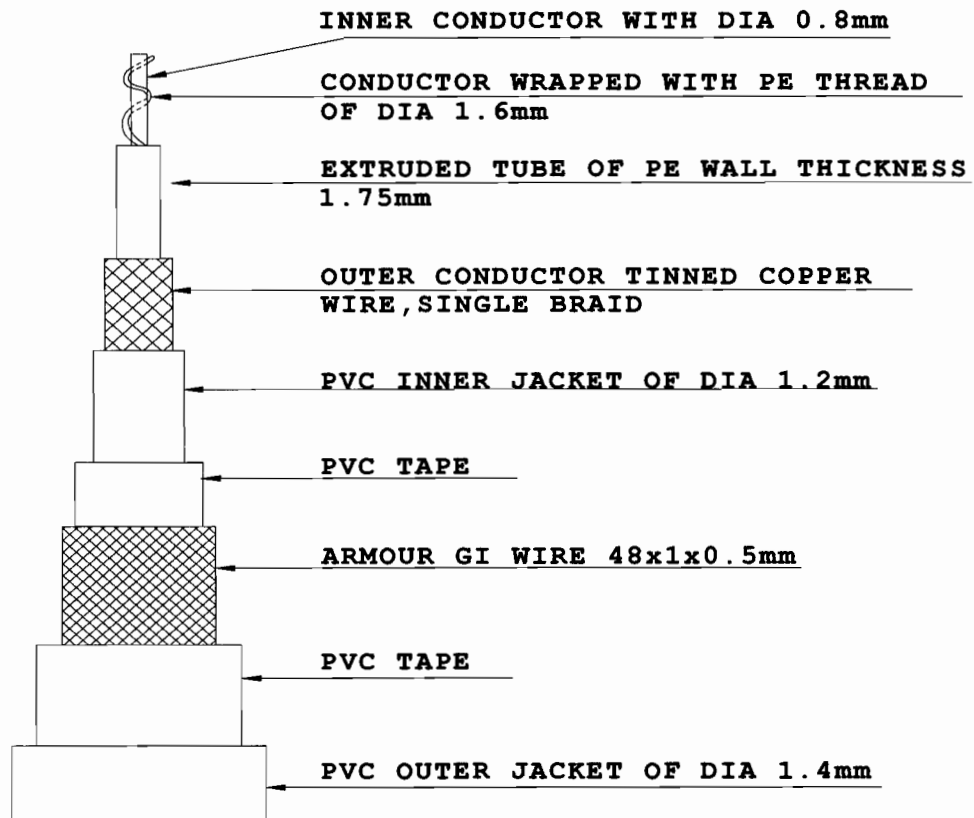
As specified in the bid document, the bidder has to furnish an undertaking that the spares required for satisfactory operation of offered goods shall be made available at reasonable cost over a minimum period of 10 years from the date of commissioning of goods in purchaser's system. In the absence of such an undertaking, the offer will be treated as non-responsive.

17.0 Please ensure the Bid document containing number of pages has been properly page numbered and signed by the bidder. All Bid documents including Schedules and Annexure should be indexed properly and index of the document should be enclosed/placed at the beginning of the document.

APPENDIX-B

S.No	Drawing No.	Description
1	JICA/MPPTCL/TR-101 TO 107/HF COAXIAL CABLE	Constructional details of HF Coaxial Cable

CONSTRUCTIONAL DETAILS OF HF COAXIAL CABLE



DRAWING NUMBER :-

JICA/MPPTCL/TR-101 TO 107/HF COAXIAL CABLE

SCHEDULE-I(A)
DESCRIPTION OF EQUIPMENT FOR SCHEDULE FOR RATES AND PRICES
TO BE FURNISHED IN VOLUME-VI

SNo	Particulars of equipment/item	Qty.
A	HF COAXIAL CABLES & TELEPHONE CABLES	As per Price Schedule
1.	HF Coaxial Cable conforming to technical specifications and meeting all design, constructional features and technical particulars as described in bid document.	
2	Telephone Cables of following sizes, conforming to technical specification of the bid document and meeting all design, constructional features and technical particulars as described in bid document.	
a)	10 Pair PVC Armoured	
b)	6 Pair PVC Armoured	

Note : 1. The above description of the equipment is given for the purpose of offering the prices and to mention description of equipment in invoice for claiming payment.

2. The quantity of above equipments has been mentioned in ~~Volume VI~~ Section- 1 .

APPENDIX-A
LIST OF STANDARDS
GENERAL

Indian Electricity Rules, Indian Electricity Act, Indian Electricity (Supply) Act, Indian
Factories Act

S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
1	IS-5	Colours for Ready Mixed Paints & Enamels	-
2	IS-335	New Insulating Oils	-
3	IS-617 (P1 to P145)	Aluminium and Aluminium Alloy Ingots and Castings for General Engineering Purposes	-
4	IS-1448 (P1 to P145)	Methods of Test for Petroleum and its Products	-
5	IS-2071 (P1 to P3)	Methods of High Voltage Testing	-
6	IS-12063	Classification of degrees of Protection provided by enclosures of electrical equipment	-
7	IS-2165 1:1997 P2:1983	Insulation Coordination	-
8	IS:3043	Code of Practice for Earthing	-
9	IS-6103	Method of Test for Specific Resistance (Resistivity) of Electrical Insulating Liquids	-
10	IS-6104	Method of Test for Interfacial Tension of Oil against Water by the Ring Method	-
11	IS-6262	Method of Test for Power Factor & Dielectric Constant of Electrical Insulating Liquids	-
12	IS-6792	Method for Determination of Electric Strength of Insulating Liquids	-
13	IS-5578	Guide for Uniform System of Marking & Identification of Conductors & Apparatus Terminals	-
14	IS-11353	Methods for Radio Interference Test on High Voltage	-
15	IS-8263	Methods of Radio Interference Test on High Voltage Insulators	-
16	IS-9924 (Part 1,2 & 4)	Low Voltage Fuses	-
17	-	High Voltage Test Techniques	IEC-60060 (Part 1 to P4)
18	-	Environmental Test	IEC-60068

S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
19		Graphical Symbols	IEC-60117
20	-	Methods for the Determination of the Electrical Strength of Insulation Oils	IEC-60156
21	-	Partial Discharge Measurements	IEC-60270
22	-	Specification and Acceptance of New Sulphur Hexafluoride	IEC-60376
23	-	Radio Interference Test on High Voltage Insulators	IEC-60437
24	-	Artificial Pollution Tests on High Voltage Insulators to be used on AC Systems	IEC-60507
25	-	Common Specification for High Voltage Switchgear & Control gear Standards	IEC-60694
26	-	Guide for the Selection of Insulators in respect of Polluted Conditions	IEC-60815
27	-	Short Circuit Current – Calculation of effects	IEC-60865 (P1 & P2)
28	-	National Electrical Code	ANSI-C.1/ NFPA.70
29	-	Guide for Surge Withstand Capability (SWC) Tests	ANSI-C37.90A
30	-	Specification for Electromagnetic Noise and Field Strength Instrumentation 10 KHz to 1 GHz	ANSI-C.6321, C63.3
31	-	Techniques for Dielectric Tests	C36.4 ANSI-C68.1
32	-	Standard General Requirements and Test Procedure for Outdoor Apparatus Bushings	ANSI-C76.1/EEE21
33	-	Specification for Sound Level Meters	ANSI-S14
34	-	Drawing Symbols	ANSI-Y32- 2/C337.2
34	-	11 Gray Finishes for Industrial Apparatus and Equipment No.61 Light Gray	ANSI-Z55.
35	-	General Standards for Industrial Control & Systems Part ICSI-109	NEMA-ICS-II
36	-	Specification for CISPR Radio Interference Measuring Apparatus for the frequency range 0.15 MHz to 30 MHz	CISPR-1
37	-	Quality Assurance Program Requirements	CSA-Z299.1-1978h

S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
38	-	Quality Control Program Requirements	CSA-Z299.2-1979h
39	-	Quality Verification Program Requirements	CSA-Z299.3-1979h
40	-	Inspection Program Requirements	CSA-Z299.4-1978h
EQUIPMENT-WISE SPECIFICATION			
A) 400KV, 220KV, 132KV & 33KV CIRCUIT BREAKERS:			
1	-	Specification for alternating current circuit breakers	IEC-62271-100-2001
2	-	Specification and acceptance of new supply of SF6	IEC-376
3	IS-1885	Electro technical vocabulary	IEC-50
4	IS-375	Marking and arrangement for switchgear bus-bar, main connections and auxiliary wirings.	-
5	IS-2147	Degree of protection provided for enclosures for low voltage switchgear and control gear.	-
6	IS-325	Specification for three phase induction motors.	-
7	IS-13947	LV Switchgears & control gear.	IEC-947
8	IS-2629	Recommended practice for hot dip galvanizing of iron and steel.	-
9	IS-5	Colour for ready mix paints.	-
10	IS-2099	High voltage porcelain bushings.	IEC-137
11	IS-5561	Electric Power connectors	-
12	IS-2516	Specification for circuit breaker	-
13	-	Synthetic Testing of High Voltage alternating current circuit breakers	IEC-6047
14	-	Pressurised hollow column insulators	IEC-61264
15	IS-13118	Specification for alternating current circuit breakers	IEC-62271-100-2001 & IEC 60056 or latest amendment thereof
B) 400 KV, 220 KV, 132 KV & 33KV C&R PANELS:			
1	IS-3842	Application guide for electric relays for AC system	-
2	IS-3231, (P-3)	3231 Electric relays for power system protection.	-
3	IS-1885	Electric technical vocabulary electrical relays and Electrical power system protection	IEC 50
4	IS-1248/2419	Indicating instruments	-

S. No.	Indian Standard Number	Title	International & Internationally Recognised Standards
5	-	Instrument Transformer Measurement of partial discharge	IEC- 6044-4
6	-	Coupling Capacitor and Capacitor Dividers	IEC-60358
N) 400 KV, 220 KV & 132 KV WAVE TRAPS			
1	IS- 8792	Line Trap For AC Power System	-
2	IS- 8793	Method For Test Line Trap	-
3	-	Line Traps for a. AC Power Systems	IEC-60353
4	IS-3070	Lightning Arresters for AC system	-
O) POWER LINE CARRIER COMMUNICATION EQUIPMENTS			
1		Single side band Power Line carrier terminals	IEC -60495
2	IS- 9482	Carrier Cabinet	IEC-60495
3	-	Carrier Cabinet	IEC-834-1
4	-	Protection Coupler	-
5	-	Guide on power line carrier	CIGRE
6	IS- 8997	Coupling Device for PLC system	-
7	IS- 8998	Methods of test for Coupling Device for PLCC System	-
8	-	Coupling Device for power line carrier systems	IEC- 60481
8	-	Impulse Voltage withstand test	IEC-255-4
9	-	High Frequency disturbance susceptibility test	IEC-255-22-1
10	-	Electrostatic discharge susceptibility test	IEC-801-2
11	-	Radiated susceptibility	IEC-801-3
12	-	Fast Transient Susceptibility Test	IEC-801-4
13	-	Power Line Coupling Voltage Transformers	ANSIC92.2
14	-	Planning of (Single side-band) power line Power Line Carrier Systems	IEC 60683
P) COAXIAL CABLE			
1	IS-11967	Coaxial Cable	-
2	IS- 1554	Armoured Cable	-
3	-	Telephone Cable	GR/WIR-06/03
Q) SUBSTATION SWITCHYARD STRUCTURES			
1	IS:209-1992	Zinc ingot- Specification	-
2	IS:802-Part-II-1978	Code of practice for use of structural steel in overhead transmission line towers - Part - II: Fabrication, Galvanizing, Inspection & packing.	-

APPENDIX - B

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not appear in various schedules and required for successful commissioning of substation shall be included in the bid price and shall be provided at no extra cost to MPPTCL.

16.0 TECHNICAL DEVIATIONS:

In case of any deviation from the requirement indicated in our technical specification then the deviation shall be mentioned explicitly and clearly for respective equipment separately for equipment/material in Schedule-XI "**Volume VI of bid specification**". While MPPTCL may consider and accept such minor deviations which may not affect overall performance of equipment/system; it may be noted that in case of any major deviation, MPPTCL reserves the right to reject the bid without assigning any reasons.

17.0 BASIC REFERENCE DRAWINGS:

17.1 Single line diagram and general arrangements, drawings are enclosed in Appendix B of this section for reference, which shall be further engineered by the bidder.

17.2 The bidder shall maintain the overall dimensions of the substation/ site, phase to earth clearance, phase to phase clearance and sectional clearances as per enclosed drawings / relevant applicable standards.

The enclosed drawings give the basic scheme, layout of substation, substation buildings, associated services etc. In case of any discrepancy between the drawings and text of specification, the requirements of text shall prevail in general. However, the Bidder is advised to get these clarified from MPPTCL.

17.3 The auxiliary transformers of rating 200 KVA shall be used for AC, 400 V supply at sub-stations.

18.0 SPECIAL TOOLS AND TACKLE:

The bidder shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately packed and brought on to Site.

19.0 QUALITY ASSURANCE PLAN & STAGE INSPECTION:

19.1 The successful bidder shall ensure that for the purpose of supply of equipments, the manufacturer will have to follow strict quality assurance programme, which will include thorough verification of samples of critical assemblies and accessories, verification of sources of raw materials, detailed verification of drawing & design, checking up of relevant calculations, stage inspections at various critical stages of manufacture and minor modifications consequent to such stage inspections as per our requirements and all other related requirements, which have generally been brought out in bidding documents and the detailed contract. It is expected that bidder would be very serious and prudent in meeting these requirements without any loss of time, so that supply of equipments in line with quality assurance programme is ensured within targeted schedule.

The MPPTCL reserves the right to specify various stages for stage inspections and also for manufacture of a proto type unit for inspection & testing, before according clearance for bulk manufacturing.

19.2 The bidder shall ensure that manufacturer must establish that they are following a proper quality assurance programme for manufacture of offered equipments.

The bidder shall ensure that manufacturer invariably furnish following information:-

- i. Statement giving list of important raw materials, names of sub supplier for the raw material, list of standards according to which the raw material are tested, list of tests normally carried out on raw material in presence of manufacturers representative, copies of test certificates.
- ii. Information and copies of test certificates as in (i) above in respect of bought out items.
- iii. List of manufacturing facilities available.
- iv. Levels of automation achieved and list of areas where manual processing exists.
- v. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.
- vi. Special features provided in the equipment to make it maintenance free.
- vii. List of testing equipment available with the manufacturer for final testing of equipment specified and test plant limitations, if any vis-à-vis type, special, acceptance and routine tests specified in the relevant Indian Standards or equivalent international standard. These limitations shall be very clearly brought out in schedule of deviations from specified test equipments.

19.3 The successful bidder shall within 30 days of award of Contract shall arrange following information to the MPPTCL.

- i. Quality Assurance Plan (QAP) with hold points for Employer's inspection. The quality assurance plans and holds points shall be discussed between the Employer and Bidder before the QAP is finalized.

19.4 The successful Bidder shall also ensure that the manufacturer submits the routine test certificates of bought out items and for raw material at the time of routine testing of the fully assembled equipment.

20.0 SYSTEM PARAMETERS

S. No.	Description of Parameters	400 KV System	220 KV System	132 KV System	33 KV System
1.	System Operating Voltage	400 KV	220 KV	132 KV	33 KV
2.	Maximum operating voltage of the system (rms)	420 KV	245 KV	145 KV	36 KV
3.	Rated Frequency	50 Hz	50 Hz	50 Hz	50 Hz
4.	No. of phase	3	3	3	3

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SECTION-3
Project Details and General Technical Requirements

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Madhya Pradesh Power Transmission Company Ltd.				
b)	Project Title	Construction of new 400 kV sub stations, transmission lines and Augmentation work/feeder bay work on total turn-key basis (Lot no. 1) – Balaghat, Badnawar, Bhopal, Chhegaon and Nagda substation				
c)	Location	Balaghat	Badnawar	Bhopal	Chhegaon	Nagada
		Balaghat is Located in district of Balaghat of Madhya Pradesh. Distance between Jabalpur to Balaghat is 232 km by Road and 130 km by Rails.	Badnawar is Located in district of Dhar of Madhya Pradesh. Distance between Badnawar to Ujain is 70 km by Road.	Bhopal site is located 20 km away from Bhopal city.	Chhegaon is located in Khandwa district of Madhya Pradesh. Distance between Chhegaon to Khandwa is 15 km by Road.	Nagda is located in Ujjain district of Madhya Pradesh. The road distance between Nagda to Ujjain is 47 km.
d)	Transport Facilities	Road/Rail				

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e)	Postal Address	To follow
SITE CONDITIONS		
a)	Maximum ambient air temperature	50°C
b)	Minimum ambient air temperature	1°C
c)	Average daily ambient temperature	35°C
d)	Maximum Relative humidity	95 % (sometimes approach saturation)
e)	Pollution Severity	Heavily Polluted
f)	Seismic level (horizontal acceleration)	0.3g
g)	Wind zone as per IS 802 (PART 1) - 1995 velocity	4
h)	maximum wind pressure	150kg/sq.mts
i)	Average annual rainfall	1250 mm
j)	Maximum altitude above mean sea level	1000m
k)	Isolceraunic level	90 days per year
l)	Climate	Moderately hot & humid tropical climate, conducive to rust & fungus growth

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V 50 Hz, 3-phase 4 wire, solidly earthed
1 phase A.C power supply	240V, 50 Hz, 1-phase, 2 wire
D.C. power supply	220V, 2-wire ungrounded , for all equipments and panels except PLCC of 400kV /220kV /132kV /33kV substation
D.C. power supply	48V, 2 wire system positively earthed for PLCC

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The above supply voltage may vary as below and all devices shall be suitable for continuous operation over entire range of voltage.

i.	AC supply	Voltage + 10 % to -25% , frequency \pm 4%
ii.	DC supply	Voltage + 10 % to -20%

SYSTEM PARAMETERS

Description parameters	400kV System	220kV System	132kV System	33kV System
System operating voltage	400 kV	220kV	132kV	33kV
Maximum operating voltage(rms)	420 kV	220kV	145kV	36 kV
Rated frequency	50Hz			
Full wave impulse withstand voltage (1.2/50 micro second)	1425kVP	1050kVP	650kVP	250kVP/ 170kVP
One minute Power frequency dry/wet withstand voltage (rms)	630kV/ 520kV	460kV	275kV	95kV/70kV
Switching Impulse withstand voltage (250/2500 micro sec.) dry and wet	1050kVP	-	-	-
Corona extinction voltage	320kV	156kV	105kV	-
Maximum radio interference voltage for frequency between 0.5MHz and 2 MHz at 320kV rms phase for 400kV system , 156kVrms for 220kV system & 92 kV rms for 132kV system	1000 Micro volt	1000 Micro volt	500 Micro volt	-
Rated short time current	40 kA for three seconds/one second as applicable			25 kA for three seconds/2 6.2kA for two second
Creepage distance @25mm/kV	10500mm	6125mm	3625m m	900mm
System Earthing	Effectively Earthed			

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3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last **five years from the date of bid opening (i.e. 20.11.13)** as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.2 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In

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general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The contractor shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

Painting process shall be of powder coating type. All surface shall be cleaned, phosphated and given two coats of rust-resistant primer followed by two coats of finish paints. The interior of all panels cabinets and enclosures shall be finished with gloss white enamel. Two final powder coats of synthetic enamel paint of light grey shade (697 of IS-5) shall be given to exterior surface of all the panels. Sufficient quantities of touch paint shall be furnished for application at site. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or other wise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling. All external painting shall be as per shade no. 697 of IS:5.

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanised conforming to latest version of IS:2629 & or 4759 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be **610 gm/sq.m** and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

- a) Name and address of the consignee.
- b) Purchase order number.
- c) Name of supplier/s.
- d) Description of equipment / material.
- e) Net weight.
- f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

Mandatory spares shall be packed in separate packing with clear identification.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.11 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

- a) Installed out door: IP-55
- b) Installed indoor in air conditioned area: IP-31
- c) Installed in covered area IP:52
- d) Installed indoor-in non air-conditioned area where possibilities of entry of water is limited:IP-41

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e) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.12 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may required by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided. All measurements shall be in M.K.S units.

3.13 EARTHING

Circuit breakers, LA, Isolator, CVT , CT , BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be **1100 V grade box –clamp type** and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be **non-disconnecting stud type equivalent to Elmex type CATM4**, Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the

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terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits : Minimum of 2 nos. of 2.5 sq.mm, copper flexible.

All CT circuits : Minimum of 4 nos. of 2.5 sq.mm, copper flexible.

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. **At least 20 % spare** terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.15 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of **CRCA** sheet steel of minimum 2.5 mm thickness. The thickness of door s/covers shall not be less than 2.5 mm. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and

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rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled **Neoprene gaskets**. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting atleast 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required

3.16 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a cerarnic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze the surface temperature of the heaters shall be restricted to a value

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which will not shorten the life of the heater sheaths or that of insulated wire or other
component in the compartments.

3.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid
proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is
waived.

All engineering data submitted by the Contractor after final process including review
and approval by the Employer shall form part of the Contract Document and the entire
works performed under this specification shall be performed in strict conformity, unless
otherwise expressly requested by the Employer in Writing.

3.18.2 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid
shall be in sufficient detail to indicate the type, size, arrangement, material description,
Bill of Materials, weight of each component, break-up for packing and shipment, the
external connections, fixing arrangement required, the dimensions required for
installation and interconnections with other equipments and materials, clearances and
spaces required for installation and interconnection between various portions of
equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the
Employer, name of consultant, the unit designation, contract no. , and the name of the
Project .If standard catalogue pages are submitted, the applicable items shall be
indicated therein. All titles, noting, markings and writings on the drawing shall be in
English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no
deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the
approval of the drawing shall be at the Contractor's risk. The Contractor may make any
changes in the design which are necessary to make the equipment conform to the
provisions and intent of the Contract and such changes will again be subject to

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approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.18.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalised at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

- 1) Drawings
- 2) Guaranteed Technical Particulars
- 3) Type Test Reports
- 4) Manufacturing Quality Plan

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3.18.5 DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
				Prints	CDs
1.	Drawings and Data Sheets	1	6	21	7 nos of all drawings/d ocuments
2.	Drawings "As Built "	-	-	21	
3.	Type Test Reports	1	6	21	
4.	Erection Manuals	-	6	21	
5.	Operation and Maintenance Manuals	-	6	21	
6.	Manufacturing Quality Plan	1	6	21	
7.	Field Quality Plan	1	6	21	
8.	Inspection Test Reports	-	-	21	

Soft copies of drawings at contract stage shall also be submitted in **PDF format**.

Drawings will also be submitted in mini cartridges in AUTOCAD Release -14 package or any other CAD package along with conversion files for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

SECTION-4
GUARANTEED TECHNICAL PARTICULARS

A. COUPLING DEVICES

1. Name of Manufacturer and Country
2. Type, Model and Catalogue Number
3. Whether suitable for mounting Outdoor in Switchyard & Type of mounting
4. Maximum temperature limit for satisfactory operation of coupling device mounted outdoor
5. Net weight
6. Nominal Primary Side Impedance
7. Nominal secondary Side Impedance
8. Composite loss within Passband
9. Return loss within Passband
10. Available Bandwidth (with 4400/6600/ 8800 pF CVTs)
11. Nominal Peak Envelope Power (with Distortion and Intermodulation Products 80 dB Down)
12. Maximum number of PLC terminals that can be connected in parallel:
 - (a) 20 W (P.E.P.) PLC terminals
 - (b) 40 W (P.E.P.) PLC terminals
 - (c) 100 W (P.E.P.) PLC terminals

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13. Power Frequency Impedance between primary terminal and Earth Terminals of Coupling Device.
14. 1 Minute Power Frequency Insulation level between Primary and Secondary Terminals of Coupling Device
15. Impulse (1.2/50 micro-sec.) Withstand Level between Primary and Secondary Terminals of Coupling Device
16. Power Frequency Current Carrying Capacity of Drain Coil (or Primary Winding of Matching Transformer).
 - (a) Continuous current
 - (b) Short time current for 0.2 sec.
 - (c) Inductance of drain coil with Tolerances (at 50 Hz)
17. Surge Arrester in Primary Side of Coupling Device:
 - (a) Type model & catalogue number
 - (b) Power frequency sparkover voltage
 - (c) Type of construction
 - (d) Maximum permissible arrester Discharge current with 8/20 micro Sec. impulse discharge
 - (e) Maximum permissible short time Current (2.2 micro sec.)
 - (f) Power frequency discharge current For 0.2 sec.
 - (g) Impulse spark over voltage 1.2/50 Micro sec.
 - (h) Rated voltage
 - (i) Whether Site tunable

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18. Surge arrestor in Secondary Side of Coupling Device
 - (a) Type model & catalogue number
 - (b) Power frequency spark over voltage
 - (c) Impulse spark over voltage (1.2/50
Micro sec.
19. Details of interlock provided with cover enclosed -
20. Overall dimensions
21. No of H.F. terminals provided for carrier equipment. connection

B. HIGH FREQUENCY CABLE

1. Name of Manufacturer and Country
2. Type, Model and Catalogue No.
3. Applicable standards
4. Characteristic Impedance
5. Rated Capacitance
6. Service Voltage
7. Attenuation per km. of cable at various Carrier Frequencies in the Range of 50 to 500 KHz. (Typically at 50,100,200,300, 400,500 KHz)
8. Withstand Test Voltage (RMS) between conductor and Sheath
9. Details and particulars of Insulation
10. Loop Resistance per Km (Typical at 20°C)
11. Details of Armouring
12. Number and Diameter of Stranded Conductor
13. Overall Diameter of Cable

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14. Net weight per Km.
15. Minimum bending radius
16. Earthing detail of H. F. Cable
17. Packing length per drum
18. Construction drawing, type test & performance reports enclosed or not

C. POWER LINE CARRIER TERMINAL FOR SPEECH & DATA TRANSMISSION

1. Name of Manufacturer and Country
2. Type, Model and Catalogue No.
3. Type of Modulation
4. Mode of transmission
5. Carrier Frequency Range
6. Nominal Carrier Frequency Band in either direction of transmission
7. Return loss within the Nominal Carrier Frequency Band
8. Effectively Transmitted V.F Band
9. Return Loss within the Effectively Transmitted Voice Frequency Band.
10. H. F. Oscillator Details
11. I. F. Oscillator Details
12. Frequency Difference between the V.F. Input and V.F. Output of a pair of terminals connected back to back for permissible Ambient Temperature and supply voltage variations.
13. Maximum H. F. Amplifier output with Single/Multiple tone keying (Peak Envelope Power).
14. Nominal carrier frequency Power (Peak Envelop Power) at output terminals.

15. H. F. Impedance at output of carrier terminals.
16. Stability of the carrier frequency.
17. Improvement in S/N due to compander
18. Whether carrier is suppressed or reduced during transmission of signal
19. Whether frequency locking between Tx/Rx provided.
20. Automatic gain control range and regulation
21. Level of spurious emission at
 - (a) Edge of nominal Carrier Frequency Band
 - (b) 4.0 KHz away from nominal carrier Frequency band.
 - (c) 8.0 KHz away from nominal carrier Frequency band.
22. Relative level at V. F. 4 wire terminating points:
 - (a) Send leg
 - (b) Receive leg
23. Permissible limits for level variation with frequency relative to 800 Hz in a speech channel (without companders) transmitted over a pair of terminals connected back to back
24. Level of telephone signalling channel:
 - a. Input level
 - b. Output level
25. Near and far end cross talk due to telephone signalling channel in a pair of PLC Terminals (without companders) connected back to back.

26. Pulse distortion of telephone signalling channel when operated at a signalling speed of 10 pps and with a mark to space ratio of 40/60 in PLC terminals connected back to back.
27. Psophometric Noise contribution of a pair of PLC terminals connected back to back
28. Group delay distortion in the frequency band relevant to the transmission of protection signals.
29. Performance Under Noise condition:
 - a. Noise generated within terminal
 - b. Additional noise introduced when terminals are connected back to back at repeater station
 - c. Noise Bandwidth.
30. Power supply requirements:
 - (a) Voltage
 - (b) Permissible voltage variation
 - (c) Maximum current
 - (d) Quiescent Current
31. Installation details
32. Insulation level
33. Meters provided on Test Panel, their range and purpose.
34. Is the equipment suitable to work in Dust laden atmosphere?
35. Whether interior lamps with door switch is provided in cabinets
36. Over all dimensions (Cabinet)
 - (a) Length mm
 - (b) Width mm
 - (c) Height mm
37. Weight

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38. Earthing detail of PLC Cabinet
39. Whether Tx/Rx loop-back facility is available for testing locally
40. Whether site tunable

D. POWER LINE CARRIER TERMINAL FOR NETWORK PROTECTION

1. Name of Manufacturer and country
2. Type, Model and Catalogue No.
3. Type of Modulation
4. Mode of transmission
5. Carrier Frequency Range
6. Nominal Carrier Frequency Band in either direction of transmission
7. Return loss within the Nominal Carrier Frequency Band
8. Effectively Transmitted V.F Band
9. Return Loss within the Effectively Transmitted Voice Frequency Band.
10. H. F. Oscillator Details
11. I. F. Oscillator Details
12. Frequency Difference between the V.F. Input and V.F. Output of a pair of terminals connected back to back for permissible Ambient Temperature and supply voltage variations.
13. Maximum H. F. Amplifier output with Single/Multiple tone keying (Peak Envelope Power).
14. Nominal carrier frequency Power (Peak Envelop Power) at output terminals.
15. H. F. Impedance at output of carrier terminals.
16. Stability of the carrier frequency.

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17. Improvement in S/N due to compander
18. Whether carrier is suppressed or reduced during transmission of signal
19. Whether frequency locking between Tx/Rx provided
20. Level of spurious emission at
 - (a) Edge of nominal Carrier Frequency Band
 - (b) 4.0 KHz away from nominal carrier Frequency band
 - (c) 8.0 KHz away from nominal carrier frequency band.
21. Whether frequency locking between Tx/Rx provided
22. Relative level at V. F. 4 wire terminating points:
 - (a) Send leg
 - (b) Receive leg
23. Permissible limits for level variation with frequency relative to 800 Hz in a speech channel (without companders) transmitted over a pair of terminals connected back to back
24. Variation in overall loss of speech circuit with a pair to PLC terminals connected back (without Companders & limiters) when voice frequency input level changes from 10 to 0 dBm
25. Psophometric Noise contribution of a pair of PLC terminals connected back to back
26. Noise frequency Band width
27. Group delay distortion in the frequency band relevant to the transmission of protection signals.
28. Signal Delay with Two PLC Terminals connected back to back

29. Power supply requirements:
 - (a) Voltage
 - (b) Permissible voltage variation
 - (c) Maximum current
30. Installation details
31. Meters provided on Test Panel, their range and purpose.
32. Is the equipment suitable to work in Dust laden atmosphere without air conditioning?
33. Whether interior lamps with door switch is provided in cabinets
34. Over all dimensions
 - (a) Length mm
 - (b) Width mm
 - (c) Height mm
35. Weight
36. Insulation level
37. Cabinet earthing details
38. Whether indication is available in sending end panel for receipt/execution of trip signal/command at remote end.
39. Whether Tx/Rx loop-back facility is available for testing locally
40. Whether site tunable

E. VF TRANSMISSION TERMINAL FOR NETWORK PROTECTION SIGNALS (PROTECTION COUPLER)

1. Name of Manufacturer and Country
2. Type, Model and Catalogue Number
3. Whether equipment works on frequency shift principle of coded signal principle
4. Whether Equipment is suitable for

Independently Protecting Two Circuits

5. Frequencies used in the equipment for transmission of signal for coded Signal transmission
 - (a) Guard frequency
 - (b) Working frequency (Trip System - I)
 - (c) Working frequency (Trip System - II)
 - (d) Working frequency (Trip System I&II)
6. Criteria used for command Transmission
7. Whether equipment is protected against Tripping by Spurious Signals.
8. Transmission time corresponding to telegraph speed for transmission on PLCC channel of coded signal
 - (a) 600 Bds.
 - (b) 400 Bds.
 - (c) 200 Bds.
9. Whether in the presence of spurious signals as well as Protection Signals simultaneously, the equipment will initiate a Trip Command.
10. Mode of Transmission of guard signal
11. Whether equipment is suitable for Direct Circuit Breaker tripping.
12. Maximum number of Noises Impulses pps in Presence of which the equipment will satisfactorily perform its duty.
13. Signal Delay with Two Terminals connected back to back
14. Whether the Command Signal is acknowledged at receiving end and in the event of non-receipt of the correct signal, the command is repeated or not by the transmitter?

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15. Whether it is possible to alter the priority of commands of various codes at site.
16. What are the performance based results under severe line noise conditions for
 - (a) False trip probability
 - (b) Fail to trip probability
17. Transmitter Input Requirements (Contact Ratings)
 - (a) Voltage
 - (b) Current
 - (c) Power
 - (d) No. of Contacts
18. Receiver Output (Contact Rating)
 - (a) Voltage
 - (b) Current
 - (c) Power
 - (d) No. of Contracts
19. Additional facilities provided in Receiver output
20. Supervisory and Alarm Contact Facilities
 - (a) Current
 - (b) Voltage
 - (c) No. of contacts
21. Installation
22. Power Supply
 - (a) Voltage
 - (b) Current
 - (c) Power
23. Type and number of counters for recording the number of Trip Commands sent and number of Trip Commands received
24. Whether loop test is possible
25. Insulation Level

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26. Whether the equipment is suitable for transmitting and receiving more than two independent commands (please give full details)

F. EPAX

- 1 Name of manufacturer
- 2 Type of Model
- 3 Number of subscriber lines
 - (a) Wired for
 - (b) Equipped for
- 4 Number of trunk lines provided
 - (a) Wired for
 - (b) Equipped for
- 5 Whether the facility to bar subscriber's access to the carrier lines is provided during maintenance?
- 6 Whether P.G. lockout facility provided along with alarm?
- 7 Whether alarm type fuse provided for audio and visual indications?
- 8 Whether suitable for satisfactory operation in conjunction with PLCC system
- 9 Signalling Pulse Width
 - (a) Engage Pulse
 - (B) Priority Pulse
 - (C) Digit pulse
 - (D) Inter digit pause
 - (E) Release Pulse
- 10 Operating voltage
- 11 Power requirement
- 12 Overall dimensions (W x D x H)
- 13 Mounting arrangement
- 14 Weight
- 15 Type of switching

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- 16 Whether four-wire interfaces are built-in

- 17 In case four-wire interfaces are built-in maximum number of PLC terminals which can be connected to a single EPAX

- 18 Whether self-diagnostics and monitoring features are built-in

- 19 Whether the following facilities are built-in
 - (a) Priority cutting
 - (b) Conference
 - (c) Alternate routing
 - (d) Call transfer

- 20 Maximum loop resistance permissible
 - (a) For trunk line
 - (b) subscriber lines

- 21 Whether suitable to work in conjunction with electromechanical PAX

- 22 Whether suitable to work with DOT leased lines as per specification