SBI INFRA MANAGEMENT SOLUTIONS PVT.LTD.
(A WhollyOwnedSubsidiary Of SBI)

HEAD OFFICE, GROUND FLOOR, RAHEJA CHAMBERS,
FREE PRESS JOURNAL MARG, NARIMAN POINT, MUMBAI – 21

PART – A: TECHNICAL BID

TENDER ID: HOM201905021

TENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI

TENDER SUBMITTED BY:

NAME **:** _____

ADDRESS **:** _____

_____

_____

GSTIN NO. **:** _____

DATE **:** _____

ARCHITECT

M/s. Design Avenues,
F-4, LAXMI PLAZA, 125, ZONE-II,
M.P.NAGAR, BHOPAL, 462011
0755-2550200

NOTICE INVITING TENDERS
TENDER ID: HOM201904010

TENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI

SBIIMS on behalf of SBI invites "online item rate E-tender" for captioned work from the SBIIM's eligible empaneled contractors under appropriate category who receive NIT from the SBIIMS /Architects are only entitled to quote for this tender.

The details of tender are as under:

S.No.	Particulars	Details
1.	Name of work	TENDER FOR PROPSED ELECTRICAL WORKS OF GU0EST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI
2.	Nature of Work	Electrical works.
3.	Time allowed for completion	(60 Days) 2Months
4.	Cost of Tender Documents (Processing Fee) non-refundable	**Rs.1,000/- (Rupees one Thousand Only)** This Non-Refundable amount to be paid only through **SB Collect Payment Portal** available in SBI's online Banking site i.e. https://www.onlinesbi.com After successful payment, submit a print of the receipt carrying a Reference no. along with the tender application. For further details, refer **annexure- 'A'** enclosed.
5.	Earnest Money Deposit	**Rs.3,250/- (Rupees three thousand two hundred fifty Only)** by means of Demand Draft / Pay Order (Valid for a period of 90 Days from the last date of submission of the tender) from any scheduled Nationalized Bank drawn in favor of SBI Infra Management Solutions Pvt. Ltd. and payable in Mumbai.
6.	Initial Security Deposit	2% of contract amount including EMD
7.	Date of issue of tender documents	
	(a) **Technical Bid** (for eligible bidders who	**15.05.2019 to 29.05.2019**

	receive NIT& Tender documents from the Project Architect)	
	(b) **Price Bid** (Only for bidders qualified in Technical bid)	From 30.05.2019 at Service Provider M/s E-Procurement Tech Ltd. portal https://etender/SBI
8.	Last date & time for submission of Technical bid, EMD and cost of tender document	29.05.2019 by 3.00 PM
9.	Address at which Technical bid (hard copy) along with EMD & Cost of tender document has to be submitted.	The Managing Director& CEO, SBI Infra Management Solutions Pvt. Ltd., Ground Floor, Raheja Chambers, Free Press Journal Marg, Nariman Point, Mumbai-21.
10.	Date & time for opening of Technical bid.	29.05.2019 by 3.30 PM
11.	Last date & time for submission of online price bid.	At: - https://etender/SBI
12.	Date & time for opening of online price bid.	At: - https://etender/SBI
13.	Place of opening tenders	The Managing Director& CEO, SBI Infra Management Solutions Pvt. Ltd., Ground Floor, Raheja Chambers, Free Press Journal Marg, Nariman Point, Mumbai-21.
14.	Liquidated Damages	0.50% of contract amount per weeks subject to max. 5% of contract value or final bill value.
15.	Defects liability period	12 Months from the date of Virtual Completion
16.	Validity of offer	90 days from the date of opening of Price-bid
17.	Value of Interim Certificate	**Rs.1.5 lakhs.** No advance on materials / plant / machinery or mobilization advance shall be paid under any circumstances
18.	Price Bid	Price bid can be downloaded from - https://etender/SBI (By the qualified bidder in Technical bid)

16. It shall be responsibility of the contractor to arrange and ensure that all pages of technical and financial bid are properly bound separately. Tenders in loose pages may be disqualified.

17. The contractor shall sign and stamp each page of the tender document thereby ensuring the number and sequence of all pages.

18. No conditions other than mentioned in the tender will be considered, and if given they will have to be withdrawn before opening of the price-bid.

19. The SBIIMS reserve their rights to accept or reject any or all the tenders, either in whole or in part without assigning any reason for doing so and any claim / correspondence shall be entertained in this regard.

20. Tenders received without EMD and Cost of Tender Documents shall be summarily rejected and such tenders shall not be allowed to participate in the online price bidding process.

21. In case the date of opening of tenders is declared as a holiday, the tenders will be opened on the next working day at the same time.

22. **The bidding contractor shall possess valid A-class electrical license and should submit the same along with technical bid failing which their tender is liable for disqualification.**

23. SBIIMS has the right to accept / reject any / all tenders without assigning any reasons and no correspondence shall be entertained in this regard.

Yours Faithfully,

For
M/s. DESIGN AVENUES

Mr. MANOJ CHOUBEY
Architect& Interior Designer

Annexure-A

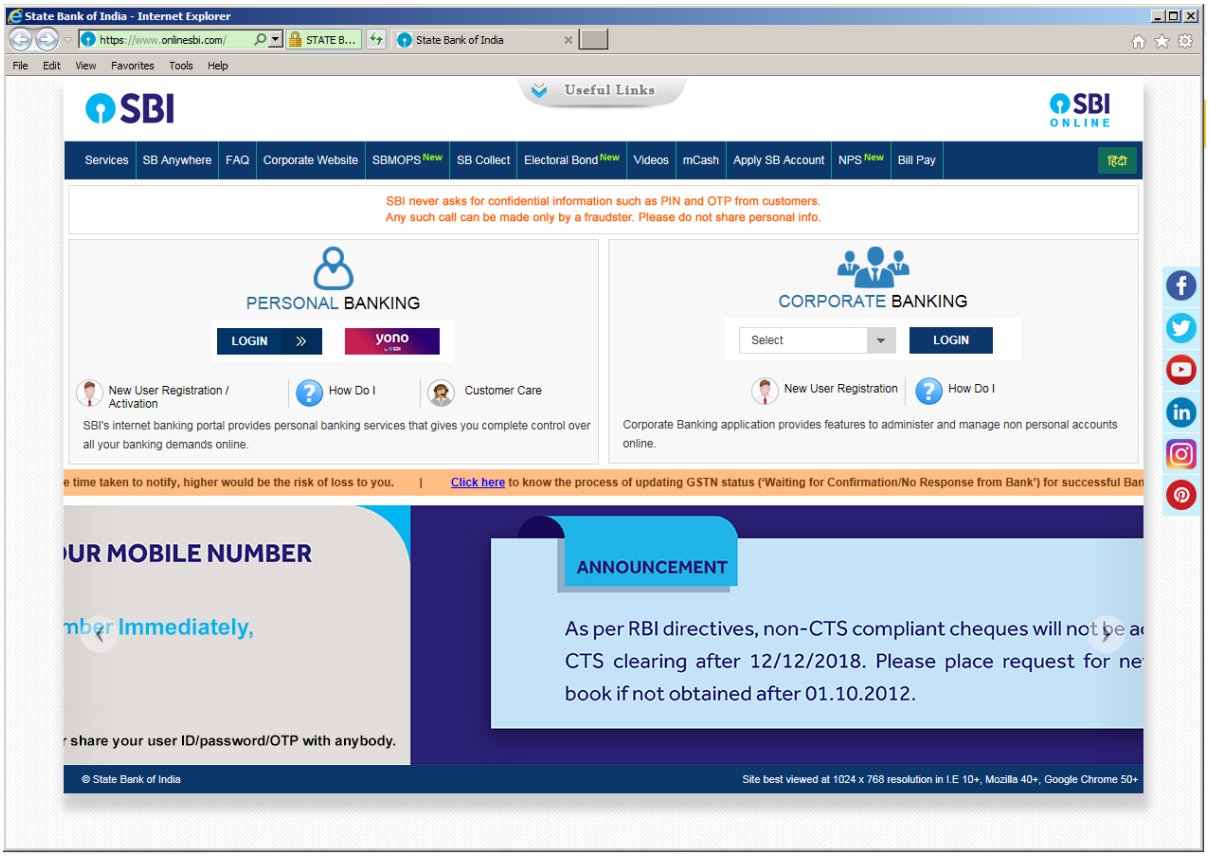
The steps involved in making the payment through SB Collect are as under:-

1. The Vendor needs to use SBI internet banking site https://www.onlinesbi.com/.
2. Select **"SB Collect"** from Top Menu, that will lead to the next page:
3. **"Proceed"** will lead to the next page:
4. Select **"All India"** in "State of Corporate / Institution" & Select **"Commercial Services"** in "Type of Corporate / Institution".
5. **"Go"** will lead to the next page:
6. Select **"SBI Infra Management Solutions"** in Commercial Services Name and **"Submit"**
7. Select **"Tender Application Fee"** in "Payment Category" and enter the **"Tender ID"** exactly as we preloaded with characters in Uppercase only in place of Circle Codes.
8. The next Page will be ready with few of the Preloaded Tender Details:
9. The Vendor will have to fill up the fields properly and upon making the payment a receipt will be generated with a Reference No.

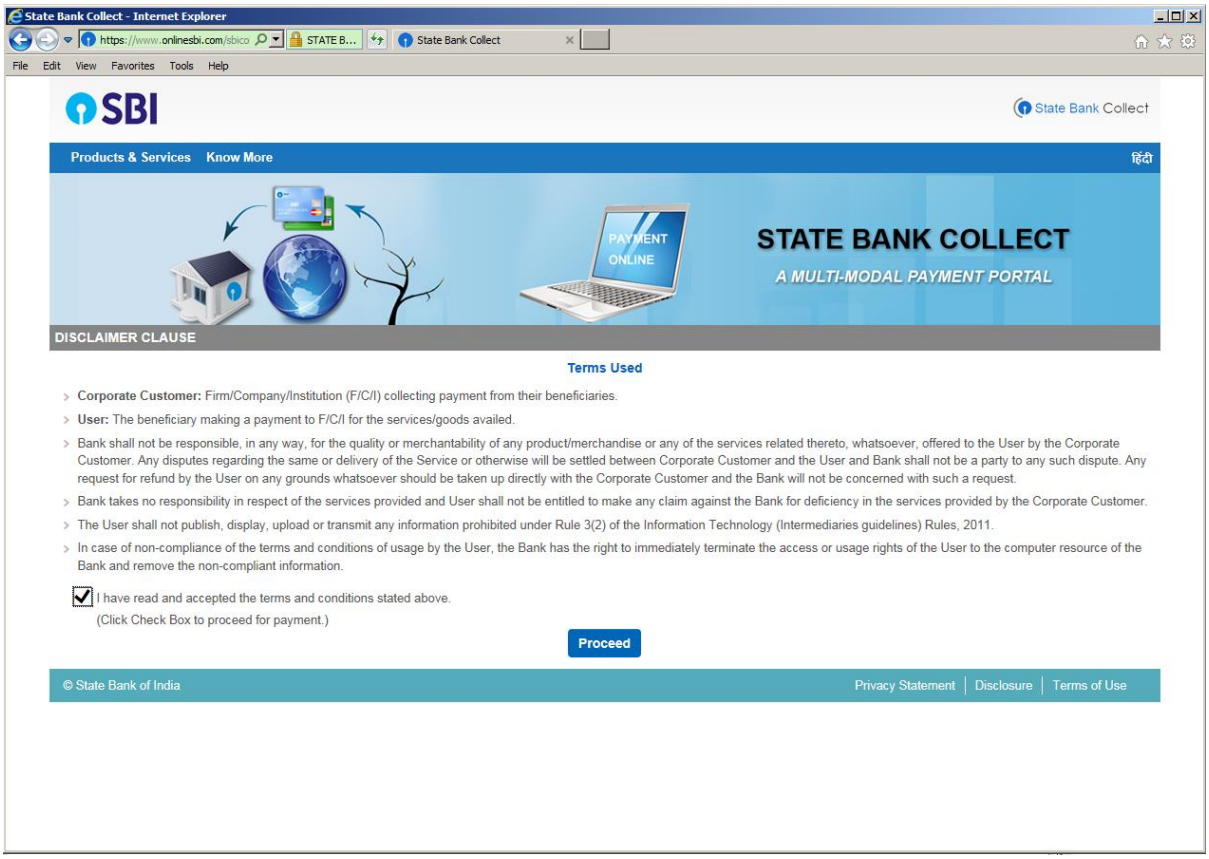
NOTE: *Any type of vendor, whether dealing with SBI or other bank can use this SB Collect facility. Even a contractor not dealing with any bank can use this portal and generate challan and deposit by cash in any SBI branch. The bank charges for cash deposit will be also borne by the vendor himself.*

Procedure for payment of Tender Fee through SB Collect payment portal:

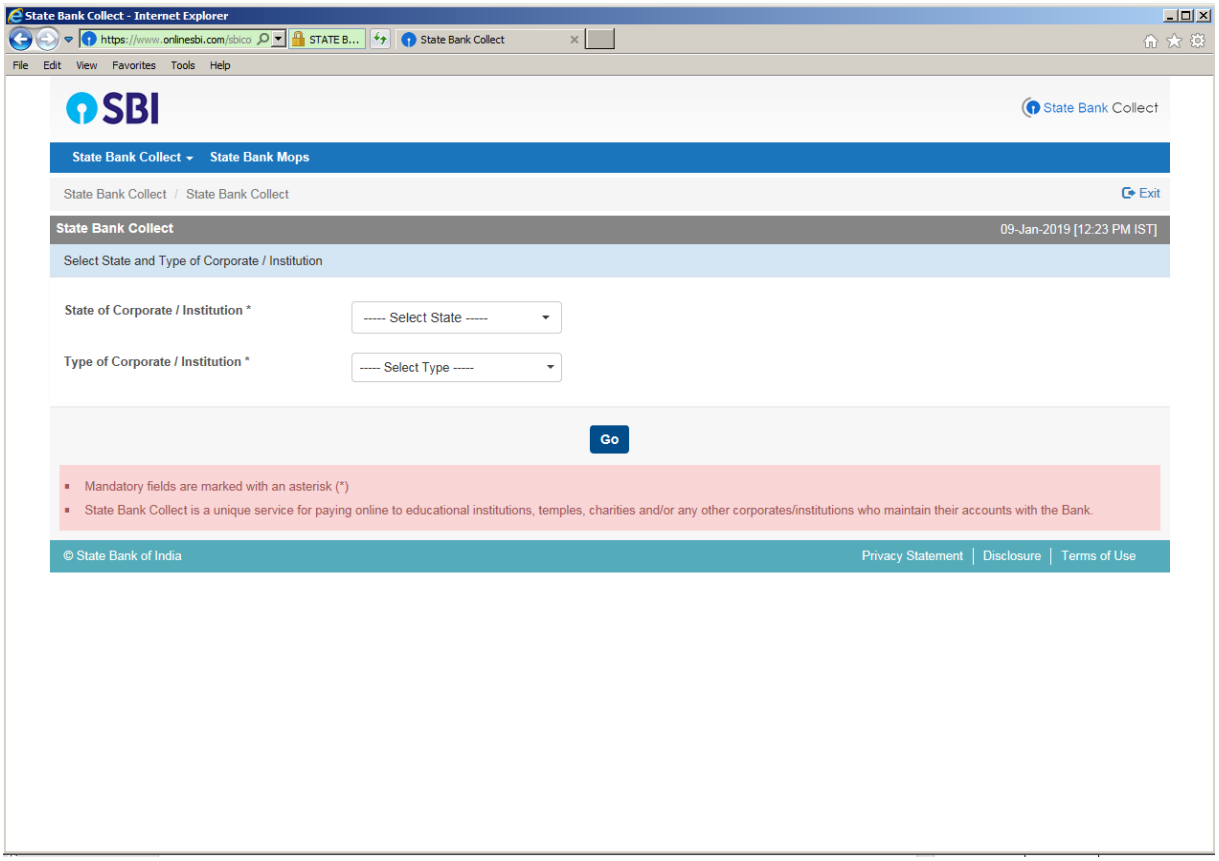
The portal link is available in SBI online banking site https://www.onlinesbi.com/.



Select **"SB Collect"** from Top Menu, that will lead to the next page:

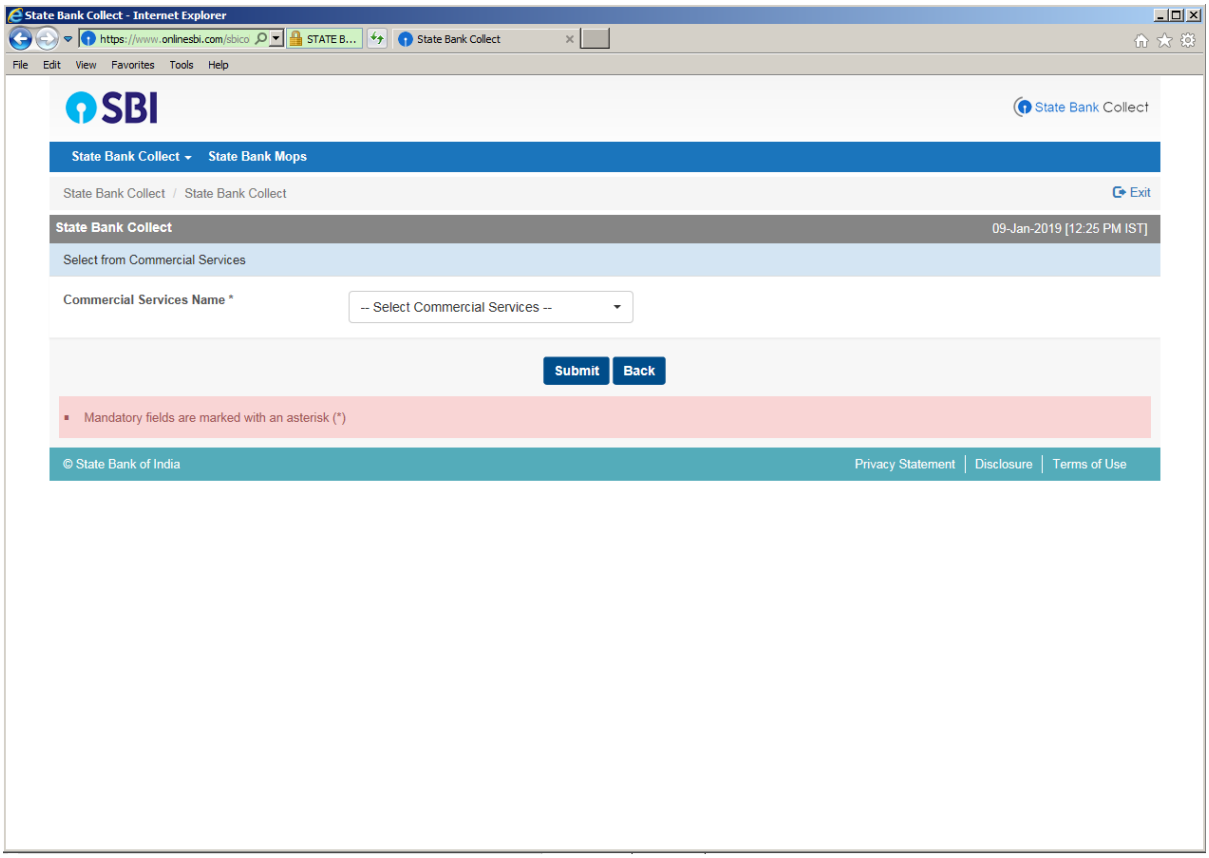


"Proceed" will lead to the next page:

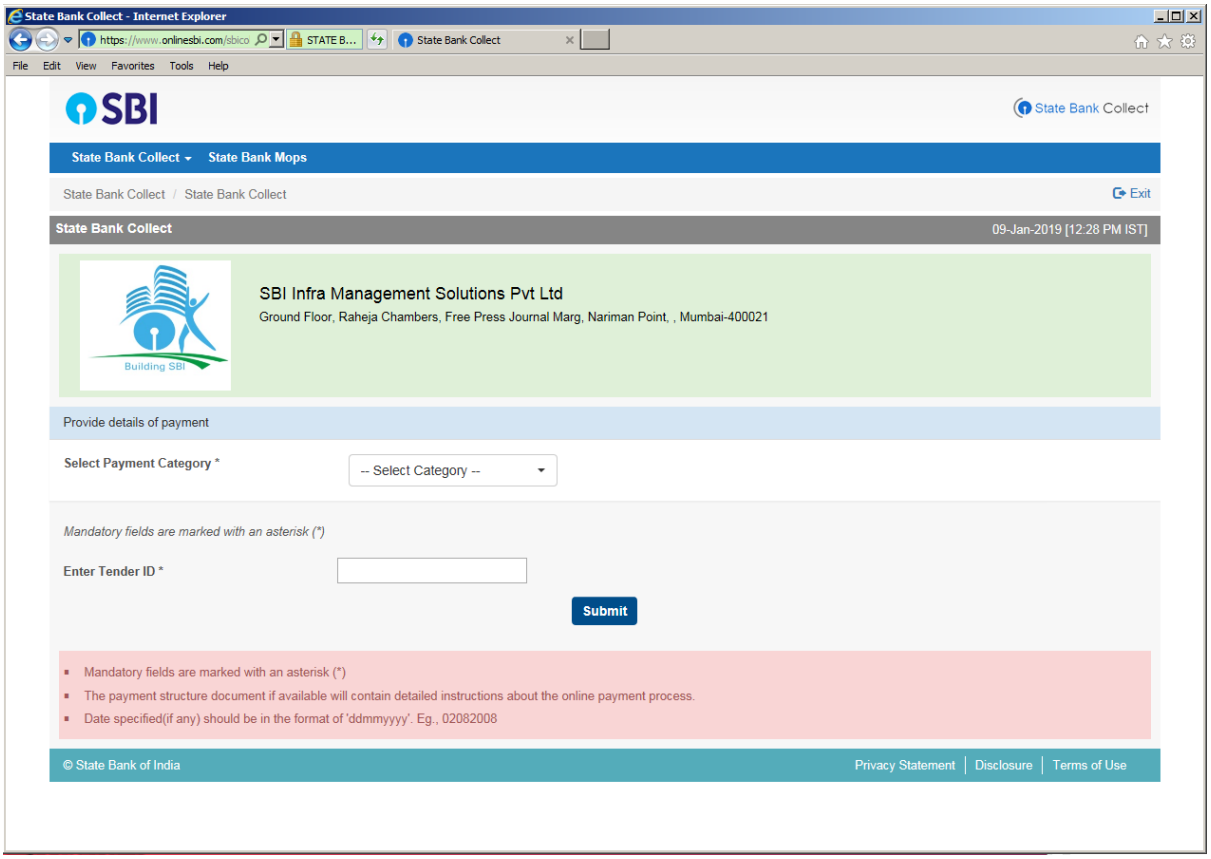


Select **"All India"** in "State of Corporate / Institution " & Select **"Commercial Services"** in "Type of Corporate / Institution".

"Go" will lead to the next page:

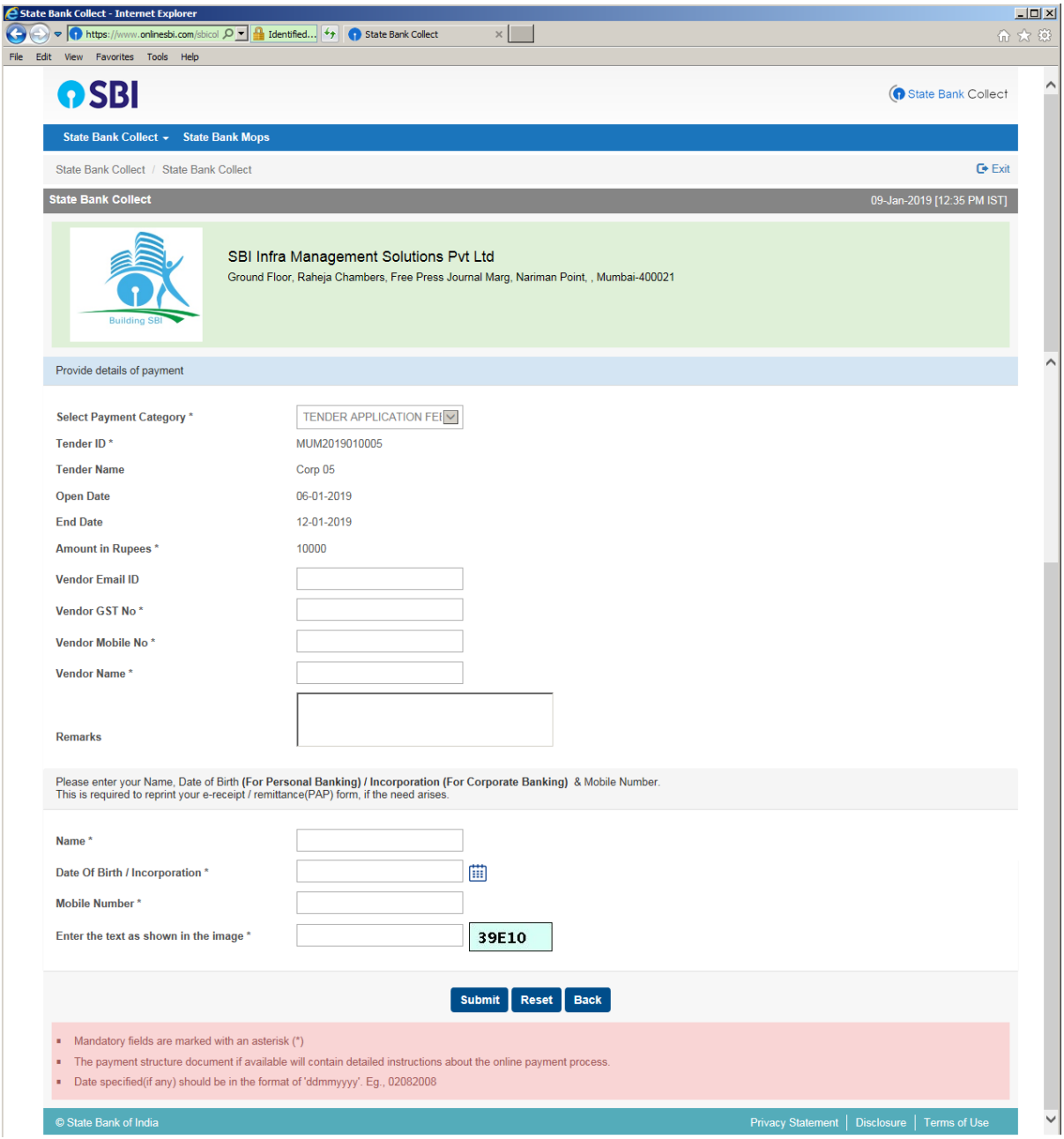


Select **"SBI Infra Management Solutions"** in Commercial Services Name and **“Submit”**



Select **"Tender Application Fee"** in "Payment Category" and enter the **"Tender ID"** exactly as we preloaded with characters in Uppercase only in place of Circle Codes.

The next Page will be ready with few of the Preloaded Tender Details:



The Vendor will have to fill up the fields properly and upon making the payment a receipt will be generated with a Reference No. Submit the printout of the Receipt, along with the Tender Application.

M/s DESIGN AVENUES

Signature of Contractor
With Seal

LETTER OF UNDERTAKING

The Managing Director& CEO,
SBI Infra Management Solutions Pvt. Ltd,
Head Office, Ground Floor,
Raheja Chamber, Free press Journal Marg,
Nariman Point, Mumbai 400 021.

Dear Sir,

Having examined the drawings, specification, design and schedule of quantities relating to the works specified in the memorandum hereinafter set out and having visited and examined the site of the works specified in the said memorandum and having acquired the requisite information relating thereto as affecting the tender, I/We hereby offer to execute the works specified in the said memorandum at the rates mentioned in the attached Schedule of Quantities and in accordance in all respects with the specifications, design, drawings and instructions in writing referred to in conditions of tender, the Articles of Agreement, Special Conditions, Schedule of Quantities and Conditions of Contract and with such materials as are provided for by, and in all other respects in accordance with such conditions so far as they may be applicable.

MEMORANDUM

(a)	Description of work	TENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI
(b)	Earnest Money	**Rs.3,250/- (Rupees three thousand two hundred fifty Only)** by means of Demand Draft / Pay Order (Valid for a period of 90 Days from the last date of submission of the tender) from any scheduled Nationalized Bank drawn in favour of SBI Infra Management Solutions Pvt. Ltd. and payable in Mumbai.
(c)	Time allowed for completion of the Works from Seven day after the date of written Order or date of handing over of the site (Whichever is later) to commence the work	60 Days, (2) months

1) Should this tender be accepted, I/we hereby agree to abide by and fulfill the terms and provisions of the said conditions of contract annexed hereto so far as may be applicable or in default thereof to forfeit and pay to SBIIM, the amount mentioned in the said contract.

2) I / We have deposited a sum of **Rs.3,250/- (Rupees three thousand two hundred fifty Only)** of the total tender amount as Earnest Money with the SBI Infra Management Solutions Pvt. Ltd. on behalf of SBI which amount is not to bear any interest. Should I / We fail to execute the Contract when called upon to do so I / We do hereby agree that this sum shall be forfeited by me/us to SBI Infra Management Solutions Pvt. Ltd. on behalf of SBI,

3) I/ We have read and understood various clauses of this tender and hereby submit our specific undertaking and concurrence in terms clause 6.2 of “Instruction to tenderer” to deposit Additional ***Security Deposit(ASD)*** of required amount as provided for in this tender and within the stipulated period, in case, my/our tender is found too low (i.e. beyond 10% of the estimated cost), as a performance guarantee for due fulfilment of our contractual obligation for the project.
Further, under any circumstances, whatsoever, if I/We fail to comply the same including compliance of any such other conditions of tender within the stipulated time. I /We hereby, authorized SBIIMS to cancel my/Our tender, to forfeit my EMD/ISD/ASD and to take further necessary action as deemed fit including debarring our firm from participating in SBIIMS future tenders/de-paneling etc.

4) I/ We understand that as per terms of this tender, the SBIIMS may consider accepting our tender in part or whole or may entrust the various work proposed in phases. We, therefore, undertake that we shall not raise any claim/ compensation in the eventuality of Bank/SBIIMS deciding to drop any of the work from the scope of work of this tender at any stage during the contract period. Further, we also undertake to execute the work entrusted to us in phases on our approved rates and within stipulated time limit without any extra claim for price escalation as also provided for in the clause 11.1.6 “Instructions to Tenderers” of this tender.

5) I/ We, hereby, also undertake that, we will not raise any claim for any escalation in the prices of any of the material during the currency of contract/execution/completion period including authorized extended contract period, if any.

6) Our Bankers are:
I)

ii)

The names of partners of our firm are:
i)

ii)

Name of the partner of the firm
Authorised to sign
Or
(Name of person having Power of
Attorney to sign the Contract.
(Certified true copy of the Power
of Attorney should be attached)
Yours faithfully,
Signature of Contractors.
Signature and addresses of Witnesses
i)

ii)

SAMPLE BUISNESS RULE DOCUMENT

ONLINE E-TENDERING FOR TENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI

(A) Business rules for E-tendering:

1. Only empanelled contractors with SBIIMS under appropriate category who are invited by the project Architect/SBIIMS shall only be eligible to participate.

2. SBIIMS PVT.LTD. will engage the services of anE-tendering service provider who will provide necessary training and assistance before commencement of online bidding on Internet.

3. In case of e-tendering, SBIIMS will inform the vendor in writing, the details of service provider to enable them to contact and get trained.

4. Business rules like event date, closing and opening time etc. also will be communicated through service provider for compliance.

5. Contractors have to send by email, the compliance form in the prescribed format (provided by service provider),before start of E-tendering. Without this the vendor will not be eligible to participate in the event.

6. The Contractors will be required to submit the various documents in sealed Envelope to the office of SBI Infra Solutions Pvt Ltd.at the address mentioned hereinbefore by the stipulated date i.e. (1) Hard Copy of Technical Bid duly signed and stamped on each page (2) Demand Draft of specified amount of EMD (3) Copy of Receipt/Challan of Cost of Tender documents. Contractors not submitting any one or more documents shall not be eligible to participate in the on-line price bidding.

7. E-tendering will be conducted on schedule date & time.

8. **The e-tendering will be treated as closed only when the bidding process gets closed in all respects for the item listed in the tender.**

(B) Terms & conditions of E-tendering:

SBIIMSshall finalize the Tender through e-tendering mode for which M/s E-Procurement Technologies Limited. has been engaged by SBIIMS an authorized service provider. Please go through the guidelines given below and submit your acceptance to the same along with your Commercial Bid.

1. E-tendering shall be conducted by SBIIMS through M/s E-Procurement Technologies Limited., on pre-specified date. While the Contractors shall be quoting from their own offices/ place of their choice, Internet connectivity and other paraphernalia requirements shall have to be ensured by Contractors themselves. In the event of failure of their Internet connectivity, (due to any reason whatsoever it

may be) it is the bidders' responsibility. In order to ward-off such contingent situation bidders are requested to make all the necessary arrangements/ alternatives such as back–up power supply whatever required so that they are able to circumvent such situation and still be able to participate in the E-tendering successfully. Failure of power at the premises of Contractors during the E-tendering cannot be the cause for not participating in the E-tendering. On account of this the time for the E-tendering cannot be extended and SBIIMS is not responsible for such eventualities.

2. M/s E-Procurement Technologies Limited., shall arrange to train your nominated person(s), without any cost to you. They shall also explain you all the Rules related to the E-tendering. You are required to give your compliance on it before start of bid process.

3. BIDDING CURRENCY AND UNIT OF MEASUREMENT: Bidding will be conducted in Indian currency & Unit of Measurement will be displayed in Online E-tendering.

4. BID PRICE: The Bidder has to quote the rate as per the Tender Document provided by SBIIMS their appointed Architects.

5. VALIDITY OF BIDS: The Bid price shall be firm for a period specified in the tender document and shall not be subjected to any change whatsoever.

6. Procedure of E-tendering:

   i. **Online E-tendering:**

   (a)The NIT &Technical bid available with the project architect.
   (b)Online e-tendering is open to the empaneled bidders who receive NIT from the Architect and qualified for participating in the price bidding as provisions mentioned hereinabove through SBIIMS approved Service Provider.
   (c)The Price-Bid shall be made available online by the Service Provider wherein the contractors will be required to fill-in their Item-wise rates for each item.
   (d)The Contractors are advised not to wait till the last minute to submit their online item-wise quote in the price bid to avoid complications related with internet connectivity, network problems, system crash down, power failure, etc.
   (e)It is mandatory to all the bidders participating in the price bid to quote their rates for each and every item.
   (f) In case, contractor fails to quote their rates for any one or more tender items, their tender shall be treated as ***"Incomplete Tender***" and shall be liable for rejection.

7. LOG IN NAME & PASSWORD: Each Bidder is assigned a Unique User Name & Password by M/s E-Procurement Technologies Limited. The Bidders are requested to change the Password after the receipt of initial Password from M/s E-Procurement Technologies Limited. All bids made from the Login ID given to the bidder will be deemed to have been made by the bidder.

8. BIDS PLACED BY BIDDER: Bids will be taken as an offer to execute the work as specified. Bids once made, cannot be cancelled / withdrawn and the Bidder shall

be bound to execute the work at the quoted bid price. In case the L-1 Bidder backs out or fail to complete the work as per the rates quoted, SBIIMS shall at liberty to take action as deemed necessary including de-paneling such contractors and forfeiting their EMD.

9. At the end of the E-tendering, SBIIMS will decide upon the winner. SBIIMS decision on award of Contract shall be final and binding on all the Bidders.

10. SBIIMS shall be at liberty to cancel the E-tendering process / tender at any time, before ordering, without assigning any reason.

11. SBIIMS shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause.

12. Other terms and conditions shall be as per your techno-commercial offers and other correspondences till date.

13. OTHER TERMS & CONDITIONS:

- The Bidder shall not involve himself or any of his representatives in Price manipulation of any kind directly or indirectly by communicating with other suppliers / bidders.

- The Bidder shall not divulge either his Bids or any other exclusive details of SBIIMS to any other party.

- SBIIMS decision on award of Contract shall be final and binding on all the Bidders.

- SBIIMSreserve their rights to extend, reschedule or cancel any E-tendering within its sole discretion.

- SBIIMS or its authorized service provider M/s E-Procurement Technologies Limited shall not have any liability to Bidders for any interruption or delay in access to the site irrespective of the cause.

- SBIIMS or its authorized service provider/s. Antares Systems Limited is not responsible for any damages, including damages that result from, but are not limited to negligence.

- SBIIMS or its authorized service M/s E-Procurement Technologies Limitedwill not be held responsible for consequential damages, including but not limited to systems problems, inability to use the system, loss of electronic information etc.

N.B.

- All the Bidders are required to submit the Process Compliance Statement (Annexure II) duly signed to M/s E-Procurement Technologies Limited.

- **All the bidders are requested to ensure that they have a valid digital signature certificate well in advance to participate in the online event.**

PROCESS COMPLIANCE STATEMENT (ANNEXURE II)

(The bidders are required to print this on their company's letter head and sign, stamp before emailing)

To,
E-Procurement Technologies Ltd. (Auction Tiger)
B-704 Wall Street - II,
Opp. Orient Club,
Nr. Gujarat College, Ahmedabad - 380 006.
Gujarat State, India

AGREEMENT TO THE PROCESS RELATED TERMS AND CONDITIONS FOR THE ONLINE E-TENDERING FOR TENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI

Dear Sir,

This has reference to the Terms & Conditions for the E-tendering mentioned in the Tender document
This letter is to confirm that:

1) The undersigned is authorized representative of the company.
2) We have studied the Commercial Terms and the Business rules governing the E-tendering as mentioned in RFP of Biomass well as this document and confirm our agreement to them.
3) We also confirm that we have taken the training on the E-tendering tool and have understood the functionality of the same thoroughly.
4) We confirm that Swim land M/s. e-Procurement Technologies Ltd, Ahmedabad (ETL) shall not be liable & responsible in any manner whatsoever for my/our failure to access& bid on the E-tendering platform due to loss of internet connectivity, electricity failure, virus attack, problems with the PC, any other unforeseen circumstances etc. before or during the E-tendering event.
5) We confirm that we have a valid digital signature certificate issued by a valid Certifying Authority.
6) We also confirm that we will mail the price confirmation & break up of our quoted price as per Annexure III & Annexure IV within 24 hour of the completion of the e-bidding and the format as requested by SBI/ETL.
7) We, hereby confirm that we will honor the Bids placed by us during the E-tendering process.

With regards,
Date:

Signature with company seal
Name:
Company / Organization:
Designation within Company / Organization:
Address of Company / Organization:
Scan it and send to this Document on**sujith@eptl.in**

Price Confirmation Letter (Annexure III)

(The bidders are required to print this on their company's letter head and sign, stamp before emailing)

To,
E-Procurement Technologies Ltd. (Auction Tiger)
B-704, Wall Street - II,
Opp. Orient Club,
Nr. Gujarat College, Ahmedabad - 380 006.
Gujarat State, India

FINAL PRICE QUOTED DURING TENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI

Reverse Auction Date:

Dear Sir,

We confirm that we have quoted.

Thanking you and looking forward to the valuable order from SBI.

Yours sincerely,

For _____

Name:
Company:
Date:
Seal:
Scan it and send to this Document on sujith@eptl.in

(F) Price break up (Annexure IV)

Price Break up

As per tender document

(A) Contact Information

E-Procurement Technologies Ltd.	State Bank of India
B-704, Wall Street - II, Opp. Orient Club, Nr. Gujarat College, Ahmedabad - 380 006. Gujarat State, India Tel.: +91 79 61200 579 | 580 | 567 | 569 | 566 Mr.Samjad Khan E-mail : samjad@auctiontiger.net Contact No : 9879996111 / 9265871720	The MD & CEO, SBI Infra Management Solutions Pvt. Ltd, Head Office, Ground Floor, Raheja Chamber, Free press Journal Marg, Nariman Point, Mumbai 400 021. Officer Name :S.Krishnan Department : AVP(Electrical) Contact No :9820727016 E-mail :avpelect.sbiims@sbi.co.in

(The bidders are required to print this on their company's letter head and sign, stamp before emailing)

To,
M/s E-Procurement Technologies Limited,
B-704, Wall Street - II,
Opp. Orient Club,
Nr. Gujarat College,
Ahmedabad - 380 006.
Gujarat State, India
Email: **sujith@eptl.in**

AGREEMENT TO THE PROCESS RELATED TERMS AND CONDITIONS FOR THE ONLINE E-TENDERING FORTENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI

Dear Sir,

This has reference to the Terms & Conditions for the E-tendering mentioned in the Tender document
This letter is to confirm that:

8) The undersigned is authorized representative of the company.
9) We have studied the Commercial Terms and the Business rules governing the E-tendering as mentioned in RFP of Biomass well as this document and confirm our agreement to them.
10) We also confirm that we have taken the training on the E-tendering tool and have understood the functionality of the same thoroughly.
11) We confirm that Swim land M/s E-Procurement Technologies Limited, shall not be liable & responsible in any manner whatsoever for my/our failure to access& bid on the E-tendering platform due to loss of internet connectivity, electricity failure, virus attack, problems with the PC, any other unforeseen circumstances etc. before or during the E-tendering event.
12) We confirm that we have a valid digital signature certificate issued by a valid Certifying Authority.
13) We, hereby confirm that we will honor the Bids placed by us during the E-tendering process.

With regards,
Date:

Signature with company seal
Name:
Company / Organization:
Designation within Company / Organization:
Address of Company / Organization:
Scan it and send to this Document on ----------

ARTICLES OF AGREEMENT

(On non-judicial Stamp Paper of Rs. 500/- or as per latest Govt. Rules)

ARTICLES OF AGREEMENT made the _____ date of _____ between SBIIMS PVT.LTD., on behalf of SBI, having its office at Mumbai hereinafter called "the Service Provider" of the One Part and

_____

_____

WHEREAS the SBIIMS PVT.LTD. is desirous of

_____

_____

_____and has caused specifications describing the work to be done to be prepared by SBIIMS.

AND WHEREAS the said Drawings numbered _____ to_____ inclusive, the Specifications and the Schedule of Quantities have been signed by or on behalf of the parties hereto.

AND WHEREAS the Contractor has agreed to execute upon and subject to the Conditions set forth herein and to the Conditions set forth herein in the Special Conditions and in the Schedule of Quantities and Conditions of Contract (all of which are collectively hereinafter referred to as “the said conditions”) the works shown upon the said Drawings and / or described in the said Specifications and included in the Schedule of Quantities at the respective rates therein set forth amounting to the sum as therein arrived at our such other sum as shall become payable there under (hereinafter referred to as “the said Contract Amount.)

NOW IT IS HEREBY AGREED AS FOLLOWS:

1) In consideration of the said Contract Amount to be paid at the times and in the manner set forth in the said Conditions, the Contractor shall upon and subject to the said Conditions execute and complete the work shown upon the said Drawings and described in the said Specifications and the priced Schedule of Quantities.

2) The Employer shall pay to the Contractor the said Contract Amount, or such other sum as shall become payable, at the times and in the manner specified in the said Conditions.

3) The term “The Architects” in the said Conditions shall mean the SBIIMS, or in the event of their ceasing to be the Architects for the purpose of this Contract for whatever reason, such other person or persons as shall be nominated for that purpose by the Employer, not being a person to whom the Contractor shall object for reasons considered to be sufficient by the Employer, PROVIDED ALWAYS that no person or persons subsequently appointed to be Architects under this Contract shall be entitled to disregard or overrule any previous decisions or approval or direction given or expressed in writing by the outgoing Architects for the time being.

4) The said Conditions and Appendix thereto shall be read and construed as forming part of this Agreement, and the parties hereto shall respectively abide by submit themselves to the said Conditions and perform the Agreements on their part respectively in the said Conditions contained.

5) The Plans, Agreements and Documents mentioned herein shall form the basis of this Contract.

6) This Contract is neither a fixed lump-sum contract nor a piece work contract but a contract to carry out the work in respect of the entire building complex to be paid for according to actual measured quantities at the rates contained in the Schedule of Quantities and Rates or as provided in the said Conditions.

7) The Contractor shall afford every reasonable facility for the carrying out of all works relating to civil works, installation of lifts, Telephone, electrical installations, fittings air-conditioning and other ancillary works in the manner laid down in the said Conditions, and shall make good any damages done to walls, floors, etc. after the completion of his work.

8) The SBIIMS reserves to itself the right of altering the drawings and nature of the work by adding to or omitting any items of work or having portions of the same carried out without prejudice to this Contract.

9) Time shall be considered as the essence of this Contract and the Contractor hereby agrees to commence the work soon after the Site is handed over to him or from 14th day after the date of issue of formal work order as provided for in the said Conditions whichever is later and to complete the entire work within **60 days (2 months)** subject to nevertheless the provisions for extension of time.

10) All payments by the SBI under this Contract will be made only at Mumbai.

11) All disputes arising out of or in any way connected with this Agreement shall be deemed to have arisen at Mumbai and only the Courts in Mumbai shall have jurisdiction to determine the same.

12) That the several parts of this Contract have been read by the Contractor and fully understood by the Contractor.

IN WITNESS WHEREOF THE SBIIMS and the Contractor have set their respective hands to these presents and two duplicates hereof the day and year first hereinabove written.

SIGNATURE CLAUSE

SIGNED AND DELIVERED by the

_____ By the
(Employer)

hand of Shri _____
_____ (Signature of Employer)
(Name and Designation)

In the presence of:

1) Shri / Smt. _____ (Signature of Witness)

Address _____
_____
(Witness)

SIGNED AND DELIVERED by the

_____ by the
(Contractor) (Signature of Contractors)
In the presence of:

Shri / Smt. _____ (Signature of Witness)

Address _____
_____
(Witness)

SECTION – 1

INSTRUCTIONS TO THE TENDERERS

1.0 Scope of work

Sealed Tenders are invited by M/s. DESIGN AVENUES, Bhopal for and on behalf of SBIIMS**,** for and behalf of SBI / SBIIMSPL for the **TENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI** for State Bank of India.

1.1 Site and its location

The proposed work is to be carried out at **1st& 6thfloor**, **Udyan Building, Nepean Sea Road, Mumbai** for State Bank of India**.**

2.0 Tender documents

2.1 The work has to be carried out strictly according to the conditions stipulated in the tender consisting of the following documents and the most workmen like manner.

Instructions to tenderers

General conditions of Contract

Special conditions of Contract

Additional specifications

Drawings

Priced bid A

2.2 The above documents shall be taken as complementary and mutually explanatory of one another but in case of ambiguities or discrepancies, shall take precedence in the order given below;

a) Price Bid

b) Additional Specifications

c) Technical specifications

d) Drawings

e) Special conditions of contract

f) General conditions of contract

g) Instructions to Tenderers

2.3 Complete set of tender documents including related drawings will be provided by the Project Architect.

2.4 The tender documents are not transferable.

3.0 **Site Visit**

3.1 The tenderer must obtain himself on his own responsibility and his own expenses all information and data that may be required for the purpose of filling this tender document and enter into a contract for the satisfactory performance of the work. The tenderer is requested satisfy himself regarding the availability of water, power, transport and communication facilities, the character quality and quantity of the materials, labour, the law and order situation, climatic conditions local authorities requirement, traffic regulations etc.

The tenderer will be fully responsible for considering the financial effect of any or all the factors while submitting his tender.

4.0 **Earnest Money**

4.1 The tenderers are requested to submit the Earnest Money of **Rs.3,250/- (Rupees three thousand two hundred fifty Only)** by means of Demand Draft / Pay Order (Valid for a period of 90 Days from the last date of submission of the tender) from any scheduled Nationalized Bank drawn in favour of SBI Infra Management Solutions Pvt. Ltd. and payable in Mumbai.

4.2 EMD in any other form other than as specified above will not be accepted. Tender not accompanied by the EMD in accordance with clause 4.1 above shall be rejected.

4.3 No interest will be paid on the EMD.

4.4 EMD of unsuccessful tenderer will be refunded within 30 days of award of Contract.

4.5 EMD of successful tenderer will be retained as a part of security deposit.

5.0 **Initial/ Security Deposit**

The successful tenderer will have to submit a sum equivalent to 2% of accepted tender value less EMD by means of DD drawn in favour of SBIIMS within a period of 15 days of acceptance of tender.

6.0 **Security Deposit**

6.1 Total security deposit shall be 5% of contract value. Out of this 2% of contract value is in the form of Initial Security Deposit (ISD) which includes the EMD. Balance 3% shall be deducted from the running account bill of the work at the rate of 10% of the respective running account bill i.e., deduction from each running bill account will be @10% till Total Security Deposit (TSD) including ISD reaches to 5% of contract value. The 50% of the Total Security Deposit shall be paid to the contract on the basis of Architect's certifying the virtual completion. The balance 50% would be paid to the contractors after the defects liability period as specified in the contract.

6.2 **Additional Security Deposit**

In case L-1 bidder quotes abnormally low rates (i.e. 10% or more, below estimated project cost), the bank may ask such bidder to deposit additional security deposit (ASD) equivalent to difference of estimated cost vis-à-vis L-1 quoted amount for due fulfillment of contract. Such ASD could be in the form of FDR / Bank's guarantee in the Bank's name as per format approved by the Bank. On successful completion of work ASD will be returned to the contractor. In case contractor fails to complete the work in time or as per tender specification or leave the job incomplete, the bank will be at liberty to recover the dues from ASD or to forfeit such ASD as the case may be within its sole discretion.

6.3 No interest shall be paid to the amount retained by the Bank as Security Deposit.

7.0 **Signing of contract Documents**

The successful tenderer shall be bound to implement the contract by signing an agreement and conditions of contract attached herewith within 30 days from the receipt of intimation of acceptance of the tender by the Bank. However, the written acceptance of the tenders by the Bank will constitute a binding agreement between the Bank and successful tenderer whether such formal agreement is subsequently entered into or not.

8.0 **Completion Period**

Time is essence of the contract. The work should be completed in all respect accordance with the terms of contract within a period of **60 days** from the date of award of work.

9.0 **Validity of tender**

Tenders shall remain valid and open for acceptance for a period of 90 days from the date of opening price bid. If the tenderer withdraws his/her offer during the value period or makes modifications in his/her original offer which are not acceptable to Bank without prejudice to any other right or remedy the Bank shall be at liberty forfeit the EMD.

10.0 **Liquidated Damages**

The liquidated damages shall be 0.50% per week subject to a maximum of 5% of contract value.

11.0 **Rate and prices:**

11.1 **In case of item rate tender**

11.1.1 The tenderers shall quote their rates for individual items both in words and figure. In case of discrepancy between the rate quoted in words and figures, the unit rate quantity in words will prevail. If no rate is quoted for one or more items such tender shall be treated as "Incomplete Tender" and shall be summarily rejected.
The amount of each item shall be calculated and the requisite total is given. In case of discrepancy between the unit rate and the total amount calculated from multiplication of unit rate and the quantity the unit rate quoted will govern and the amount will be corrected.

11.1.2 The tenderers need not quote their rates for which no quantities have been given. In case the tenderers quote their rates for such items those rates will be ignored and will not be considered during execution.

11.1.3 The tenderers should not change the units as specified in the tender. If any unit is changed the tenders would be evaluated as per the original unit and the contractor would be paid accordingly.

The tenderer should not change or modify or delete the description of the item. If any discrepancy is observed he should immediately bring to the knowledge of the Architect/ SBIIMS

11.1.4 Each page of the BOQ shall be signed by the authorized person and cutting or overwriting shall be duly attested by him.

11.1.5 Each page shall be totaled and the grand total shall be given.

11.1.6 **The rate quoted shall be firm and shall include all costs, allowances etc. except G.S.T, which shall be payable / reimbursed at actuals.**

11.1.7 The SBIIMS reserve their rights to accept any tenders, either in whole or in part or may entrust the work in phases or may drop the part scope of work at any stage of the project within its sole discretion without assigning any reason(s) for doing so and no claim / correspondence shall be entertained in this regard.

11.1.8 In case it is decided by the SBIIMS to drop one or more buildings from the scope of work at any stage of the project, the contractor shall not be entitled to raise any claim / compensation for such deleted scope of work. Also, the SBIIMS may consider issuing work order for various buildings in phases but within a reasonable time interval and the contractor shall be bound to execute the same within the stipulated time period and as per rates quoted by them in this tender without any claim for price escalation.

SIGNATURE OF THE CONTRACTOR

WITH SEAL

GENERAL CONDITIONS OF CONTRACT

1.0 **Definitions**: -
"Contract means the documents forming the tender and the acceptance thereof and the formal agreement executed between SBI Infra Management Solutions Pvt. Ltd. (client) and the contractor, together with the documents referred there in including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Architects/ Bank and all these documents taken together shall be deemed to form one contract and shall be complementary to one another.

1.1 In the contract the following expressions shall, unless the context otherwise requires, have the meaning hereby respectively assigned to them.

1.1.1 'SBIIMS' shall mean SBI Infra Management Solutions Pvt. Ltd. (Service Provider) having its Head Office, Ground Floor, Raheja Chambers, Free Press Marg, Nariman Point, Mumbai- 400 021 and includes the client's representatives, successors and assigns.

1.1.2 SBIIMS shall mean SBI Infra Management Solution Pvt. Ltd., Mumbai.

1.1.3 'Site Engineer' shall mean an Engineer appointed by the SBIIMS at site as their representative for day-to-day supervision of work and to give instructions to the contractors.

1.1.4 'The Contractor' shall mean the individual or firm or company whether incorporate not, undertaking the works and shall include legal personal representative of individual or the composing the firm or company and the permitted assignees of individual or firms of company.

The expression 'works' or 'work' shall mean the permanent or temporary work description in the "Scope of work" and / or to be executed in accordance with the contract includes materials, apparatus, equipment, temporary supports, fittings and things of kinds to be provided, the obligations of the contractor hereunder and work to be done by the contractor under the contract.

1.1.5 'Engineer' shall mean the representative of the Architect/consultant.

1.1.6 'Drawings' shall mean the drawings prepared by the Architects and issued by the Engineer and referred to in the specifications and any modifications of such drawings as may be issued by the Engineer from time to time 'Contract value shall mean value of the entire work as stipulated in the letter of acceptance of tender subject such additions there to or deductions there from as may be made under the provide herein after contained.

1.1.7 Specifications' shall mean the specifications referred to in the tender and modifications thereof as may time to time be furnished or approved by the Architect/ Consultant.

1.1.8 "Month" means calendar month.

1.1.9 "Week" means seven consecutive days.

1 .1.10"Day" means a calendar day beginning and ending at 00 Hrs. and 24 Hrs. respectively.

1.1.11 "SBIIMS's Engineer" shall mean The Civil / Electrical Engineer in - charge of the Project, as nominated by the M.D.& CEO, SBI Infra Management Solutions Pvt. Ltd.

1.1.12 The following shall constitute the Joint Project Committee (herein under referred to as JPC) for assessing and reviewing the progress of the work on the project and to issue instructions or directions from time to time for being observed and followed by the Architects Site Engineer /PMC and other consultants / contractors engaged in the execution of the project.

i) Vice President – Circle Head / Vertical Head of SBIIMS
ii) SBIIMS Engineer (Civil and Electrical) in-charge of the Project, as may be nominated by the M.D. & CEO, SBI Infra Management Solutions Pvt. Ltd.
iii) Concerned partner / proprietor of the Architects and their Resident Architect Member.

CLAUSE

1.0 Total Security Deposit

Total Security deposit comprise of

Earnest Money Deposit

Initial security deposit

Retention Money

a) **Earnest Money Deposit -**

The tenderer shall furnish EMD of **Rs.3,250/- (Rupees three thousand two hundred fifty Only)** in the form of Demand draft or banker's cheque drawn in favour of SBI Infra Management Solutions Pvt. Ltd., on any Scheduled Bank. No tender shall be considered unless the EMD is so deposited in the required form. No interest shall be paid on this EMD. The EMD of the unsuccessful tenderer shall be refunded soon after the decision to award the contract is taken without interest. The EMD shall stand absolutely forfeited if the tenderer revokes his tender at any time the period when he is required to keep his tender open acceptance by the SBIIMSor after it is accepted by the SBIIMS the contractor fails to enter into a formal agreement or fails to pay the initial security deposit as stipulated or fails to commence the commence the work within the stipulated time.

b) **Initial Security Deposit (ISD)**

The amount of ISD shall be 2% of accepted value of tender including the EMD in the form of DD/FDR drawn on any scheduled Bank and shall be deposited within 15 days from the date of acceptance of tender.

ADDITIONAL SECURITY DEPOSIT / PERFORMANCE GUARANTEE

In case L-1 bidder quotes abnormally low rates (i.e. 10% or more, below estimated project cost), the bank may ask such bidder to deposit additional security deposit (ASD) equivalent to difference of estimated cost vis-à-vis L-1 quoted amount for due fulfillment of contract as performance guarantee. Such ASD could be in the form of FDR / Bank's guarantee in the Bank's name as per format approved by the Bank. On successful completion of work ASD will be returned to the contractor. In case contractor fails to complete the work in time or as per tender specification or leave the job incomplete, the bank will be at liberty to recover the dues from ASD or to forfeit such ASD as the case may be within its sole discretion.
No interest shall be paid to the amount retained by the Bank as Security Deposit.

c) **Retention Money: -**

Besides the SD as deposited by the contractor in the above said manner, the Retention money shall be deducted from the running account bill at the rate of 10% of the gross value of work done by the contractor and claimed in each bill provided the total security deposit i.e. ISD plus EMD plus Retention Money shall both together not exceed 5% of the contract value.The50% of the total security deposit shall be refunded to the contractor without any interest on issue of Virtual Completion certificate by the Architect/consultant. The balance 50% of the total security deposit shall be refunded to the contractors without interest within fifteen days after the end of defects liability period provided the contractor has satisfactorily attended to all defects, if any, in accordance with the conditions of contract including site clearance.

2.0 **Language**

The language in which the contract documents shall be drawn shall be in English.

3.0 **Errors, omissions and discrepancies**

In case of errors, omissions and/ or disagreement between written and scaled dimensions on the drawings or between the drawings and specifications etc., the following order shall apply.

i) Between scaled and written dimension (or description) on a drawing, the latter shall be adopted.

ii) Between the written or shown description or dimensions in the drawings and the corresponding one in the specification the former shall be taken as correct.

iii) Between written description of the item in the specifications and descriptions in bills of quantities of the same item, the former shall be adopted:

a) In case of difference between rates written in figures and words, the rate in words shall prevail.
b) Between the duplicate / subsequent copies of the tender, the original tender shall be taken as correct.

4.0 **Scope of Work:**

The contractor shall carryout complete and maintain the said work in every respect strictly accordance with this contract and with the directions of and to the satisfaction Bank to be communicated through the Architect/consultant. The Architect/consultant at the directions of the SBIIMS from time to time issue further drawings and / or write instructions, details directions and explanations which are here after collectively references to as Architect's /consultant's instructions in regard to the variation or modification of the design, quality or quantity of any work or the addition or omission or substitution work. Any discrepancy in the drawings or between BOQ and / or drawings and / or specifications. The removal from the site of any material brought thereon by the Contractor and any substitution of any other materials therefore the removal and / or re-executed of any work executed by him. The dismissal from the work of any person engaged thereupon.

5.0 i) **Letter of Acceptance:**

Within the validity period of the tender the SBIIMS shall issue a letter of acceptance directly or through the Architect by registered post or otherwise depositing at the of the contractor as given in the tender to enter into a Contract for the execution of the work as per the terms of the tender. The letter of acceptance shall constitute a binding contract between the SBIIMS and the contractor.

ii) **Contract Agreement:**

On receipt of intimation of the acceptance of tender from the SBIIMS Pvt. Ltd/ Architect, the successful tenderer shall be bound to implement the contract and within fifteen days there of shall sign an agreement in a non-judicial stamp paper of appropriate value.

6.0 **Ownership of drawings**:

All drawings, specifications and copies thereof furnished by the SBIIMS / SBI through its Architect / consultants are the properties of the SBIIMS They are not to be used on other work.

7.0 **Detailed drawings and instructions:**

The SBIIMS through its Architects / consultants shall furnish with reasonable proper additional instructions by means of drawings or otherwise necessary for the execution of the work. All such drawings and instructions shall be consistent with contract documents, true developments thereof and reasonably inferable there.

The work shall be executed in conformity therewith and the contractor prepare a detailed programme schedule indicating therein the date of start and completion of various activities on receipt of the work order and submit the same to the SBIIMS through the Architect/consultant.

7.0 **Copies of agreement**

Two copies of agreement duly signed by both the parties with the drawings shall be handed over to the contractors.

8.0 **Liquidated damages:**

If the contractor fails to maintain the required progress in terms of clause 6. 0 of GOC or to complete the work and clear the site including vacating their office on or before the contracted or extended date or completion, without justification in support of the cause of delay, he may be called upon without prejudice to any other right of remedy available under the law to the SBIIMS on account of such breach to pay a liquidated damage at the rate of 0.50% of the contract value which subject to a maximum of 5% of the contract value.

9.0 **Materials, Appliances and Employees**

Unless or otherwise specified the contractor shall provide and pay for all materials, labour, water, power, tools, equipment transportation and any other facilities that are required for the satisfactory execution and completion of the work. Unless or otherwise specified all materials shall be new and both workmanship and materials shall be best quality. The contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him. Workman whose work or behavior is found to be unsatisfactory by the SBIIMS /ARCHITECT/ consultant he shall be removed from the site immediately.

10.0 **Permits, Laws and Regulations:**

Permits and licenses required for the execution of the work shall be obtained by the contractor at his own expenses. The contractor shall give notices and comply with the regulations, laws, and ordinances rules, applicable to the contract. If the contractor observes any discrepancy between the drawings and specifications, he shall promptly notify the SBIIMS in writing under intimation of the Architect/ Consultant. If the contractor performs any act, which is against the law, rules and regulations he shall meet all the costs arising there from and shall indemnify the SBIIMS any legal actions arising there from.

11.0 **Setting out Work:**

The contractor shall set out the work and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions, and alignment of all parts thereof and get it approved by the Architect / consultant before proceeding with the work. If at any time any error in this respect shall appear during the progress of the works, irrespective of the fact that the layout had been approved by, the Architect / consultant the contractor shall be responsible for the same ad shall his own expenses rectify such error, if so, required to satisfaction of the SBIIMS.

12.0 **Protection of works and property:**

The contractor shall continuously maintain adequate protection. of all his work from damage and shall protect the SBI's properties from injury or loss arising in connection with contract. He shall make good any such damage, injury, loss, except due to causes beyond his control and due to his fault or negligence.

He shall take adequate care and steps for protection of the adjacent properties. The contractor shall take all precautions for safety and protections of his employees on the works and shall comply with all applicable provisions of Govt. and local bodies' safety laws and building codes to prevent accidents, or injuries to persons or property on about or adjacent to his place of work. The contractor shall take insurance covers as per clause 24.0 at his own cost. The policy may be taken in joint names of the contractor and the SBIIMS and the original policy may be lodged with the SBIIMS

13.0 **Inspection of work:**

The SBIIMS / Architect / Consultant or their representatives shall at all reasonable times have free access to the work site and / or to the workshop, factories, or other places where materials are lying or from where they are obtained and the contractor shall give every facility to the SBIIMS/Architect/consultant and their representatives necessary for inspection and examination and test of the materials and workmanship. No person unless authorized by the SBIIMS/ Architect /Consultant except the representative of Public authorities shall be allowed on the work at any time. The proposed work either during its construction stage or its completion can also be inspected by the Chief Technical Examiner's Organization a wing of Central Vigilance commission.

14.0 **Assignment and subletting**

The whole of work included in the contract shall be executed the contractor and he shall not directly entrust and engage or indirectly transfer, assign or underlet the contract or any part or share there of or interest therein without the written consent of the SBIIMS through the Architect and no undertaking shall relieve the contractor from the responsibility of the contractor from active & superintendence of the work during its progress.

15.0 **Quality of materials, workmanship & Test**

All materials and workmanship shall be best of the respective kinds described in the contract and in accordance with Architect/consultant instructions and shall be subject from time to time to such tests as the Architect/consultant may direct at the place of manufacture or fabrication or on the site or an approved testing laboratory. The contractor shall provide such assistance, instruments, machinery, labor, and materials as are normally required for examining measuring sampling and testing any material or part of work before incorporation in the work for testing as may be selected and required by the Architect/consultant.

ii) **Samples**

All samples of adequate numbers, size, shades & pattern as per specifications shall be supplied by the contractor without any extra charges. If certain items

proposed to be used are of such nature that samples cannot be presented or prepared at the site detailed literature / test certificate of the same shall be provided to the satisfaction of the Architect/consultant. Before submitting the sample / literature the contractor shall satisfy himself that the material / equipment for which he is submitting the sample / literature meet with the requirement of tender specification. Only when the samples are approved in writing by the Architect / consultant the contractor shall proceed with the procurement and installation of the particular material / equipment. The approved samples shall be the signed by the Architect / Consultant for identification and shall be kept on record at site office until the completion of the work for inspection / comparison at any time. The Architect/Consultant shall take reasonable time to approve the sample. Any delay that might occur in approving the samples for reasons of its not meeting the specifications or other discrepancies inadequacy in ELECTRICAL samples of best qualities from various manufacturers and such other aspects causing delay on the approval of the materials / equipment etc. shall be to the account of the contractor.

iii) **Cost of tests**

The cost of making any test shall be borne by the contractor if such test is intended by or provided for in the specification or BOQ.

iv) **Costs of tests not provided for**

If any test is ordered by the Architect/ Consultant which is either

a) If so intended by or provided for or (in the cases above mentioned) is not so particularized, or though so intended or provided for but ordered by the Architect / Consultant to be carried out by an independent person at any place other than the site or the place of manufacture or fabrication of the materials tested or any Government / approved laboratory, then the cost of such test shall be borne by the contractor.

16.0 **Obtaining information related to execution of work**

No claim by the contractor for additional payment shall be entertained which is consequent upon failure on his part to obtain correct information as to any matter affecting the execution of the work nor any misunderstanding or the obtaining incorrect information or the failure to obtain correct information relieve him from any risks or from the entire responsibility for the fulfillment of contract.

17.0 **Contractor's superintendence**

The contractor shall give necessary personal superintendence during the execution the works and as long, thereafter, as the Architect / Consultant may consider necessary until the expiry of the defects liability period, stated here to.

18.0 **Quantities**

i) The bill of quantities (BOQ) unless or otherwise stated shall be deemed to have been prepared in accordance with the Indian Standard Method of Measurements and quantities. The rate quoted shall remain valid for variation of quantity against individual item to any extent. The entire amount paid under Clause 19, 20 hereof as well as amounts of prime cost and provision sums, if any, shall be excluded.

19.0 **Works to be measured**

The Architect/Consultant may from time to time intimate to the contractor that he requires the work to be measured and the contractor shall forthwith attend or send a representative to assist the Architect in taking such measurements and calculation and to furnish all particulars or to give all assistance required by any of them. Such measurements shall be taken in accordance with the Mode of measurements detail in the specifications. The representative of the Architect / Consultant shall take measurements with the contractor's representative and the measurements shall be entered in the measurement book. The contractor or his authorized representative shall sign all the pages of the measurement book in which the measurements have been recorded in token of his acceptance. All the corrections shall be duly attested by both representatives. No over writings shall be made in the Measurement Book(M.B.) Should the contractor not attend or neglect or omit to depute his representative to take measurements, the measurements recorded by the representative of the Architect / consultant shall be final. All authorized extra work, omissions and all variations made shall be included such measurement.

20.0 **Variations**

No alteration, omission or variation ordered in writing by the Architect / consultant vitiates the contract. In case the SBIIMS / Architect / Consultant thinks proper at any during the progress of works to make any alteration in, or additions to or omission from the works or any. alteration in the kind or quality of the materials to be used therein, the Architect / Consultant shall give notice thereof in writing to the contractor shall confirm in writing within seven days of giving such oral instructions the contract shall alter to, add to, or omit from as the case may be in accordance with such but the contractor shall not do any work extra to or make any alterations or additions to or omissions from the works or any deviation from any of the provisions of the contract, stipulations, specifications or contract drawings without previous consent in writing of the Architect/ Consultant and the value of such extras, alterations, additions or omissions shall in all cases be determined by the Architect / Consultant and the same shall be added to or deducted from the contract value, as the case may be.

21.0 **Valuation of Variations**

No claim for an extra shall be allowed unless it shall have been executed under the authority of the Architect / Consultant with the concurrence of the SBIIMS as herein mentioned. Any such extra is herein referred to as authorized extra and shall be made in accordance with the following provisions.

a) (i) The net rates or prices in the contract shall determine the valuation of the extra work where such extra work is of similar character and executed under similar conditions as the work priced herein.

(ii) Rates for all items, wherever possible should be derived out of the rates given in the priced BOQ.

b) The net prices of the original tender shall determine the value of the items omitted, provided if omissions do not vary the conditions under which any remaining items of

Works are carried out; otherwise the prices for the same shall be valued under sub-Clause ‘c’ hereunder.

c) Where the extra works are not of similar character and/or executed under similar conditions as aforesaid or where the omissions vary the conditions under which any remaining items or works are carried out, then the contractor shall within 7 days of the receipt of the letter of acceptance inform the Architect/ consultant of the rate which he intends to charge for such items of work, duly supported by analysis of the rate or rates claimed and the Architect/ consultant shall fix such rate or prices as in the circumstances in his opinion are reasonable and proper, based on the market rate.

d) Where extra work cannot be properly measured or valued the contractor shall be allowed day work prices at the net rates stated in the tender, of the BOQ or, if not, so stated then in accordance with the local day work rates and wages for the district; provided that in either case, vouchers specifying the daily time (and if required by the Architect/Consultant) the workman’s name and materials employed be delivered for verifications to the Architect /consultant at or before the end of the week following that in which the work has been executed.

e) It is further clarified that for all such authorized extra items where rates cannot be derived from the tender, the Contractor shall submit rates duly supported by rate analysis worked on the ‘market rate basis for material, labour hire / running charges of equipment and wastages etc. plus 15% towards establishment charges, contractor’s overheads and profit. Such items shall, not be eligible for escalation.

22.0 **Final measurement**

The measurement and valuation in respect of the contract shall be completed within two months of the virtual completion of the work.

23.0 **Virtual Completion Certificate (VCC)**

On successful completion of entire works covered by the contract to the full satisfaction of the SBIIMS, the contractor shall ensure that the following works have been completed the satisfaction of the SBIIMS:

a) Clear the site of all scaffolding, wiring, pipes, surplus materials, contractor’s labour equipment and machinery.

b) Demolish, dismantle and remove the contractor’s site office, temporary works, structure including labour sheds/camps and constructions and other items and things whatsoever brought upon or erected at the site or any land allotted to the contractor by the SBIIMS not incorporated in the permanent works.

c) Remove all rubbish, debris etc. from the site and the land allotted to the contractor the SBIIMS and shall clear, level and dress, compact the site as required by the SBIIMS

d) Shall put the SBIIMS in undisputed custody and possession of the site and all land allot by the SBIIMS

e) Shall hand over the work in a peaceful manner to the SBIIMS

f) All defects / imperfections have been attended and rectified as pointed out by the Architects to the full satisfaction of SBIIMS

Upon the satisfactory fulfillment by the contractor as stated above, the contractor is entitled to apply to the Architect / consultant is satisfied of the completion of work. Relative to which the completion certificate has been sought, the Architect/ consultant shall within fourteen (14) days of the receipt of the application for completion certificate, issue a VCC in respect of the work for which the VCC has applied.

This issuance of a VCC shall not be without prejudice to the SBIIMS's rights and contractor liabilities under the contract including the contractor's liability for defects liability nor shall the issuance of VCC in respect of the works or work at any site be construction as a waiver of any right or claim of the SBIIMS against the contractor in respect of or work at the site and in respect of which the VCC has been issued.

24.0 **Work by other agencies**

The SBIIMS / Architect / consultant reserves the rights to use premises and any portion the site for execution of any work not included in the scope of this contract which it may desire to have carried out by other persons simultaneously and the contractor shall not only allow but also extend reasonable facilities for the execution of such work. The contractor however shall not be required to provide any plant or material for the execution of such work except by special arrangement with the SBI. Such work shall be carried out in such manner as not to impede the progress of the works included in the contract.

25.0 **Insurance of works**

25.1 Without limiting his obligations and responsibilities under the contract the contractor shall insure in the joint names of the SBI / SBIIMS and the contractor against all loss of damages from whatever cause arising other than the excepted risks, for which he is responsible under the terms of contract and in such a manner that the SBIIMSand contractor are covered for the period stipulated vide clause of GCC and are also covered during the period of maintenance for loss or damage arising from a cause, occurring prior to the commencement of the period of maintenance and for any loss or damage occasioned by the contractor in the course of any operations carried out by him for the purpose of complying with his obligations under clause.

a) The Works for the time being executed to the estimated current Contract value thereof, or such additional sum as may be specified together with the materials for incorporation in the works at their replacement value.

b) The constructional plant and other things brought on to the site by the contractor to the replacement value of such constructional plant and other things.

c) Such insurance shall be affected with an insurer and in terms approved by the SBIIMS which approval shall not be unreasonably withheld and the contractor shall whenever require produce to the Architect / consultant the policy if insurance and the receipts for payment of the current premiums.

25.2 **Damage to persons and property**

The contractor shall, except if and so far as the contract provides otherwise indemnify the SBI against all losses and claims in respect of injuries or damages to any person or material or physical damage to any property whatsoever which may arise out of or in consequence of the execution and maintenance of the works and against all claims proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto except any compensation of damages for or with respect to:

a) The permanent use or occupation of land by or any part thereof.

b) The right of SBIIMS to execute the works or any part thereof on, over, under, in or through any lands.

c) Injuries or damages to persons or properties which are unavoidable result of the execution or maintenance of the works in accordance with the contract

d) Injuries or damage to persons or property resulting from any act or neglect of the SBIIMStheir agents, employees or other contractors not being employed by the contractor or for or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or where the injury or damage was contributed to by the contractor, his servants or agents such part of the compensation as may be just and equitable having regard to the extent of the responsibility of the SBIIMS, their employees, or agents or other employees, or agents or other contractors for the damage or injury.

25.3 **Contractor to indemnify SBIIMS**

The contractor shall indemnify the SBIIMS against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the provision sub-clause 25.2 of this clause.

25.4 **Contractor's superintendence**

The contractor shall fully indemnify and keep indemnified the SBI/SBIIMS against any action, claim, or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claim made under or action brought against SBIIMS in respect of such matters as aforesaid the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expenses to settle any dispute or to conduct any litigation that may arise there from, provided that the contractor shall not be liable to indemnify the SBIIMS if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Architect / consultant in this behalf.

25.5 **Third Party Insurance**

25.5.1 Before commencing the execution of the work the contractor but without limiting his obligations and responsibilities under clause 24.0 of GCC shall insure against his liability for any material or physical damage, loss, or injury which may occur to any

property including that of SBIIMS, or to any person, including any employee of the SBIIMS, by or arising out of the execution of the works or in the carrying out of the contract, otherwise than due to the matters referred to in the provision to clause 24.0 thereof.

25.5.2 **Minimum amount of Third Party Insurance**

Such insurance shall be affected with an insurer and in terms approved by the SBIIMS which approval shall not be reasonably withheld and for at least the amount stated below. The contractor shall, whenever required, produce to the. Architect / consultant the policy or policies of insurance cover and receipts for payment of the current premiums.

25.6 The minimum insurance cover for physical property, injury, and death is Rs.5 Lakh per occurrence with the number of occurrences limited to four. After each occurrence contractor will pay additional premium necessary to make insurance valid for four occurrences always.

25.7 **Accident or Injury to workman:**

25.7.1 The SBIIMS shall not be liable for or in respect of any damages or compensation payable at law in respect or in consequence of any accident or injury to any workmen or other person in the employment of the contractor or any sub-contractor, save and except an accident or injury resulting from any act or default of the SBIIMS or their agents, or employees. The contractor shall indemnify and keep indemnified SBIIMS against all such damages and compensation, save and except as aforesaid, and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

25.7.2 **Insurance against accidents etc. to workmen**

The contractor shall insure against such liability with an insurer approved by the SBIIMS during the whole of the time that any persons are employed by him on the works and shall, when required, produce to the Architect / consultant such policy of insurance and receipt for payment of the current premium. Provided always that, in respect of any persons employed by any sub-contractor the contractor's obligation to insured as aforesaid under this sub-clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that SBIIMS is indemnified under the policy but the contractor shall require such sub-contractor to produce to the Architect /consultant when such policy of insurance and the receipt for the payment of the current premium.

25.7.3 **Remedy on contractor's failure to insure**

If the contractor fails to effect and keep in force the insurance referred to above or any other insurance which he may be required to effect under the terms of contract, then and in any such case the SBIIMS may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the SBIIMS as aforesaid from any amount due or which may become due to the contractor, or recover the same as debt from the contractor.

25.7.4 Without prejudice to the others rights of the SBIIMS against contractors. In respect of such default, the employer shall be entitled to deduct from any sums payable to the contractor the amount of any damages costs, charges, and other expenses paid by the SBIIMS and which are payable by the contractors under this clause. The contractor shall upon settlement by the Insurer of any claim made against the insurer pursuant to a policy taken under this clause, proceed with due diligence to rebuild or repair the works destroyed or damaged. In this event all the monies received from the Insurer in respect of such damage shall be paid to the contractor and the Contractor shall not be entitled to any further payment in respect of the expenditure incurred for rebuilding or repairing of the materials or goods destroyed or damaged

26.0 **Commencement of Works:**
The date of commencement of the work will be reckoned as the date, fifteen days from the date of award of letter by the SBIIMS

27.0 **Time for completion**

Time is essence of the contract and shall be strictly observed by the contractor. The entire work shall be completed within a period of **60 days** from the date of commencement. If required in the contract or as directed by the Architect / consultant. The contractor shall complete certain portions of work before completion of the entire work. However, the completion date shall be reckoned as the date by which the whole work is completed as per the terms of the contract.

28.0 **Extension of time**
If, in the opinion of the Architect/consultant, the work be delayed for reasons beyond the control of the contractor, the Architect/consultant may submit a recommendation to the SBIIMS to grant a fair and reasonable extension of time for completion of work as per the terms of contract. If the contractor needs an extension of time for the completion of work or if the completion of work is likely to be delayed for any reasons beyond the due date of completion as stipulated in the contract, the contractor shall apply to theSBIIMS through the Architect' Consultant in writing at least 30 Days before the expiry of the scheduled time and while applying for extension of time he shall furnish the reason in detail and his justification if an', for the delays. The Architect/consultant shall submit their recommendations to the SBIIMS in the prescribed format for granting extension of time. While granting extension of time the contractor shall be informed the period extended time which will qualify for levy of liquidated damages. For the balance period in excess of original stipulated period and duly sanctioned extension of time by the provision of liquidated damages as stated under clause 10.0 shall become applicable. Further the contract shall remain in force even for the period beyond the due date of completion irrespective whether the extension is granted or not.

29.0 **Rate of progress**
Whole of the materials, plant and labour to be provided by the contractor and the mode, manner and speed of execution and maintenance of the works are to be of a kind and conducted in a manner to the satisfaction of the Architect / consultant should the rate of progress of the work or any part thereof be at any time be in the opinion the. Architect / consultant too Slow to ensure the completion of the whole of the work the prescribed time or extended time for completion the Architect / consultant shall thereupon take such steps as considered necessary by the Architect / consultant to expedite progress so as to complete the works by the

prescribed time or extended time. Such communications from the Architect / consultant neither shall relieve the contractor from fulfilling obligations under the contract nor will he be entitled to raise any claims arising out of such directions.

30.0 **Work during nights and holidays**

Subject to any provision to the contrary contained in the contract no permanent work shall save as herein provided be carried on during the night or on holidays without the permission in writing of the Architect / consultant, save when the work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the work in which case the contractor shall immediately advise the Architect / consultant. However, the provisions of the clause shall not be applicable in the case of any work which becomes essential to carry by rotary or double shifts in order to achieve the progress and quality of the part of the works being technically required / continued with the prior approval of the Architect / consultant at no extra cost to the SBIIMS

All work at night after obtaining approval from competent authorities shall be carried out without unreasonable noise and disturbance.

31.0 **No compensation or restrictions of work**

If at any time after acceptance of the tender SBIIMS shall decide to abandon or reduce the scope of work for any reason whatsoever and hence not required the whole or any part of the work to be carried out. The Architect / consultant shall give notice in writing that effect to the contractor and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise what so ever on account of any profit or advantage which he might have derived from the execution of the Work fully but which he did not derive in consequence of the foreclosure of the whole or part of the work.

Provided that the contractor shall be paid the charges on the cartage only of materials actually and bona-fide brought to the site of the work by the contractor and rendered surplus as a result of the abandonment, curtailment of the work or any portion thereof and then taken back by the contractor, provided however that the Architect / Consultant shall have in such cases the option of taking over all or any such materials at their purchase price or a local current rate whichever is less.

“In case of such stores having been issued from SBIIMS stores and returned by the contractor to stores, credit shall be given to him at the rates not exceeding those at which were originally issued to the contractor after taking into consideration and deduction for claims on account of any deterioration or damage while in the custody of the contractor and in this respect the decision of Architect / consultant shall be final.

32.0 **Suspension of work**

i) The contractor shall, on receipt of the order in writing of the Architect / consultant (whose decision shall be final and binding on the contractor) suspend the progress of works or any part thereof for such time and in such manner as Architect /consultant may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of following reasons:

a) On account any default on the part of the contractor, or

b) For proper execution of the works or part thereof for reasons other than the default the contractor, or

c) For safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works the extent necessary and carry out the instructions given in that behalf by the Architect / consultant.

i) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above:

The contractor shall be entitled to an extension of time equal to the period of every such suspension. No compensation whatsoever shall be paid on this account.

33 **Action when the whole security deposit is forfeited**

In any case in which under any clause or clauses of this contract, the Contractor shall have rendered himself liable to pay compensation amounting to the whole of his security deposit the Architect / consultant shall have the power to adopt any of the following course as they may deem best suited to the interest of the SBIIMS:

a) To rescind the contract (of which rescission notice in writing to the contractor by - Architect / consultant shall be conclusive evidence) and in which case the security, deposit of the contractor shall be forfeited and be absolutely at the disposal of SBIIMS

b) To employ labour paid by the SBIIMSand to supply materials to carry out the work, or part of the work, debiting the contractor with the cost of the labour and materials cost of such labour and materials as worked out by the Architect/consultant shall final and conclusive against the contractor) and crediting him with the value of the work done, in all respects in the same manner and at the same manner and at the same rates as if it had been carried out by the contractor under the terms of this contract certificate of Architect /consultant as to the value of work done shall be final conclusive against the contractor.

c) To measure up the work of the contractor, and to take such part thereof as shall unexecuted, out of his hands, and to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (The amount of which excess the certificates in writing of the Architects / consultant shall final and conclusive) shall be borne by original contractor and may be deducted f any money due to him by SBIIMS under the contract or otherwise, or from his security deposit or the proceeds of sale thereof, or sufficient part thereof.

In the event of any of above courses being adopted by the SBIIMS the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any material or entered into any engagements or make any advances on account of, or with a view to the execution of the work or the performance of the contract and in case the contract shall be rescind under the provision aforesaid, the contractor shall not be entitled to recover or to be paid any sum or any work thereto for actually performed under this contract, unless, and until the Architect / consultant will have certified in writing the performance of such work and the value payable in respect thereof, and he shall only be entitled to be paid the value so certified.

34.0 **Owner's right to terminate the contract**

If the contractor being an individual or a firm commit any 'Act of insolvency' or shall be adjusted an insolvent or being an incorporated company shall have an order for compulsory winding up voluntarily or subject to the supervision of Govt. and of the Official Assignee of the liquidator in such acts of insolvency or winding up shall be unable within seven days after notice to him to do so, to show to the reasonable satisfaction of the Architect / Consultant that he is able to carry out and fulfill the contract, and to dye security therefore if so required by the Architect / Consultant or if the contractor (whether an individual firm or incorporated Company) shall suffer execution to be issued or shall suffer any payment under this contract to be attached by or on behalf of any of the creditors of the contractor.

Or shall assign or sublet this contract without the consent in writing of the SBIIMS through the Architect/Consultant or shall charge or encumber this contract or any payment due to which may become due to the contractor there under:

a) Has abandoned the contract; or

b) has failed to commence the works, or has without any lawful excuse under these conditions suspended the progress of the works for 14 days after receiving from the SBIIMS through the Architect / consultant written notice to proceed, or

c) has failed to proceed with the works with such diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or
has failed to remove the materials from the site or to pull down and replace work within seven days after written notice from the SBIIMS through the Architect / Consultant that the said materials were condemned and rejected by the Architect/consultant under these conditions; or has neglected or failed persistently to observe and perform all or any of the acts matters or things by this contract to be observed and performed by the contactor for seven days after written notice shall have been given to the contractor to observe or perform the same or has to the detriment of good workmanship or in defiance of the SBIIMS or Architect's / consultant's instructions to the contrary subject any part of the contract. Then and in any of said cases the SBIIMS and or the Architect / consultant, may not withstanding any previous waiver, after giving seven days' notice in writing to the contractor, determine the contract, but without thereby affecting the powers of the SBIIMS or the Architect / consultant or the obligation and liabilities of the contractor the whole of which shall continue in force as fully as if the contract had not been determined and as if the works subsequently had been executed by or on behalf of the contractor. And, further the SBIIMS through the Architect / consultant their agents or employees may enter upon and take possession of the work and all plants, took scaffoldings, materials, sheds, machineries lying upon the premises or on the adjoining lands or roads use the same by means of their own employees or workmen in carrying on and completing the work or by engaging any other contractors or persons to the work and the contractor shall not in any was interrupt or do any act, matter or thing to prevent or hinder such other contractor or other persons employed for complement and finishing or using the materials and plant for the works.

When the works shall be completed or as soon thereafter as convenient the SBIIMS or Architect / consultant shall give a notice in writing to the contractor to

remove his surplus materials and plants and should the contractor fail to do so within 14 days after receive thereof by him the SBIIMS sell the same by publication, and after due publication, and shall, adjust the amount realized by such auction. The contractor shall have no right to question any of the act of the SBIIMS incidental to the sale of the materials etc.

35.0 **Certificate of payment**

The contractor shall be entitled under the certificates to be issued by the Architect / consultant to the contractor within 10 working days from the date of certificate to payment from SBIIMS from time to time. The SBIIMS shall recover the statutory recovering other dues including the retention amount from the certificate of payment.

Provided always that the issue of any certificate by the Architect / consultant during progress of works or completion shall not have effect as certificate of satisfaction relieve the contractor from his liability under clause.

The Architect / consultant shall have power to withhold the certificate if the work or in part thereof is not carried out to their satisfaction.

The Architect / consultant may by any certificate make any corrections required previous certificate.

The SBIIMS shall modify the certificate of payment as issued by the Architect / consultant from time to time while making the payment

The contractor shall submit interim bills only after taking actual measurements and properly recorded in the Measurement Book (M. B.)

The Contractor shall not submit interim bills when the approximate value of work done by him is less than **Rs.30.0 Lakh (Rupees Thirty Lakhs Only).**

The final bill may be submitted by contractor within a period of one month from the date of virtual completion and Architect / consultant shall issue the certificate of payment within a period of two months. The SBIIMS shall pay the amount within a period of three months from the date of issue of certificate provided there is no dispute in respect of rates and quantities.

The contractor shall submit the interim bills in the prescribed format with all details.

36.0 **A. Settlement of Disputes and Arbitration**

Except where otherwise provided in the contract all questions and disputes to the meaning of the specifications, design, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or as to any other question , claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings specifications, estimates, instructions orders or these conditions or otherwise concerning the work or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter:

i) If the contractor considers that he is entitled to any extra payment or compensation in respect of the works over and above the amounts admitted as payable by the Architect or in case the contractor wants to dispute the validity of any deductions or recoveries made or proposed to be made from the contract or raise any dispute, the contractor shall forthwith give notice in writing of his claim, or dispute to The M.D.& C.E.O. SBIIMS, Head Office, Raheja Chambers, Free Press Journal Marg, Mumbai And endorse a copy of the same to the Architect, within 30 days from the date of disallowance thereof or the date of deduction or recovery. The said notice shall give full particulars of the claim, grounds on which it is based and detailed calculations of the amount claimed and the contractor shall not be entitled to raise any claim nor shall the SBIIMS Pvt. Ltd be in any way liable in respect of any claim by the contractor unless notice of such claim shall have been given by the contractor to the M.D.& C.E.O. SBIIMS, Head Office in the manner and within the time as aforesaid. The Contractor shall be deemed to have waived and extinguished all his rights in respect of any claim not notified to the M.D.& C.E.O. SBIIMS, Head Office in writing in the manner and within the time aforesaid.

B. Settlement of Disputes and Arbitration

The M.D.& C.E.O. SBIIMS, Head Officeshall give his decision in writing on the claims notified by the receipt of the contractor may within 30 days of the receipt of the decision of the M.D.& C.E.O. SBIIMS, Head Office/ Submit his claims to the conciliating authoritynamely the M.D.& C.E.O. SBIIMS, Head Office, Raheja Chambers, Free Press Journal Marg, Mumbai. For conciliation along with all details and copies of correspondence exchanged between him and the SBIIMS

i) If the conciliation proceedings are terminated without settlement of the disputes, the contractor shall, within a period of 30 days of termination thereof shall give a notice to the concerned MD&CEOof the SBIIMS for appointment of an arbitrator to adjudicate the notified claims falling which the claims of the contractor shall be deemed to have been considered absolutely barred and waived.

ii) Except where the decision has become final, binding and conclusive in terms of the contract, all disputes or differences arising out of the notified claims of the contractor as aforesaid and all claims of the SBIIMS Pvt. Ltd shall be referred for adjudication through arbitration by the Sole Arbitrator appointed by the MD&CEO and who will be of Deputy General Manager rank. It will also be no objection to any such appointment that the Arbitrator so appointed is a SBIIMS, Officer and that he had to deal with the matters to which the Contract relates in the course of his duties as SBIIMS, Officer. If the arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever another sole arbitrator shall be appointed in the manner aforesaid by the said MD&CEOof the SBIIMSSuch person shall be entitled to proceed with the reference from the stage at which it was let by his predecessor.

It is a term of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed in respect of each dispute along with the notice for appointment of arbitrator.

It is also a term of this contract that no person other than a person appointed by such Chief General Manager as aforesaid should act as arbitrator.

The conciliation and arbitration shall be conducted in accordance with the provisions of the Arbitration & Conciliation Act 1996 or any or any accordance modification or reenactment thereof and the rules made there under.

It is also a term of the contract that if any fees are payable to the Arbitrator these shall be paid equally by both the parties. However, no fees will be payable to the arbitrator if he is a SBIIMSOfficer.

It is also a term of the contract that the Arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties calling them to submit their statement of claims and counter statement of claims. The venue of the arbitration shall be such place as may be fixed by the arbitrator in his sole discretion. The fees, if any of the arbitrators shall, if required to be paid before the award is made and published, be paid half and half by each of the parties. The Cost of the reference and of the award (including the fees, if any of the arbitrator) shall be in the discretion of the arbitrator who may direct to any by whom and din what manner, such costs or any part thereof, shall be paid and fix or settle the amount of costs to be so paid.

37.0 **Water Supply**

The contractor shall make his own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following condition.

i) That the water used by the contractor shall be fit for construction purposes to the satisfaction of the Architect / consultant's.

ii) The contractor shall make alternative arrangements for the supply of water if the arrangement made by the contractor for procurement of water in the opinion of the Architect / consultant is unsatisfactory.

37.1 The contractor shall construct temporary well / tube well in SBIIMS Pvt. Ltd land for taking water for construction purposes only after obtaining permission in writing from the SBIIMS. The contractor has to make his own arrangements for drawing and distributing the water at his own cost. He has to make necessary arrangements. To avoid any accidents or damages caused due to construction and subsequent maintenance of the wells. He has to obtain necessary approvals from local authorities, if required, at his own cost. He shall restore the ground to its original condition after wells are dismantled on completion of work or hand over the well to the SBIIMSwithout any compensation as directed by the Architect / consultant.

38.0 **Power Supply**

The contractor shall make his own arrangements for power and supply / distribution system for driving plant or machinery for the work and for lighting purpose at his own cost, the cost of running and maintenance of the plants are to be included in his tender prices, He shall pay all fees and charges required, by the power supply and include the same in his tendered rates and hold the owner free from all such costs. He has to obtain necessary approval from the appropriate authorities, if required.

39.0 **Treasure Trove etc.**

Any treasure trove, coin or object antique which may be found on the site shall be the property of SBIIMS and shall be handed over to the bank immediately.

40.0 **Method of Measurement**

Unless otherwise mentioned in the schedule of quantities or in mode of measurement, the measurement will be on the net quantities or work produced in accordance with up to date rules laid down by the Bureau of Indian Standards. In the event any dispute / disagreement the decision of the Architect / consultant shall be final and binding on the corrector.

41.0 **Maintenance of Registers**

The contractor shall maintain the following registers as per the enclosed perform at site of work and should produce the same for inspection of SBIIMS Pvt. Ltd/Architect / consultant whenever desired by them. The contractor shall also maintain the records / registers as required by the local authorities / Govt. from time to time.

I) Register for secured advance
ii) Register for hindrance to work
iii) Register for running account bill
iv) Register for labor

42.0 **Force Majeure**

42.1 Neither contractor nor SBIIMS shall be considered in default in performance of the obligations if such performance is prevented or delayed by events such as but not war, hostilities revolution, riots, civil commotion, strikes, lockout, conflagrations, epidemics, accidents, fire, storms, floods, droughts, earthquakes or ordinances or any act of or for any other cause beyond the reasonable control of the party affected or prevents or delayed. However, a notice is required to be given within 30 days from the happening of the event with complete details, to the other party to the contract, if it is not possible to serve a notice, within the shortest possible period without delay.

42.2 As soon as the cause of force majeure has been removed the party whose ability perform its obligations has been affected, shall notify the other of such cessation and the actual delay incurred in such affected activity adducing necessary evidence in support thereof.

42.3 From the date of occurrence of a case of force majeure obligations of the party affected shall be suspended during the continuance of any inability so caused. With the caused itself and inability resulting there from having been removed, the agreed time completion of the respective obligations under this agreement shall stand extended a period equal to the period of delay occasioned by such events.

42.4 Should one or both parties be prevented from fulfilling the contractual obligations by state of force majeure lasting to a period of 6 months or wore the two parties, shall each other to decide regarding the future execution of this agreement.

43.0 **Local laws, Acts Regulations:**

The contractor shall strictly adhere to all prevailing labour laws inclusive at contract labour (regulation and abolition act of 1970) and other safety regulations. The contractors should comply with the provision of all labour legislation including the latest requirements of the Acts, laws, any other regulations that are applicable to the execution of the project.

i) Minimum wages Act 1948 (Amended)
ii) Payment of wages Act 1936 (Amended)
iii) Workmen's compensation Act 1923 (Amended)
iv) Contract labour regulation and abolition act 1970 and central rules 1971 (Amended)
v) Apprentice act 1961 (amended)
vi) Industrial employment (standing order) Act 1946 (Amended)
vii) Personal injuries (Compensation insurance) act 1 963 and any other modifications
viii) Employees' provident fund and miscellaneous provisions Act 1952 and amendment thereof
ix) Shop and establishment act
x) Any other act or enactment relating thereto and rules framed there under from time to time.
xi) Prevailing Indian Electricity rules & act.

44.0 **Accidents**

The contractor shall immediately on occurrence of any accident at or about the site or in connection with the execution of the work report such accident to the Architect / consultant. The contractor shall also such report immediately to the competent authority whenever such report is required to be lodged by the law and take appropriate actions thereof.

SPECIAL CONDITION OF CONTRACT

Scope of work

1.0 The scope of work is to carry out for the **TENDER FOR PROPSED ELECTRICAL WORKS OF GUEST HOUSE AT 1st FLOOR & CHUMMERY TYPE ACCOMODATION AT 6th FLOOR OF UDYAN BUILDING, NEPEAN SEA ROAD, MUMBAI** for State Bank of India

2.0 Address of site

The site is located at 1st& 6thFloor, Udyan Building, Nepean Sea Road, Mumbai.

3.0 **Dimensions and levels**

All dimensions and levels shown on the drawings shall be verified by the contractor and the site and he will be held responsible for the accuracy and maintenance of. All the dimensions and the levels. Figured dimensions are in all cases to be accepted and dimension shall be scaled. Large scale details shall take precedence over small scale drawings. In case of discrepancy the contractor shall ask for clarification from the Architect / consultant before proceeding with the work.

4.0 **Notice of operation**

The contractor shall not carry out any important operation without the Consent in with from the Architect / consultant:

5.0 **Construction records**

The contractor shall keep and provide to the Architect / consultant full and accurate records of the dimensions and positions of all new work and any other information necessary to prepare complete drawings recording details of the work as construction.

6.0 **Safety of adjacent structures and trees**

The contractor shall provide and erect to the approval of the Architect / consultant supports as may be required to protect effectively all structures and protective give to trees, which may be endangered by the execution of the works or otherwise such permanent measures as may be required by the Architect to protect the tree structures.

7.0 **Temporary works.**

Before any temporary works are commenced the contractor shall submit at least in advance to the Architect / consultant for approval complete drawings of all temporary works he may require for the execution of the works. The contractor shall carry out the modifications relating to strength, if required by the Architect / consultant may require in accordance with the conditions of contract at his own cost the contractor shall be solely responsible for the stability and safety of all

temporary works and unfinished works and for the quality of the permanent works resulting from the arrangement eventually adopted for their execution.

8.0 **Water power and other facilities**

a) The rate quoted by the contractor shall include all expenses that are required for providing all the water required for the work and the contractor shall make his own arrangements for the supply of good quality water suitable for the construction and good quality drinking water for their workers If necessary the contractor has to sink a tube well / open well and bring water by means of tankers at his own cost for the purpose The SBIIMS will not be liable to pay any charges in connection with the above

b) The rate quoted in the tender shall include the expenses for obtaining and maintaining power connections and shall pay for the consumption charges

c) The contractors for other trades directly appointed by the SBIIMSshall be entitled to take power and water connections from the temporary water and power supply obtained by the contractor However, the concerned contractor shall make their own arrangements to draw the supply and pay directly the actual consumption charges at mutually agreed rates between them. All municipal charges for drainage and water connection for Construction purposes shall be borne by the contactor and charges payable for permanent connections, if any, shall be initially paid by the contactor and the SBIIMSwill reimburse the amount on production of receipts

d) The SBIIMS as well as the Architect / consultant shall give all possible assistance to the Contractor's to obtain the requisite permission from the various authorities, but the responsibility for obtaining the same in time shall be of the contractor

9.0 **Facilities for contractor's employees**

The contractor shall make his own arrangement for the housing and welfare of his staff and workmen including adequate drinking water facilities. The contractor shall also make the arrangements at his own cost for transport where necessary for his staff and workmen to and from site of work at his own cost.

10.0 **Lighting of works**

The contractor shall at all times provide adequate and approved lighting as required for the proper execution and supervision and inspection of work.

11.0 **Firefighting arrangements**

i) The contractor shall provide suitable arrangement for firefighting at his own cost. This purpose he shall provide requisite number of fire extinguishers and adequate number of buckets, some of which are to be always kept filled with sand and some with water this equipment shall be provided at suitable prominent and easily accessible place and shall be properly maintained.

ii) Any deficiency in the fire safety or unsafe conditions shall be corrected by the contractor at his own cost and, to the approval of the relevant authorities. The

contractor makes the following arrangements at his own cost but not limited the following:

a) Proper handling, storage and disposal of combustible materials and waste.
b) Work operations which can create fire hazards.
c) Access for fire-fighting equipment.
d) Type, number and location of containers for the removal of surplus materials and rubbish.
e) Type, size, number and location of fire extinguishers or other tire fighting equipment.
f) General house keeping

12.0 Site order book

A site order book shall be maintained at site for the purpose of quick communication between the Architect / Consultant. Any communication relating to the work may be conveyed through records in the site order book. Such a communication from one party to the other shall be deemed to have been adequately served in terms of contract Each site order book shall have machine numbered pages in triplicate and shall carefully maintained and preserved by the contractor and shall be made available to the Architect / consultant as and when demanded- Any instruction which the Architect /consultant may like to issue to the contractor or the contractor may like to bring to the Architect / consultant two copies of such instructions shall be taken from the site order book and one copy will be handed over to the party against proper acknowledgment and the second copy will be retained for their record.

13.0 Temporary fencing/ barricading

The contractor shall provide and maintain a suitable temporary fencing / barricading and gates at his cost to adequately enclose all boundaries of the site for the protection of the public and for the proper execution and security of the work and in accordance with the requirement of the Architect I consultant and regulations of local authorities. These shall be altered, relocated and adopted from time to time as necessary and removed on completion of the work.

14.0 Site meetings

Site meetings will be held to review the progress and quality evaluation. The contractor shall depute a senior representative along with the site representative and other staff of approved sub-contractors and suppliers as required to the site meetings and ensure all follow up actions. Any additional review meetings shall he held if required by the Architect/ consultant. -

15.0 Disposal of refuse

The contractor shall cart away all debris, refuse etc. arising from the work from the site and deposit the same as directed by the Architect / consultant at his own cost. It is the responsibility of the contractor to obtain from the local authorities concerned to the effect that all rubbish arising out of contractor's activities at the construction site or any other off-site activities borrow pits has been properly disposed of.

16.0 **Contractor to verify site measurement**

The contractor shall check and verify all site measurements whenever requested other specialist contractors or other sub-contractors to enable them to prepare the own shop drawing and pass on the information with sufficient promptness as will in any way delay the works.

17.0 **Displaying the name of the work**

The contractor shall put up a name board of suitable size as directed by the Architect/ consultant indicating therein the name of the project and other details as given by the Architect/consultant at his own cost and remove the same on completion of work.

18.0 **As built drawings**

i) For the drawings issued to the contractor by the Architect / Consultant. The Architect Consultant will issue two sets of drawings to the Contractor for the items for some changes have been made. From the approved drawings as instructed by the SBIIMS / Architect / Consultant. The contractor will make the changes made on these copies and return these copies to the Architect / Consultant for their approval. In cases revision is required or the corrections are not properly marked the Architect / Consultant will point out the discrepancies to the contractor. The contractor will have to incorporated these corrections and / or attend to discrepancies either on copies as directed by the Architect / consultant and resubmit to him for approval. The Architect / consultant will return one copy duly approved by him.

ii) For the drawings prepared by the contractor

The contractor will modify the drawing prepared by him wherever the changes made by the SBIIMS/ Architect / Consultant and submit two copies of such modified drawings to the Architect / Consultant for approval. The Architect / consultant will return one copy of the approved drawing to the contractor.

19.0 **Approved make**

The contractor shall provide all materials from the list of approved makes at his own cost and also appoint the specialized agency for the waterproofing anti-termite, aluminum doors and windows and any other item as specified in the tender. The Architect / Consultant may approve any make / agency within the approved list as given in the tender after inspection of the sample/mock up.

20.0 **Procurement of materials**

The contractor shall make his own arrangements to procure all the required materials for the work. All wastages and losses in weight shall be to the contractors account

21.0 **Excise Duty, Taxes, Leveis etc.;**

The contractor shall pay and be responsible for payment of all taxes, duties, levies, royalties, fees, cess or charges in respect of the works including but not limited to sales tax, tax on works contract excise duty, and octroi, payable in respect of materials, equipment plant and other things required for the contact. All of the aforesaid taxes, duties, levies, fees and charges shall be to the contractor's

account and the SBIIMSshall not be required to pay any additional or extra amount on this account. Variation of taxes, duties, fees, levies etc. if any, till completion of work shall be deemed to be included in the quoted rates and no extra amount on this account. Variation of taxes, duties, fees, levies etc. if any, till completion of work shall be deemed to be included in the quoted rates and no extra claim on this account will in any case be entertained. If a new tax or duty or levy or cess or royalty or octroi is imposed under as statutory law during the currency of contract the same shall be borne by the contractor.

22.0 **Acceptance of tender**

The SBIIMSshall have the right to reject any or all tenders without assigning any reason. They are not to bind to accept the lowest or any tender and the tenderer or tenderers shall have no right to question the acts of the SBIIMS However adequate transparency would be maintained by the SBIIMS.

23.0 **Photographs:**

- The Contractor shall at his own expense supply to the Architects with duplicate hard copies of large photographs not less than 25 cm. x 20 cm. (10” x 8”) of the works, taken from two approved portions of each building, at intervals of not more than one months during the progress of the work or at every important stage of construction.

- In addition to above, the contractor shall be bound to submit adequate no. of site photographs along with each Running Bill for the project clearing showing major progress of work measured and claimed therein failing which the Architect/SBIIMS may consider returning the Bill to the contractor and no claim for delay on this account will be entertained.

SAFETY CODE

1. First aid appliances including adequate supply of sterilized dressing and cotton wool shall be kept in a readily accessible place.

2. An injured person shall be taken to a public hospital without loss of time, in cases when the injury necessitates hospitalization.

3. Suitable and strong scaffolds should be provided for workmen for all works that cannot safely be done from the ground.

4. No portable single ladder shall be over 8 meters in length. The width between the side rails shall not be less than 30 cm. (clear) and the distance between two adjacent running shall not be more than 30 cm. When a ladder is used an extra mazdoor shall be engaged for holding ladder.

5. The excavated material shall not be placed within 1.5 meters of the edge of the trench half of the depth of trench whichever is more. All trenches and excavations shall be provided with necessary fencing and lighting.

6. Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be one meter.

7. No floor, roof or other part of the structure shall be so overloaded with debris or material as to render it unsafe.

8. Workers employed on mixing and handling material such as asphalt, cement,mortar, concrete and lime shall be provided with protective footwear and rubber hand gloves.

9 Those engaged in welding works shall be provided with welders' protective eye shield and gloves.

10. (i) No paint containing lead or lead products shall be used except in the form of paste readymade paint.
(ii) Suitable facemasks should be supplied for use by the workers when the paint applied in the form of spray or surface having lead paint dry rubbed and scrapped.

11. Overalls shall be supplied by the contractor to the painters and adequate facilities shall be provided to enable the working painters to wash during cessation of work.

12 Hoisting machines and tackle used in the works including their attachments anchor and supports shall be in perfect condition.

13. The ropes used in hoisting or lowering material or as a means of suspension shall be durable quality and adequate strength and free form defects.

TECHNICAL SPECIFICATION (ELECTRICAL LT & ALLIED SERVICES)

1. GENERAL

This specification is for work to be done, item to be supplied and materials to be used in the works as shown and defined on the drawings and described herein, all under the supervision and to the satisfaction of the Competent Authority.

SECTION-A
ELECTRICAL LT WORKS

A - GENERAL SPECIFICATION FOR ELECTRICAL INSTALLATION

Complete Installation will be done complying with the requirements of the followings:

a) Indian Electricity Act, 1910.

b) Indian Electricity Rules (1956) amended upto date.

c) Code of practice for Electrical wiring installations (system voltage not exceeding 650v) IS 732-1963 Revised

d) Code of practice for Electrical wiring installations (system voltage exceeding 650v) IS 2274-1963.

e) Rules and Regulations, Regional Council of Fire Insurance Association of India for Electrical wiring.

RULES AND REGULATION

ISI SPECIFICATIONS

I.S. NO	I.S. TITLE	MATERIAL EQUIPMENTS
694	PVC Insulated Cables	PVC Cables
1293/3854	Switch socket outlet	5A/15A/Switch sockets.
3043	Code of practice for earthing.	Earthing.
3646	Interior illumination	Luminaries/Fittings.
5216	Guide for safety of installation	Procedure & practices.
1248	Electrical Indicating	Instrument.
1534	Ballast for fluorescent Luminaries.	Tubes.
1653/266	P.V.C. conduit	
2667/3837	Code of practice for electrical wiring installation	Wiring
371	Ceiling Roses	Luminaries
1567	Metal clad switches.	
2268	Electric call bells/Buzzers	Call bells.

37A	Fans & Regulators	Fans

A) TECHNICAL SPECIFICATIONS FOR LIGHTING & POWER DISTRIBUTION BOARDS

TECHNICAL SPECIFICATIONS FOR MEDIUM VOLTAGE PANEL

1.0 SCOPE OF WORK

1.1 This scope shall cover design, manufacture, check test, and supply of medium and low voltage motor/power control Panel boards, MCB distribution boards etc. as described in this specification, as per drawings and schedule of quantities.

2.0 CODES & STANDARDS

2.1 The Panels shall comply with the latest edition of relevant Indian Standards and Indian Electricity Rules and Regulations. The following Indian standards shall be complied with:

Sr.	Item	Relevant IS
1	General requirements for switchgear and control gear for voltages not exceeding 1000 V AC or 1200 V DC	IS: 4237
2	Switchgear bus bars, main connection and auxiliary wiring, marking and arrangement.	IS: 375
3	Degree of protection provided by enclosures for Low voltage switch gear and control gear.	IS: 2147
4	Terminal marking for electrical measuring instrument and their accessories.	IS: 8197
5	Danger notice plates	IS: 2551
6	Code of Practice for selection, installation and maintenance of switchgear and control gear.	IS: 10118
7	Specification for factory built assemblies of switchgear and control gear for voltage up to and including 1000 V AC and 1200 V D.C.	IS: 8623
8	Miniature circuit breakers.	IS: 8828
9	Current transformers	IS: 2705
10	Voltage transformer	IS: 3155
11	Electrical relay for protection	IS: 3231
12	Indicating instruments	IS: 1248
13	Integrating instruments	IS: 722
14	Control switches and push buttons	IS: 6875

15	AC motor starters of voltage not exceeding 1000 V	IS: 1822
16	Moulded Case Circuit Breakers	IS 2516 (Part I & II/ Sec I) – 1977
17	Fuse Switch & Switch Fuse Units	IS 4064 - 1978
18	H.R.C. Fuse links	IS 2208-1962 or IS 9224-1979
19	Current Transformers	IS 2705
20	Voltage Transformer	IS 3156
21	Relays	IS 32.31
22	Indicating Instruments	IS 1248
23	Integrating Instruments	IS 722
24	Control Switches & Push Buttons	IS 6875
25	Auxiliary Concessionaires	IS 2959

3.0 DESIGN BASIS & SITE CONDITIONS

Site conditions			
Location : MUMBAI		**Site altitude** : 50 M above MSL	
Ambient temperature		**Relative humidity**	
Maximum : 45 ^{0} C		Maximum : 98 %	
Minimum : 5 ^{0} C		Minimum : 40 %	
Design : 45 ^{0} C		Design 98 % at 45 ^{0} C	
Seismic factor : AS PER IS		**Rainfall** : 1000 mm/year	
Environmental : Non corrosive, Humid and Dusty		**Location of Equipment :** Indoor	
Wind speed : 80 kmph maximum			
Electrical system data:			
Power supply for Equipment			
Voltage 11 kV ± 10 %		**Frequency** 50 Hz ± 3 %	
Permissible combined voltage & frequency variation	± 6 %	**System design faultslevel (Symmetrical)**	18.37 kA for 1sec. max.
System earthing LV side neutral solidly earthed		**Wiring** 3 phase, 3 wire on 11kV system	
Auxiliary power supply :			
Power supply		240V AC, 1-Ph, 50Hz	
Control Supply		240V AC, 1-Ph, 50Hz	
Space heater power supply		240V AC, 1-Ph, 50Hz	
Illumination power supply		240V AC, 1-Ph, 50Hz	

4.0 TECHNICAL REQUIREMENTS

All the Panels shall be metal clad, totally enclosed, rigid, floor mounting, air insulated, cubicle type suitable for operation on three phase/single phase, 415 V/240 V, 50 Hz., neutral effectively grounded at transformer and short circuit level as mentioned in the drawings.

All the outdoor panel shall be double door type with minimum IP65 protection class construction unless otherwise specified.

All the indoor panel shall have IP51 protection class construction.

The painting of all the metal part shall be as per the painting specification defined in the datasheet.

The Panels shall be designed to withstand heaviest condition at site, with maximum expected ambient temperature of 50°c, 90% humidity and non corrosive, dusty weather.

CUBICAL TYPE PANELS:

4.1 STRUCTURE

4.1.1 The Panels shall be metal clad enclosed and be fabricated out of high quality CRCA sheet, suitable for indoor installation having dead front operated and floor mounting type.

4.1.2 All CRCA sheet steel used in the construction of Panels shall be 2 mm. thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet steel shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal.

4.1.3 The Panels shall be totally enclosed, completely dust and vermin proof and degree of protection being not less than IP: 51. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be fully gasketed with neoprene and shall be lockable.

4.1.4 All panels and covers shall be properly fitted and secured with the frame and holds in the panel correctly positioned. Fixing screws shall enter into holes, taped into an adequate thickness of metal or provided with bolts and nuts. Self-threading screws shall not be used in the construction of Panels.

4.1.5 A base channel of 100 mm. x 50 mm. shall be provided at the bottom. A clearance of 300 mm. between the floor of the Panels and the bottom of the lower most units shall be provided.

4.1.6 Panels shall be preferably arranged in multi-tier formation. The Panels shall be of adequate size with a provision of 20% spare space to accommodate possible future additional switchgear. The size of the Panels shall be designed in such a way that the internal space is sufficient for hot air movement and the electrical component does not attain temperature more than 45°c. The entire electrical component shall be derated for 50°c. Switchgear rating indicated in single line diagram are minimum derating at continues 50°c.

4.1.7 Knock out holes of appropriate size and number shall be provided in the Panels in conformity with the number, and the size of incoming and outgoing conduits/cables.

4.1.8 Alternately, the Panels shall be provided with removable sheet steel plates at top and bottom to drill holes for cable/conduit entry at site.

4.1.9 The Panels shall be designed to facilitate easy inspection, maintenance and repair.

4.1.10 The Panels shall be sufficiently rigid to support the equipment without distortion under normal and under short circuit condition. They shall be suitably braced for short circuit duty.

4.2 **PROTECTION CLASS:**

4.2.1 All the indoor Panels shall have protection class of IP 51 for indoor installation and IP 65 for outdoor installation.

4.3. PAINTING:

4.3.1 In general the panel shall be 7 tank process powder coated. The shade shall be confirmed with client prior to construction.

4.4 **CIRCUIT COMPARTMENTS:**

4.4.1 Each circuit breaker and switch fuse unit shall be housed in separate compartments and shall be enclosed on all sides. Sheet steel hinged lockable door shall be duly interlocked with the breaker/switch fuse unit in `ON' and `OFF' position. Safety interlocks shall be provided for air circuit breaker to prevent the breaker from being drawn out when the breaker is in `ON' position.

4.4.2 The door shall not form an integral part of draw out position of the circuit breaker. All instruments and indicating lamp shall be mounted on the compartment door. Sheet steel barriers shall be provided between the tiers in a vertical section.

4.5 **INSTRUMENT COMPARTMENTS:**

4.5.1 Separate adequate compartment shall be provided for accommodating instruments, indicating lamps, control contactors/relays and control fuses etc. These components shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker/switch fuse unit, busbar and connections.

4.6 **BUS-BARS:**

4.6.1 The busbar shall be air insulated and made of high quality, high conductivity, high strength Aluminum.

4.6.2 The busbar shall be of 3 phases and neutral system with separate neutral and earth bar. The bus bar and interconnection between bus bars and various components shall be of high conductivity Aluminum. The busbar shall be of rectangular cross-section designed to withstand full load current for phase bus bars and half rated current for neutral bus bars and shall be extensible on either side. The busbar size shall be as per drawing. The busbar shall have uniform

cross-section throughout the length.

4.6.3 The bus bars and interconnections shall be insulated with heat shrinkable PVC sleeve and be colour coded in red, yellow, blue and black to identify the 3 phases and neutral of the system if specified in datasheet. The busbar shall be supported on unbreakable, non-hydroscopic SMC/DMC insulated supports at sufficiently close intervals to prevent bus bars sag and shall effectively withstand electromagnetic stresses in the event of short circuit capacity of 15 KA RMS symmetrical for 1 sec. and a peak short circuit withstand of 31.5 KA minimum.

4.6.4 The bus bar shall be housed in a separate compartment. The bus bar shall be isolated with 3 mm. thick Bakelite sheet to avoid any accidental contact. The bus bar shall be arranged such that minimum clearance between the bus bars to be maintained as below:

Between phases	:	25 mm. minimum
Between phases and neutral	:	25 mm.
Between phases and earth	:	25 mm.
Between neutral and earth	:	20 mm. minimum

4.6.5 All bus bar connections shall be done by drilling holes in bus bars and connecting by chromium plated or tinned plated brass bolts and nuts. Additional cross-section of bus bar shall be provided in all Panels to cover up the holes drilled in the bus bar. Spring and flat washers shall be used for tightening the bolts.

4.6.6 All connections between bus bars and circuit breakers/switches and cable terminals shall be through aluminum strips of proper size to carry full rated current. These strips shall be insulated with insulating tapes.

4.7 **ELECTRICAL POWER AND CONTROL WIRING CONNECTION:**

4.7.1 Terminal for both incoming and outgoing cable connections shall be suitable for 1100 V grade, aluminum/copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solder-less sockets for the cable size as indicated on the appended drawings for the Panels.

4.7.2 Power connections for incoming feeders of the main Panels shall be suitable for 1100 V grade aluminum conductor (LT XLPE) cables.

4.7.3 Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.

4.7.4 Both control and power terminals shall be properly shrouded.

4.7.5 10% spare terminals shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block, so that not more than one outgoing wire is connected per terminal.

4.7.6 Terminal strips for power and control shall preferably be separated from each other by suitable barriers of enclosures.

4.7.7 Wiring inside the modules for power, control, protection and instruments etc. shall be done with use of 660/1100 V grade, PVC insulated copper conductor cables conforming to IS: 694 and IS: 8130. Power wiring inside the starter module shall

be rated for full current raring of respective contactor, but not less than 4.0 sq.mm. cross-section area. For current transformer circuits, 2.5 sq.mm. copper conductor wire shall be used. Other control wiring shall be done with 1.5 sq.mm. copper conductor wires. Wires for connections to the door shall be flexible. All conductors shall be crimped with solderless sockets at the ends before connections are made to the terminals.

4.7.8 Control power for the Motor starter module shall be taken from the respective module switchgear outgoing. Control power wiring shall have control fuses, (HRC fuse type) for circuit protection. All indicating lamps shall be protected by HRC fuses.

4.7.9 Particular care shall be taken to ensure that the layout of wiring is neat and orderly. Identification ferrules shall be fitted to all the wire termination for ease of identification and to facilitate checking and testing.

4.7.10 Spring type washers shall be used for all copper and aluminium connections.

4.7.11 Final wiring diagram of the Panels power and control circuit with ferrules numbers shall be submitted alongwith the Panels as one of the documents against the contract.

4.8 **TERMINALS:**

4.8.1 The outgoing terminals and neutral link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformers for instruments metering shall be mounted on the disconnecting type terminal blocks. No direct connection of incoming or outgoing cables to internal components of the distribution board is permitted; only one conductor may be connected in one terminal.

4.9 **WIRE-WAYS:**

4.9.1 A horizontal PVC wire way with screwed covers shall be provided at the top to take interconnecting control wiring between different vertical sections.

4.10 **CABLE COMPARTMENTS:**

4.10.1 Cable compartments of adequate size shall be provided in the Panels for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate supports shall be provided in the cable compartments to support cables. All outgoing and incoming feeder terminals shall be brought out to terminal blocks in the cable compartment.

4.11 **EARTHING:**

4.11.1 Copper earth bus of 40 X 6 mm shall be provided in the Panels for the entire length of the panel. The frame work of the Panels shall be connected to this earth bar. Provisions shall be made for connection from this earth bar on both sides of the panels to the main earthing bar coming from the earth pit. Door earthing shall be provided for all the compartments.

4.11.2 The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar. The armour shall be properly connected with earthing

clamp, and the clamp shall be made for connection from this earth pit on both sides of the Panels.

4.11.3 The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar. The armour shall be properly connected with earthing clamp, and the clamp shall be ultimately bonded with the earth bar.

4.12 **LABELS:**

4.12.1 Engraved metal labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.

4.13 **NAME PLATE:**

4.13.1 A name plate with the Panel's designation in bold letters shall be fixed at top of the central panel. A separate name plate giving feeder details shall be provided for each feeder module door.

4.13.2 Inside the feeder compartments, the electrical components, equipments, accessories like switchgear, control gear, lamps, relays etc. shall suitably be identified by providing stickers.

4.13.3 Engraved name plates shall preferably be of 3 ply,(Red-White-Red or Black-White-Black) lamicold sheet. However, black engraved Perspex sheet name plates shall also be acceptable. Engraving shall be done with square groove cutters.

4.13.4 Name plate shall be fastened by counter sunk screws and not by adhesives.

4.14 **DANGER NOTICE PLATES:**

4.14.1 The danger notice plate shall be affixed in a permanent manner on operating side of the Panels.

4.14.2 The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.

4.14.3 The danger notice plates, in general, meet the requirements of local inspecting authorities.

4.14.4 Overall dimensions of the danger notice plate shall be 200 mm. wide x 150 mm. high.

4.14.5 The danger notice plate shall be made from minimum 1.6 mm. thick mild steel sheet and after due pre-treatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.

4.14.6 The letters, the figures, the conventional skull and bones etc. shall be positioned on plate as per recommendation of IS: 2551-1982.

4.14.7 The said letters, the figures and the sign of skull and bones shall be painted in signal red colour as per IS: 5-1978.

4.14.8 The danger plate shall have rounded corners. Location of fixing holes for the plate shall be decided to suit design of the Panels.

4.14.9 The danger notice plate, if possible, be of ISI certification mark. Suitable Voltage rated rubber mates to be provided.

4.15 **INTERNAL COMPONENTS:**

4.15.1 The Panels shall be equipped complete with all types of required number of auto transformer starters, switch fuse units, contactors, relays, fuses, meters, instruments, indicating lamps, push buttons, equipment, fittings, bus bars, cable boxes, cable glands etc. and all the necessary internal connections/wiring as required and as indicated on relevant drawings. Components necessary for the proper and complete functioning of the Panels but not indicated on the drawings shall be supplied and installed on the Panels.

4.15.2 All parts of the Panels carrying current including the components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the acceptable values of the relevant specifications at the part of the Panels.

4.15.3 All units of the same rating and specifications shall be fully interchangeable.

COMPONENTS

4.16 **GENERAL:**

4.16.1 The type, size and rating of the components shall be as indicated on the relevant drawings.

While selection of the capacity of the components resulting from the prevailing conditions like ambient temperature shall be allowed for. The thermal and magnetic trip rating shall be compensated for the ambient temperature.

The ratings indicated on the drawing are ratings anticipated at prevailing site conditions.

4.17 **MINIATURE CIRCUIT BREAKERS:**

4.17.1 Miniature Circuit breakers shall be current limiting type conformed with British standard BS: 3871 (Part I) 1965 and IS: 8825. The housing of MCBs shall be heat resistant and having a high impact strength. The fault current of MCBs shall not be less than 9000 A at 230 V. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical `ON' and `OFF' indications.

4.17.2 The circuit breaker dollies shall be of the trip free pattern to prevent closing the breaker on a faulty circuit.

4.17.3 The MCB contacts shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCBs shall be provided with magnetic fluid plunger release for over current and

short circuit protection. The overload or short circuit device shall have a common trip bar in the case of DP and TPN miniature circuit breakers. All the MCBs shall be tested and certified as per Indian Standards, prior to installation.

4.18 **FUSE:**

4.18.1 Fuses shall be of high rupturing capacity (HRC) fuse links and shall be in accordance with IS: 2000-1962 and having high rupturing capacity of not less than 35 MVA at 415 V. The back-up fuse rating for each motor/equipment shall be so chosen that the fuse does not operate on starting of motors/equipment. HRC fuses shall be of the make as specified in Make of Material.

4.19 **AIR CIRCUIT BREAKER:**

4.19.1 **Construction:**

The ACBs shall have following features:

1. Motorised with 230 V A.C. motor.
2. 230 V A.C closing and shunt trip coil
3. Draw out type with "service", "test", "isolated" and "maintenance" position.
4. Safety shutter of Fibre glass/polycarbonate sheet of 2mm thickness shall be provided
5. Mechanically trip free plus anti-pumping feature is to be provided.
6. Electrical trip free plus anti pumping shall be provided with relay ONLY and not by contactors.
7. Electrical/Mechanical operation counter shall be provided.
8. Door interlock with defeat features to be provided.
9. ACB shall be lockable in isolation position.

4.19.2 **Release:**

1. Thermal Magnetic release shall be direct acting type, tripping ACB mechanically.
2. Short circuit, overload and earth fault protection shall be provided.
3. Vendor to suggest release type for feeders of supply range characteristic and accuracy.

4.19.3 **ACB Performance:**

1. ACB performance inside panels at ambient 50 Degree.
2. Ith Symmetrical breaking, 35KA
3. Making capacity peak 87.5 KA
4. Short time rating, 1sec. 35KA

4.20 **CONTACTORS:**

4.20.1 The contractors shall meet with the requirements of IS: 2959 and BS: 775.

The contractors shall have minimum making and breaking capacity in accordance

with utilisation category AC3 and shall be suitable for minimum Class II intermittent duty.

If the contractor forms part of a distribution board then a separate enclosure is not required, but the installation of the contractor shall be such that it is not possible to make an accidental contact with live parts.

4.21 **CURRENT TRANSFORMER:**

4.21.1 Where ammeters are called for C.T.s shall be provided for current measuring. Each phase shall be provided with separate current transformer of accuracy Class I and suitable VA burden for operation of associated metering and controls. Current transformer shall be in accordance with IS: 2705 - 1964 as amended upto date.

4.22 **PUSH BUTTONS:**

4.22.1 The push button unit shall comprise of the contact element, a fixing holder, and a push button actuator. The push button shall be momentary contact type. The contacts shall be of silver alloy and rated at 10 Amps. continuous current rating. The actuator shall of standard type and colour as per its usage for ON, OFF and TRIP.

4.23 **INDICATING LAMPS:**

4.23.1 Indicating lamps shall be transformer operated low voltage rated and shall be supplied complete with translucent covers to diffuse the lamp light.

Colour shade for the indicating lamps shall be as below – the LED shall be 22.5 mm and self coloured:

ON indicating lamp	:	Red
OFF indicating lamp	:	Green
TRIP indicating lamp	:	Amber
PHASE indicating lamp	:	Red, Yellow, and Blue

4.24 **DIGITAL MULTI FUNCTION METER**

4.24.1 The load manager shall be digital type with RS485 port. It should measure KW, KVA, KVAR, V, I, PF etc.]

4.25 **MOULDED CASE CIRCUIT BREAKER:**

The moulded case circuit breaker (MCCB) shall be air break type and having quick make - quick break with trip free operating mechanism.

Housing of the MCCB shall be of heat resistant and flame retardant insulating material.

Operating handle of the MCCB shall be in front and clearly indicate ON/OFF/TRIP positions.

The electrical contact of the circuit breaker shall be of high conducting non deteriorating silver alloy contacts.

The MCCB shall be provided with thermal / magnetic type bi-metal overload release and electro magnetic short circuit protection device. All the releases shall

operate on common trip busbar so that in case of operation of any one of the releases in any of the three phases, it will cut off all the three phases and thereby single phasing of the system is avoided.

The MCCB wherever called for in the appended drawings shall provide an earth fault relay.

The MCCB shall provide two sets of extra auxiliary contacts with connections for additional controls at future date.

The electrical parameters of the MCCB shall be as per the description given in the appended drawings.

The MCCB shall be provided with 230 V A.C motor for closing and tripping / switching off for the feeders if indicated in single line diagram.

5.0 DRAWING & INFORMATION

5.1 Prior to fabrication of the Panels the supplier/contractor shall submit for consultant's approval the shop/vendor drawing consisting of G.A. drawing, sectional elevation, single line diagram, bill of material etc. and design calculations indicating type, size, short circuiting rating of all the electrical components used, busbar size, internal wiring size, Panels dimension, colour, mounting details etc.. The contractor shall submit manufacturer's catalogues of the electrical components installed in the Panels.

6.0 INSPECTION & TESTING

6.1 At all reasonable times during production and prior to transport of the Panels to site, the supplier/contractor shall arrange and provide all the facilities at their plant for inspection.

6.2 Testing of Panels shall be carried out at factory and at site as specified in Indian standards in the presence of consultant. The test results shall be recorded on a prescribed form. The test certificate for the test carried out at factory and at site shall be submitted in duplicate to the consultant for approvals.

7.0 METHOD OF MEASUREMENT

7.1 All the items will be measured as mentioned in Bill of quantity.

8.0 TRANSPORT, DELIVERY & STORAGE

8.1 The prices shall be **F.O.R. site basis** including packing & forwarding charges. The quoted price must include all the costs for necessary mode of transportation up to the final location of site or site store. All incidental expenses during transportation shall be part of quoted prices including **transit insurance**. The charges for loading and unloading of equipments at site should form part of offer.

9.0 GUARANTEE & WARRENTY

9.1 The Bidder shall stand guarantee for the performance of entire equipment and components for twelve (12) months from the date of commissioning or eighteen (18) months from the date of dispatch, whichever is earlier.

TECHNICAL DATA SHEET FOR MEDIUM VOLTAGE DISTRIBUTION BOARD

SR. NO.	PARTICULARS	DESCRIPTION
1.0	Site Condition	
1.1	Type	Indoor / Outdoor (As per location shown in drawing)
1.2	Mounting	Floor / wall, Indoor
1.3	Ambient Temperature	45° C.
1.4	Atmosphere	Non Corrosive, Dusty
2.0	OPERATIVE CONDITION	
2.1	Voltage	415 V ± 5 %
2.2	No. Of Phase	3
2.3	System	3 Ø , 4 WIRE
2.4	Frequency	50 HZ, + / - 3 %.
2.5	Fault Level	18 MVA
2.6	Fault Current	As per SLD
3.0	CONTROL SYSTEM	
3.1	Voltage	
	For Indication	230 V A.C.
	For Metering	230 V A.C.
	For Protection	230 V A.C.
3.2	Control Supply Through Control Transformer	230 V A.C. only
	Control Wiring	2.5 MM² FRLS Cu. Wire
		4.0 MM² FRLS cu. Wire for CT ckt.
4.0	BUSBAR	
4.1	Phase Bus bar	
A.	Material	Aluminium
B.	Support	SMC/DMC
C.	Insulation	Epoxy Moulded (Resin)
D.	Insulating Barriers	Fibre Glass / Poly Carbonate Of Minimum 1.5 Mm Thick And To Be Of Fr4 Class
E.	Current Density	1.0 Amp. / mm²
4.2	Neutral Bus bar Material	Aluminium
4.3	Earth Bus bar Material	GI
5.0	Source changeover System	Required

SR. NO.	PARTICULARS	DESCRIPTION
6.0	PAINTING	
6.1 6.2 6.3 6.4 6.5	Sheet Should Be 7 Tank Processed, Oven Baked At 310°C. With Powder coating. Shade Exterior Interior Degree Of Protection Max. Temperature Rise Inside The Panel (°C.)	7 Tank process, powder coated Shall be confirmed with client Shall be confirmed with client IP 51 indoor & IP 65 outdoor 50 ° C. above ambient
7.0	CONTROL WIRING	
7.1	Wire Size	1 C × 4.0 mm² as specified 1 C × 2.5 mm² / 3 C × 1.5 mm²/4 C x 1.5 mm²
8.0	HARDWARE (ZINC PLATED)	YES
9.0	SPACE HEATER	230 V A.C. With thermostat control
10.0	POCKET FOR DRAWINGS AT DOOR	YES
11.0	Illumination and switched power plug	YES

B). TECHNICAL SPECIFICATIONS FOR LIGHTING & POWER DISTRIBUTION BOARDS

TECHNICAL SPECIFICATIONS FOR LIGHTING DISTRIBUTION BOARDS

1.0 SCOPE OF WORK

1.1 This section relates to specifications for supply of lighting distribution board (LDB) & Power distribution board (PDB) TPN/FP/DP/SP MCB isolator & ELMCB, Earthing terminal, connector strip for phase neutral and earth for each circuit, CRCA sheet steel housing and complete the item supply. Common banking of neutral and earth conductor is not allowed.

2.0 CODES & STANDARDS

2.1 The Distribution Board shall comply with the latest edition of relevant Indian Standards and Indian Electricity Rules and Regulations. The following Indian standards shall be complied with:

Sr.	Item	Relevant IS	Relevant IEC
	General requirements for switchgear and control gear for voltages not exceeding 1000 V AC or 1200 V DC	IS: 4237	
	Switchgear bus bars, main connection and auxiliary wiring, marking and arrangement.	IS: 375	
	Terminal marking for electrical measuring instrument and their accessories.	IS: 8197	
	Miniature circuit breakers.	IS: 8828	

3.0 DESIGN BASIS & SITE CONDITIONS

3.1 All the equipment and components provided in the DB and accessories shall be suitably designed for installation and satisfactory operation as specified below.

Site conditions			
Location MUMBAI		**Site altitude** 50 M above mean sea level	
Ambient temperature		**Relative humidity**	
Maximum 45 ^{0} C		Maximum 98 %	
Minimum 05 ^{0} C		Minimum 40 %	
Design 45 ^{0} C		Design 98 % at 45 ^{0} C	
Seismic factor Zone III as per IS:1893		**Rainfall** 1000 mm/year	
Environmental Tropical conditions		**Location of Equipment** Indoor	
Wind speed 80 kmph maximum			
Electrical system data:			
Power supply for Equipment			
Voltage 415 V ± 5 %		**Frequency** 50 Hz ± 3 %	
Permissible combined voltage & frequency	± 6 %	**System design faultslevel(Sy**	10kA for 1 sec. max.

variation		**mmetrical)**	
System earthing LV side neutral solidly earthed		**Wiring** 3 phase, 4 wire on 415V system	
Auxiliary power supply :			
Power supply		------	
Control Supply		-----	
Space heater power supply		-----	
Illumination power supply		-----	
Plug-socket power supply		-----	

4.0 TECHNICAL REQUIREMENTS

4.1 SYSTEM

4.1.1 The lighting distribution boards shall be suitable for operation on 415/240 volt, 50 cycle per second, A.C supply system. The lighting & power distribution boards MCB shall be capable of withstanding short circuit current of 10 KA.

4.2 CONSTRUCTION :

4.2.1 The DB's shall be factory made and of those and as per the G.A. layout enclosed. General arrangement lay out of the DB's shall be approved by the consultants in charge before starting the manufacture.

4.2.2 The DB shall metal clad duly fabricated from 2mm. thick high quality CRCA sheet metal.

4.2.3 The DB shall be wall mounted and dead front operated.

4.2.4 The DB shall totally be enclosed and made dust, vermin and weather proof such that it meets to IP42 protection classification for installation.

4.2.5 A detachable cover plate of 2 mm thick CRCA sheet to be provided on front of the board such that all live parts of the electrical accessories mounted on the board can be accessible only on removal of the said cover plate.

1. The cover plate shall be fixed to the board with adequate size zinc passivated machine screws.
2. Above the detachable cover plate, one additional hinged door of 2 mm thick CRCA sheet shall be provided with a suitable locking arrangement.

The hinged door shall be provided with a suitable gasket capable of withstanding corrosive & humid atmosphere and to maintain degree of enclosure protection to IP 42 as per IS: 13947 for installation.

4.2.6 The DB shall have top/Bottom entry arrangement for incoming and out going cables/conduits.

4.2.7 All hardware to be used in manufacture of the DB shall be S.S 304 to prevent corrosion due to humid atmosphere prevailing at the project site.

4.2.8 All internal electrical connections shall be carried out using 660/1100 volt grade, FRLS insulated, Copper conductor of ISI approved make, having rated current carrying capacity to carry continuous full current of respective switch

Fuse rating at operating conditions prevailing at the project site.

4.2.9 The DB internals shall be earthed with use of Copper wires/strips running through out the length. Size of the earthing strip/wire shall be as shown in the respective drawing.

4.2.10 All non current carrying metal surface of the DB's shall adequately be treated and painted.

4.2.11 The surface imperfection shall then be rectified with applications of putty.

4.2.12 The DB's shall be provided with electric components and accessories as per the details shown in the drawing for the respective electric distribution board. The circuit connection from all the circuit MCB shall be brought to connector provided on top or bottom of the DB with suitable lugs. The connector shall be suitable to receive phase, neutral and earth wire/cable coming from each individual circuit. The connector's shall have circuit identification tag.

4.2.13 Use of paper/fabric base laminates is not acceptable.

4.3 PAINTING

4.3.1 The painting shall be as per "PAINTING" specification only.

5.0 DRAWING & INFORMATION

The following drawings shall be submitted along with the bid:

General arrangement drawing showing overall dimensions, weight, internal arrangement and mounting details.

Terminal chamber, showing bus-bar arrangement with all dimensions.

Power wiring diagram

6.0 METHOD OF MEASUREMENT

6.1 Supply of the Lighting DB including transport to site, loading and unloading etc. as specified will be treated as one unit for measurement and payment.

7.0 TRANSPORT, DELIVERY & STORAGE

7.1 The prices shall be F.O.R. site basis including packing & forwarding charges. The quoted price must include all the costs for necessary mode of transportation up to the final location of Lighting DB on site store. The Lighting DB should be supplied with required storage arrangements suitable for placing in open storage yard. All incidental expenses during transportation shall be part of quoted prices including transit insurance. The charges for loading and unloading of equipments at site should form part of offer.

8.0 GUARANTEE & WARRENTY

8.1 The quotes values of parameters shall be within given tolerance for given period of service life.

9.0 SPARES

9.1 The bidder shall quote for minimum spares required for two years safe operation of Distribution Board along with the offer separately

10.0 ATTACHMENTS

10.1 Supply BOQ for LDB & PDB

11.0 MAKE OF MATERIALS

11.1 **DB Enclosure -** Hagger,Legrand

11.2 **MCB -** C & S,Siemens ,L&T ,ABB

C. TECHNICAL SPECIFICATIONS FOR LT XLPE CABLE

TECHNICAL SPECIFICATIONS FOR LT XLPE CABLE

1.0 SCOPE OF WORK

1.1 This section shall cover supply, laying, testing and commissioning of medium voltage XLPE cables.

1.2 This specification gives the general requirement of cables. However, **it is the responsibility of the vendor to take the joint measurement and obtain client's approval before the placement of orders** to the main supplier / manufacturer.

2.0 CODES & STANDARDS

2.1 The following standards and rules shall be applicable :

Sr. No	Item	Relevant IS	Relevant IEC
1	XLPE insulated electric cables (heavy duty).	IS : 7098 Part I	
2	Recommended current ratings for cables.	IS : 3961	
3	Aluminium conductors for insulated cables	IS : 8130	IndianElectricity Act and Rules.

3.0 DESIGN BASIS & SITE CONDITIONS

3.1 All equipment and materials will be selected and rated for use at the following site conditions.

Site conditions	
Location MUMBAI	**Site altitude** 50 M above mean sea level
Ambient temperature	**Relative humidity**

Maximum 45 ^{0} C		Maximum 98 %	
Minimum 5 ^{0} C		Minimum 40 %	
Design 45 ^{0} C		Design 98 % at 45 ^{0} C	
Seismic factor Zone III as per IS:1893		**Rainfall** 1000 mm/year	
Environmental Non corrosive, Humid and Dusty		**Location of Equipment** Ground/Air	
Wind speed 80 kmph maximum			
Electrical system data :			
Power supply for Equipment			
Voltage 415 V ± 5 %		**Frequency** 50 Hz ± 3 %	
Permissible combined voltage & frequency variation	±	**System design faultslevel(Symmetrical)**	35 kA for 1 sec. max.
System earthing LV side neutral solidly earthed		**Wiring** 3 phase, 4 wire on 415V system	
Auxiliary power supply			
Power supply	240V AC, 1-Ph, 50Hz		
Control Supply	-----		
Space heater power supply	240V AC, 1-Ph, 50Hz		
Illumination power supply	240V AC, 1-Ph, 50Hz		
Plug-socket power supply	240V AC, 1-Ph, 50Hz		

4.0 TECHNICAL REQUIREMENTS

4.1 GENERAL CONSTRUCTIONAL FEATURES

4.1.1 The medium voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian Standards specifications, manufacturer's instructions. The cables shall be delivered at site in original drums with manufacturer's name, size, and type, clearly written on the drums.

4.2 MATERIAL :

Medium voltage cable shall be XLPE insulated. PVC sheathed, aluminium or copper conductor, armoured conforming to IS: 7098 Part I.

4.2.1 Type:

The cables shall be circular, multi core, annealed copper or aluminium conductor, XLPE insulated and PVC sheathed, armoured or unarmoured.

4.2.2 Conductor:

Uncoated, annealed copper / aluminium, of high conductivity upto 4 mm.² size, the conductor shall be solid and above 4 mm.², conductors shall be concentrically stranded as per IEC : 228.

4.2.3 Insulation:

XLPE rated 70° c. extruded insulation

4.2.4 Core Identification:

Two core	:	Red and Black
Three cor	:	Red, Yellow and Blue
Four core	:	Red, Yellow, Blue and Black
Single core	:	Green, Yellow for earthing

Black shall always be used for neutral.

4.2.5 Assembly:

Two, three or four insulated conductors shall be laid up, filled with non-hygroscopic material and covered with an additional layer of thermoplastic material.

4.2.6 Armour:

Galvanised steel flat strip / round wires applied helicaly in single layers complete with covering the assembly of cores.

For cable size upto 25 Sq. mm. : Armour of 1.4 mm dia G.I. round wire

For cable size above 25 Sq. mm. : Armour of 4 mm wide 0.8 mm thick G.I strip

4.2.7 Sheath:

XLPE 70 deg.c. rated extruded.

Inner sheath shall be extruded type and shall be compatible with the insulation provided for the cables.

Outer sheath shall be of an extruded type layer of suitable PVC material compatible with the specified ambient temp. 50 deg. C and operating temperature of cables. The sheath shall be resistant to water, ultraviolet radiation, fungus, termite and rodent attacks. The colour of outer sheath shall be black.

Sequential length marking required at every 1.0 mtr. interval on outer sheath Vendor has to furnish resistance / reactance / capacitances of the cable

4.2.8 Rating:

Up to and including 1100 Volts.

5.0 DRAWINGS & INFORMATION

5.1 Contractor shall submit the as built drawing of the cable laying drawing.

5.2 HANDINGOVER DOCUMENTS

The supplier shall submit following:

1. Data sheet indicating results of tests
2. Test reports

6.0 INSPECTION AND TESTING

6.1 All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.

The cable shall be supplied in single length i.e. without any intermediate joint or cut unless specifically approved by the client.

The cable ends shall be suitably sealed against entry of moisture, dust, water etc. with cable compound as per standard practice.

6.2 **Finished Cable Tests at Manufacturer's Works:**

The finished cables shall be tested at manufacturer's works. Following routine tests for each and every length of cable and copy of test results shall be furnished for each length of cable alongwith supply. If specified, the cables shall be tested in presence of client's representative.

6.2.1 Voltage Test:

Each core of cable shall be tested at room temperature at 3 KV A.C. R.M.S. for duration of 5 minutes.

6.2.2 Conductor Resistance Test:

The D.C. Resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20° c. to check the compliance with the values specified in IS 8130 - 1976.

6.3 **Cable Test Before and After Laying of Cables at Site**

6.3.1 Insulation Resistance test between phases and phase to Neutral and phase to earth.

6.3.2 Continuity test of all the phases, neutral and earth continuity conductor.

6.3.3 Sheathing continuity test.

6.3.4 Earth resistance test of all the phases and neutral.

7.0 METHOD OF MEASUREMENT

7.1 The cables will be measured in meters. The unit rate shall include cutting

the cable into required lengths, packing , loading , unloading, insurance, transportation, delivery to stores/site as per work order, stocking in stores, testing of cables at stores etc. of medium voltage cable. Total quantity in meters shall be measured lug to lug basis.

8.0 TRANSPORT, DELIVERY AND STORAGE

8.1 The cable shall be supplied in the actual length as per detailed purchase order

8.2 The cable shall be dispatched at client's stores or at site as per detailed instructions given by client at later stage.

8.3 The cable shall be loaded from the main vendor's store and properly stacked as per instruction of client's local representative. All such labour and transportation charges shall be clearly mentioned in the offer.

9.0 GUARANTEE OF PERFORMANCE

9.1 The quotes values of parameters shall be within given tolerance for given period of service life.

D. TECHNICAL SPECIFICATIONS FOR ELV WIRING

TECHNICAL SPECIFICATIONS FOR ELV WIRING

1.0 SCOPE OF WORK

1.1 This section relates to specification for the supply, installation, connection, testing and commissioning of the wiring for Telephone / Computer / Fire detection / Music & Signage & wiring installation including supply of telephone cables, Multiple flexible wires, Shielded Wire, CAT-5 UTP computer signal wire, Junction boxes, Outlet boxes, and other related accessories required to complete the wiring and installation.

1.2 The main hardware of the systems shall be supplied by the client

2.0 CODES & STANDARDS

2.1 The cables shall be conforming to the following standards of latest revision :

Sr.	Item	Relevant IS	Relevant IEC
1	PVC insulated (heavy duty) electric cable.	IS : 1554 (Part I)	
2	Copper conductors in insulated cables and cords.	IS : 8130	
3	Mild steel wires, strips and tapes.	IS : 3975	

2.2 **For Armoured Cables,**

Sr.	Item	Relevant IS	Relevant IEC
1	PVC insulated and sheath of electric cables	IS : 5831	
2	Recommended current rating for cables.	IS : 3961 (Part I)	

2.3 Cables shall also meet the requirement of Indian Electricity rules, Fire Insurance Association and Electrical Inspector.

The wire for the systems shall confirm to IS: 694, 1554, 624 and local fire department.

The CCTV & Security Access System cable shall confirm to BS : 2316 and American Military standard MIL -C - 17 / JSS - 51100 and of Radio frequency co-axial type (RG - 11)

3.0 DESIGN BASIS & SITE CONDITIONS

3.1 The extra low voltage system wiring installation shall be carried out in the manner as approved by the local Authority. If found necessary, the drawing for installation shall be got approved by the local sanctioning authorities before commencement of the work.

Separate conduits of 25 mm. diameter (minimum) shall be laid for extra low voltage system cables / wires.

3.3 The installation of conduits shall be carried out as per detailed specification given under section “INTERNAL WIRING”.

3.4 All cables, lay on cable racks / trays shall be neatly stitched together.

3.5 Extra low voltage system wires / cable terminations both at the junction boxes and at the socket outlets shall be done as per method approved by consultants and in conformity with their rules and regulations.

3.6 The final branch connections with single / twin pair cables in conduits and the minimum number of cables in each conduit shall be as follows:

Conduit dia. in mm.	Max. No. of cables
20	2 Nos. single pair
25	6 Nos. single pair
32	12 Nos. single pair
40	18 Nos. single pair

All the cables/wires provided shall be suitably designed for installation and satisfactory operation as specified below.

Site conditions

Location MUMBAI	
Ambient temperature	**Relative humidity**
Maximum 45 ^{0} C	Maximum 98 %
Minimum 05 ^{0} C	Minimum 40 %
Design 45 ^{0} C	Design 98 % at 45 ^{0} C
Electrical system data:	
Power supply for Equipment	
Voltage 12V to 90V ± 15 %	**Frequency** 10Hz to 300Hz ± 3 %
Permissible combined voltage & frequency variation ± 6 %	

4.0 TECHNICAL REQUIREMENTS

4.1 SYSTEM:

4.1.1

	Voltage	Frequency
Fire alarm, Security	12 V DC	10 Hz. -100 KHz
Music & P.A. system	30 V AC	20 Hz. - 20 KHz.
Telephone system	90 V AC	300 Hz. - 5 KHz.

4.1.2 The extra low voltage system cables will be terminated on the tag block / junction box located at each floor.

4.1.3 From this tag block / junction boxes, separate M.S. conduits shall run for individual outlet connections to each area through tag boxes / junction boxes.

4.1.4 The conduits shall run in the surface manner in the vertical shaft and shall run in surface / concealed manner at every floor between shaft and the outlet box through tag box / junction boxes located on each floor.

4.1.5 Extra low voltage system cables / multi pair telephone cables shall be pulled through the above conduits and then be connected at both ends.

4.2 MATERIAL OF CONSTRUCTION

4.2.1 Conduit:

M.S. conduit, conduit accessories, steel junction boxes, etc. to be used for telephone wiring system shall have material specifications as described in section under title “INTERNAL WIRING “ of this tender document.

4.2. 2 Cables & Wires:

The type of cables and the services shall be as follows :

4.3 TELEPHONE CABLE

4.3.1 Telephone multipair cable shall confirm to P & T specifications.

4.3.2 Annealed tinned bare copper conduction 0.6 mm. dia.

4.3.3 Cores twisted into pairs, pairs laid - up, fully filled and taped with suitable absorbent tape.

4.3.4 Armouring of galvanized steel wire.

4.3.5 PVC insulated, PVC inner sheathed and outer sheathed.

4.3.6 Aluminium Mylar tape with drain wire

4. 4 **FIRE DETECTION & ALARM SYSTEM :**

4.4.1 The wire for the systems shall confirm to IS: 694, 1554, 624 and local fire department.

4.4.2 Annealed tinned copper conductor 1.5 mm^2

4.4.3 2 core twisted into pair

4.4.4 Shielded Al. Mylar tape.

4.4.5 PVC insulated, PVC inner sheathed and outer FRLS sheathed

4. 5 **C.C.T.V. & SECURITY ACCESS SYSTEM :**

4.5.1 The system cable shall confirm to BS : 2316 and American Military standard MIL -C - 17 / JSS - 51100 and of Radio frequency co-axial type (RG - 11)

4.5.2 Annealed tinned copper conductor.

4.5.3 Polyethylene insulated.

4.5.4 Annealed bare copper braiding.

4.5.5 PVC sheathing

4.5.6 Characteristic impedance - 75 ohm ± 3

4. 6 **INSTRUMENT CABLES :**

4.6.1 Multipair cables shall be used for transferring digital / analog signals from electrical meters to PLC.

4.6.2 Cable shall be capable of withstanding normal and short circuit condition of various systems to which it is connected, without damage, transportation to site, installation at site and operation.

4.6.3 Cable shall be capable of performing satisfactorily when laid in trenches, trays and directly buried in the ground.

4.6.4 All overhead wiring shall be supported in cable trays. The shield shall be grounded at one location only. All the wiring, cables, and termination points

shall be suitably identified as per applicable codes and practices.

4.6.5 The vendor shall provide detailed cable scheduling mentioning the make, standard followed and other necessary details so as to satisfy the specified requirements.

4. 7 SIGNAL CABLES :

4.7.1 Multi core twisted cables shall be rated for 660 / 1100 volts.

4.7.2 The cable shall be 1.0 mm.² multi stranded, PVC coated, high conductivity annealed tinned copper conductor with PVC insulation and sheathing, 100% aluminium Mylar shielding with copper drain conductor, galvanized steel armouring and overall PVC sheathing. Rip cord shall also be provided.

4.7.3 Multi core cables shall have the following additional features :

4.7.4 Pair identification by color coding / numbering.

4.7.5 Individual pair shielding and testing, apart from overall shielding and twisting. All the cables shall be of flame-retardant type .All the cables shall be terminated using Siemens type gland.

4. 8 JUNCTION BOXES FOR EXTRA LOW VOLTAGE SYSTEM :

4.8.1 The junction boxes / the telephone tag blocks shall be suitable for the multi pair wires / cables and shall have two terminal blocks, cross connect type. All incoming and outgoing cables shall be terminated on separate terminal blocks. The cross connecting jumpers shall be insulated wires of same diameter and connected in same manner.

4.8.2 The junction boxes shall be mounted inside fabricated sheet steel boxes with removable hinged covers and lockable type and shall be painted as specified in section “Painting ".

5.0 DRAWINGS & INFORMATION

Not applicable

6.0 INSPECTION AND TESTING

Performance of each equipment in coordination with other systems to prove the functional requirement.

7.0 METHOD OF MESUREMENT

7.1 The extra low voltage system cable shall include supply, laying, connection, testing and commissioning of multi pair cable / wire on ceiling / wall on cable trays / racks including all supports and shall be measured and paid on running length basis. Cable trays / racks shall be paid for separately.

7.2 The multi pair junction boxes for extra low voltage system shall consist of strip, jumpered interconnections enclosure etc. and shall be measured and paid as one unit.

7.3 The conduit wiring for extra low voltage system outlet point shall include wire / cable in M.S. conduits and shall include junction boxes, pull boxes, 2A two pair connector / socket in M.S. box, outlet plate etc. from the floor tag blocks to the outlet point.

8.0 TRANSPORT, DELIVERY AND STORAGE

The prices shall be **F.O.R. site basis** including packing & forwarding charges. The quoted price must include all the costs for necessary mode of transportation up to the final location or site store. The ELV Wiring cables/wires should be supplied with required storage arrangements suitable for placing in open storage space. All incidental expenses during transportation shall be part of quoted prices including **transit insurance**. The charges for loading and unloading of equipments at site should form part of offer.

9.0 GURANTEE OF PERFORMANCE

The Bidder shall stand guarantee for the performance of entire wiring for twelve (12) months from the date of commissioning or eighteen (18) months from the date of dispatch, whichever is earlier, as agreed up on and as reproduced in the purchase order within the tolerance specified or as permitted by the relevant standards for the wiring in his scope of supply.

E. TECHNICAL SPECIFICATIONS FOR SUPPLY OF EARTHING SYSTEM

TECHNICAL SPECIFICATIONS FOR SUPPLY OF EARTHING SYSTEM

1.0 SCOPE OF WORK

1.1 Design, assembling, testing, painting, supply, delivery at site with all related accessories as per the specifications as specified below. Compliance with the provisions of this specification shall not relieve the Bidder of the responsibility of furnishing apparatus and accessories of proper design, electrically and mechanically suited to meet the operating requirements under the specified service conditions and be suitable for the purpose of which they are intended.

2.0 CODES & STANDARDS

2.1 The design, material, assembling, inspection and testing shall comply with all currently applicable statutes, regulations and safety codes in the locality where the system will be installed. The equipment shall also conform to the latest applicable standards and codes of practice as mentioned below.

2.2

Sr.	Item	Relevant IS
1	Code of Practice for Earthing	IS 3043
2	Insulation Co-ordination Application Guide	IS 3716
3	Code of Practice for Protection of Buildings and Allied Structures against Lightning	IS 2309
4	Indian Electricity Rules, 1956	
5	Indian Electricity Act, 1910	

6	National Electrical Code	

3.0 DESIGN BASIS & SITE CONDITIONS

3.1 All the equipment and components provided in the system and accessories shall be suitably designed for installation and satisfactory operation as specified below.

Site conditions			
Location MUMBAI		**Site altitude** 50 M above mean sea level	
Ambient temperature		**Relative humidity**	
Maximum 45^0 C		Maximum 98%	
Minimum 05^0 C		Minimum 40 %	
Design 45 C		Design 98% at 45 C	
Seismic factor Zone III as per IS:1893		**Rainfall** 1000 mm/year	
Environmental Tropical/humid/corrosive conditions		**Location of Equipment** Outdoor	
Electrical system data:			
Power supply for Equipment			
Voltage 415V ± 5 %		**Frequency** 50 Hz ± 3 %	
Permissible combined voltage & frequency variation	± 6 %	**System design faultslevel(Symmetrical)**	10kA for 1 sec. max.
Wiring 3 phase, 4 wire on 415V system			

4.0 TECHNICAL REQUIREMENTS

4.1 The earth gird shall consist of main grounding grid conductors forming a closed ring network with required number of pipe/plate type earthing stations connected to it to provide a common earth for electrical equipments and metallic structures. Two distinct connections shall be made from each earthing station to the main grounding/earthing mat through GI/Cu. flat.

4.2 The earth bus in required numbers shall be installed in various plant open areas and rooms. Each earth bus shall be provided two distinct connections by GI flats from the main grounding grid conductors available nearby. The plant equipment, metallic structures, tanks, etc. shall be brought to earth by providing two distinct connections between earth bus installed nearby and that equipments, tank, apparatus, etc.

4.3 GENERAL CONSTRUCTIONAL DETAILS

4.3.1 Plate Earthing Stations

1. The plate electrode shall be 600 x 600 x 3.25 mm copper plate or 600 x 600

x 6.15 mm hot dip GI.

2. The earth resistance shall be maintained with suitable soil treatment
3. The earth lead shall be connected to the earth plate through Hot Dip G.I. bolts
4. The earthing conductors shall be of copper strip in case of copper earthing
5. G.I. pipe with funnel of approved quality shall be used for watering the earthing electrodes / stations.
6. This brick chamber with cement plaster of dimensions in accordance with the drawing shall be constructed so as to protect the earthing station and to facilitate to locate the earthing station easily. The chamber shall also facilitate pouring of water and would provide easy access for testing, which would require disconnection of the earth electrode and connection to the earthing grid.
7. IS marked cast iron cover of appropriate dimensions shall be supplied as specified in IS: 3043 along with fabricated MS angle frame. The cover shall be hinged to the frame. The frame shall be grouted in brick masonry work of earthing station. The cove rand frame shall be painted with bitumen paint after applying primer. Earthing station Tag No. shall be painted on top of cover as per designation given on the layout drawing.
8. The hardware and other consumables for earthing installation shall be of copper/bras in case of copper earth plate and shall be hot dip galvanised iron material in case of G.I. earth plate
9. The depth of an earth electrode pipe shall be in approximately in accordance with the drawing as well as on nature of soil. However as per general guidelines, the pipe electrode shall have to be placed at depth where soft earth is available. This is to reduce the effect of earth resistance.

4.3.2 Pipe Electrode Earth Station

1. The earth station shall be as shown on the drawing and shall be used for equipment earth grid and/or street light pole earthing
2. The earth electrode shall be 3 M long 38/50 mm diameter class "A", Galvanized steel pipe
3. The earth resistance shall be maintained with a suitable soil treatment.
4. The earth lead shall be fixed to the pipe with a nut and safety set screws. The clamp shall be permanently accessible
5. The earthing grid and the earthing conductor shall be hot dip Galvanized iron strips of the size as shown in the drawing
6. G.I. pipe with funnel of approved quality shall be used for watering the earth electrode \ station
7. This brick chamber with cement plaster of dimensions in accordance with the drawing shall be constructed so as to protect the earthing station and to facilitate to locate the earthing station easily. The chamber shall also facilitate pouring of water and would provide easy access for testing, which would require disconnection of the earth electrode and connection to the earthing

grid.

8. The hardware and other consumables for earthing installation shall be of copper/bras in case of copper earth plate and shall be hot dip galvanised iron material in case of G.I. earth plate
9. The depth of an earth electrode pipe shall be in approximately in accordance with the drawing as well as on nature of soil. However as per general guidelines, the pipe electrode shall have to be placed at depth where soft earth is available. This is to reduce the effect of earth resistance.

4.4 EQUIPMENT EARTHING

All apparatus and equipment transmitting or utilizing power shall be earthed in the following manner. Copper /G.I. Earth strips/wires shall be used unless other-wise indicated.

4.5 ELECTRICAL AND PERFORMANCE REQUIREMENTS

4.5.1 Power Transmission Apparatus

1. Metallic conduit shall not be accepted as an earth continuity conductor. A separate insulated continuity conductor of size 100% of the phase conductor subject to the minimum shall be provided.
2. Non metallic conduit shall have an insulated earth continuity conductor of the same size for metallic conduit. All metal junction and switch boxes shall have an inside earth stud to which the earth conductor shall be connected. The earth conductor shall be distinctly coloured (Green or Green / Yellow) for easy identification
3. Armoured cable shall be earthed by two distinct earth connections to the armouring at both the ends and the size of connection being as for the metallic conduit.
4. In the case of unarmoured cable, an earth continuity conductor shall either be run outside along with the cable or should form a separate insulated core of the cable
5. Three phase power panel and distribution boards shall have two distinct earth connections of the size correlated to the incoming cable size. In case of single phase DB's a single earth connection is adequate

5.0 DRAWINGS & INFORMATION

5.1 Drawing for Plate Type Earthing Station – Annexure-1

5.2 Drawing for Pipe Type Earthing Station – Annexure 2

6.0 INSPECTION AND TESTING

6.1 The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS: 3043

6.2 The following earth resistance values shall be measured with an approved earth megger and recorded.

1. Each earthing station
2. Earthing system as a whole
3. Earth continuity conductors

6.3 Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 ohm in each case.

6.4 Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed

6.5 All tests shall be carried out in presence of the consultant / client

7.0 METHOD OF MEASUREMENT

7.1 Provision of earthing station complete with excavation, electrode, watering pipe, soil treatment, masonry chamber with cast iron cover etc. shall be treated as one unit of measurement

7.2 The following items of work shall be measured and paid per unit length covering the cost of the earth wires / strips, clamps, labour etc.

1. Main equipment earthing grid and connection to the earthing station.
2. Connection to the switch board, power panels, DB etc

7.3 The cost of earthing the following items shall become part of the cost of the item itself and no separate payment for earthing shall be made.

1. Motors - earthing forming part of the cabling / writing for the motors.
2. Isolating switches and starters should form part of mounting frame, switch starter etc.
3. Light fittings - form part of installation of the light fittings.
4. Conduit wiring, cabling - should form part of the wiring or cabling.
5. Street lighting - should form part of the street light poles

8.0 TRANSPORT, DELIVERY AND STORAGE

8.1 The prices shall be **F.O.R. site basis** including packing & forwarding charges. The quoted price must include all the costs for necessary mode of transportation up to the final location of earthing system or site store. All incidental expenses during transportation shall be part of quoted prices including **transit insurance**. The charges for loading and unloading of equipments at site should form part of offer.

9.0 GUARANTEE & WARRENTY

9.1 The Bidder shall stand guarantee for the performance of entire equipment and components for twelve (12) months from the date of commissioning or eighteen (18) months from the date of dispatch, whichever is earlier, as agreed up on and as reproduced in the purchase order within the tolerance specified or as permitted by the relevant standards for the equipment in his scope of supply.

10.0 SPARES

10.1 Not applicable

11.0 MATERIALS REQUIRED

11.1 All required hardware such as bolts, nuts, washers (round and spring type), anchor fasteners, screws, etc. of sizes and type as required shall be conforming to relevant IS. All hardware shall be hot-dip galvanized or zinc passivated /cadmium plated as per requirement of work either mechanical fabrication or electrical jointing.

11.2 All other items required for installation shall be as approved by site in-charge.

12.0 INSTALLATION OF SYSTEM

12.1 The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case less than 3 M below finished ground level

12.2 The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column

12.3 The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture

12.4 20 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber

12.5 Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe

12.6 The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing

12.7 The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry

12.8 Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS: 3043, Code of Practice for Earthing Installation.

12.9 The earth conductors (Strips / Wires, Hot dip G.I. / copper) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Hot Dip GI screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level/

12.10 The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished

12.11 Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long and bitumen coated.

12.12 The earth conductors shall be in one length between the earthing grid and the equipment to be earthed

12.13 Minimum distance of 2 mtr shall be maintained between other electric conductor, earthing conductor and the conductor laid for the lightning protection system. Earthing and lightning protection system conductors shall be bonded to each other to prevent side flashover in case of non-availability of adequate clearance.

12.14 The earthing met conductors, risers, earthing cables, etc. passing through walls shall be covered with galvanized iron sleeves for the passage through wall. Water stop sleeves shall also be provided wherever the earthing conductor enters the building from outside.

F. TECHNICAL SPECIFICATIONS FOR INTERNAL WIRING:

TECHNICAL SPECIFICATIONS FOR INTERNAL WIRING

1.0 SCOPE OF WORK

1.1 This section covers, definition of point wiring, system of wiring and supply, installation, connection, testing and commissioning of point wiring for light points, ceiling fan points, exhaust fan points, convenience socket outlet points, power socket outlet points, bell outlet points etc. including fixing of light fixtures, ceiling fan, exhaust fan, wall fan, bell etc

2.0 CODES & STANDARDS

2.1 The following standards and rules shall be applicable:

Sr. No.	Item	Relevant IS	Relevant IEC
1	Code of practice for electrical wiring installation (System voltage not exceeding 650 V)	IS: 732	
2	Code of practice for fire safety of buildings (General) Electrical installation.	IS: 1646	
3	Rigid steel conduits for electrical	IS: 9537 (Part -	

	wiring.	2)	
4	Fittings for rigid steel conduits for electrical wiring.	IS: 2667	
5	Flexible steel conduits for Electrical wiring.	IS: 3480	
6	Accessories for rigid steel conduit for electrical wiring.	IS: 3837	
7	PVC insulated cables.	IS: 694	
8	Rigid non-metallic conduits for electrical wiring.	IS: 9537 (Part - 3)	
9	Flexible (Pliable) non-metallic conduits for electrical installation.	IS: 6946	
10	3 pin plugs and sockets.	IS: 1293	
11	Specifications of conduits for electrical installation.	IS: 8130	
12	Switches for domestic purpose.	IS: 3854	
13	Fittings for rigid non-metallic conduits.	IS: 3419	
14	Guide for electrical layout in residential buildings Indian electricity act and rules.	IS: 4648	

3.0 DESIGN BASIS & SITE CONDITIONS

3.1 All the equipment and components provided in the transformer and accessories shall be suitably designed for installation and satisfactory operation as specified below.

Site conditions	
Location MUMBAI	**Site altitude** 50 M above mean sea level
Ambient temperature	**Relative humidity**
Maximum 45^0 C	Maximum 98 %
Minimum 05 ^{0} C	Minimum 40 %
Design 45 ^{0} C	Design 98 % at 50 ^{0} C
Seismic factor Zone III as per IS:1893	**Rainfall** 1000 mm/year
Environmental Tropical/humid/corrosive conditions	**Location of Equipment** Indoor
Wind speed 80 kmph	

maximum			
Electrical system data:			
Power supply for Equipment			
Voltage 415 V ± 5 %		**Frequency** 50 Hz ± 3 %	
Permissible combined voltage & frequency variation	± 6 %	**System design faultslevel(Symmetrical)**	10 kA for 1 sec. max.
System earthing LV side neutral solidly earthed		**Wiring** 3 phase, 4 wire on 415V system	
Auxiliary power supply :			
Power supply		240V AC, 1-Ph, 50Hz	
Control Supply		-----	
Space heater power supply		240V AC, 1-Ph, 50Hz	
Illumination power supply		240V AC, 1-Ph, 50Hz	
Plug-socket power supply		240V AC, 1-Ph, 50Hz	

4.0 TECHNICAL REQUIREMENTS

4.1 POINT WIRING

4.1.1 A point shall consist of the branch wiring from the distribution board together with a switch as required, including the ceiling rose or pendant holder or swan holder, or ceiling fan box or socket or suitable termination. A point shall include, in addition, the earth continuity conductor/wire from the distribution board to the earth pin/stud of the outlet/switch box and to the outlet points

4.1.2 Supply, installation, fixing of conduits with necessary accessories, junction/pull/inspection/switch boxes and outlet boxes

4.1.3 Supplying and drawing of wires of required size including earth continuity wire

4.1.4 Supply, installation and connection of Modular type switches, sockets, cover plates, switch plates, and fixing fan regulator etc

4.1.5 The point shall be complete with the branch wiring from the distribution board to the outlet point, through switch board, FRLS wire, conduit with accessories, junction, pull, inspection boxes, control switch, socket, outlet boxes, ceiling roses, double mounting plate, PVC/metal GI concealed box, button/swan holder, connector etc

4.2 POINT RATE

4.2.1 The rate per point shall include supply, installation, connection, testing and commissioning of point as described under “point wiring”. The measurements of the points will be enumerated

4.3 SYSTEM OF WIRING

4.3.1 Unless otherwise mentioned on the drawings, the system of point wiring shall be as follows:

The system of wiring shall consist of single core, FRLS insulated, 650/1100 volt grade, copper conductor wires/cables laid through exposed (surface mounted) PVC conduits as directed & wherever required, conduits shall be concealed in walls and slabs

4.4 GENERAL

4.4.1 Prior to laying of conduits, the contractor shall submit for approval, the shop drawing for conduit layout indicating the route of the conduits, number and size of the conduits, location of junction/inspection/pull/outlet boxes, size and location of switch boxes, number and size of wires pulled through each conduit and all other necessary relevant details. Only after the drawings are approved, the contractor shall proceed with the work of laying of conduits.

4.5 MATERIAL

4.5.1 PVC Conduit

All non-metallic PVC conduits shall conform to IS: 9537 (Part - 3). The conduit shall be planed and of type as specified in IS: 9537 and shall be used with the corresponding accessories (Refer IS: 3419 specification for fittings for rigid non metallic conduits). PVC conduits shall be rigid unplasticised, heavy gauge having 2.0 mm. wall thickness upto 20 mm. diameter conduit and 2.5 mm. wall thickness for all sizes above 20 mm. diameter

4.5.2 M.S. Conduit

Conduits shall conform to IS: 9537 (Part - 2), finished with galvanized surface. No steel conduit less than 25 mm. in diameter shall be used. Conduits shall be solid drawn of lap welded type, with minimum wall thickness for conduits having 25 mm. and above diameter

The conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of manufacturers

The conduit accessories such bends, coupling etc. shall be conforming to the relevant

Indian Standard specification

4.5.3 Boxes

1. All the boxes for switches, sockets and other receptacles, junction boxes, pull boxes and outlet boxes shall be fabricated from 2.0 mm. thick mild sheet painted with two coats of red-oxide and then two coats of enamel paints as called for. Colour of the paints shall be as approved by the client. The boxes shall have smooth external and internal finished surface
2. Boxes in contact with earth or exposed to the weather shall be of 2 mm. mild steel and hot dip galvanized after fabrication
3. Separate screwed earth terminal shall be provided in the box for earthing purpose
4. All boxes shall have adequate no. of knock out holes of required diameter for conduit entry

5. Switch boxes to receive switches, socket outlets, power outlets, telephone outlets, fan regulators, etc. shall be fabricated to the approved shape and size to accommodate all the devices without overcrowding.
6. Outlet boxes to receive ceiling fan shall be fitted with adequately sized rod
7. Hook to fix ceiling fan. The boxes shall be of minimum depth of 65 mm.
8. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers as required. Boxes for use in masonry block or tiled walls shall be square cornered tile type, or standard boxes having square cornered tile type covers. These boxes shall be installed in the center of the masonry block or tiles
9. Cast metal boxes installed in wet locations and boxes installed flush with the outside of exterior surface shall be gasketed

4.5.4 Cover Plate

The cover of the boxes to receive outlet points shall be of best anodized sheet

cut to shape and size or plate of approved manufacturers of switches

4.5.5 Cables

1. The cables shall conform to IS: 694. For all internal wiring FRLS insulated cables of 650/1100 volts grade, single core shall be used
2. The conductors shall be plain annealed copper conductors complying with IS: 1554
3. The conductors shall be circular copper conductor
4. The insulation shall be FRLS compound complying with the requirements of IS: 694. It shall be applied by an extrusion process and shall form a compact homogenous body.
5. The thickness of FRLS insulation shall be as set out in the relevant standards
6. The cores of all cables shall be identified by colours in accordance with the following sequence.

Single phase	Red
Three phase	Red, Yellow, Blue
Neutral	Black
Earth	Green or Green/Yellow

7. Means of identifying the manufacturer shall be provided throughout the length of cable
8. Unless otherwise specified in the drawings the size of the cables used for internal wiring shall be as follows:

- In case of circuit wiring for lights, exhaust fans, ceiling fans, bell, convenience socket outlet points (P+N+E):

2.5sq.mm.	From D.B. to switch boards.
1.5sq.mm.	From switch boards to outlet points

- In case of power socket outlet circuit having not more than two 15 A power outlet (P+N+E):

4.0sq.mm.	From D.B. to first power outlet
2.5sq.mm.	From first power outlet to second power outlet

- In case of power socket outlet circuit having single 15 A power outlet (like water heater) (P+N+E):

4.0sq.mm.	From D.B. to power outlet.

- In case of 15 A. power outlet for window Air conditioner or other likewise appliances (P+N+E):

4.0sq.mm.	From D.B. to power outlet.

9. The earth continuity conductor shall be similar to circuit cables and shall be drawn through conduit along with other circuit cables. The size of the earth continuity conductor shall be as follows:

   MINIMUM SIZE OF EARTH CONTINUITY CONDUCTOR NOT FORMING PART OF THE SAME CABLE AS THE ASSOCIATE CIRCUIT CONDUCTOR

Nominal cross-section area of largest associated copper circuit conductor in sq.mm.	Nominal cross-sectional area of earth continuity conductor in sq.mm.
1.5	1.5
2.5	2.5
4.0	4.0

   Separate circuit shall run for each water heater, kitchen equipment, window air conditioner, and similar outlets at location as shown on drawing

4.5.6 Switches

1. Switches shall conform to IS: 3854, IS: 1293 and IS: 4615. The switches shall be single pole, single or two way as shown on the drawings or as specified. They shall be of moulded type rated for 250 volt, and of full 5/15 A capacity. They shall be provided with insulated dollies and covers
2. The switches shall be rocker operated with a quiet operating mechanism with bounce free snap action mechanism enclosed in an arc resistant chamber.
3. The switches shall have pure silver and silver cadmium contacts.
4. The switches shall be flush modular type.
5. The make of the switches shall be as indicated in the drawings or BOQ or make of material or as suggested and approved by the client.
6. The switches installed in outdoor area shall be industrial, metal clad type, and shall be provided in weather proof enclosures, complete with weather proof gasketed covers.

4.5.7 Socket

1. The universal sockets shall conform to IS: 1293. Each universal socket shall be

provided with control switch of appropriate rating. The universal sockets shall be moulded type, rated for 250 volts, and either of full 5 A or 15 A capacity, as mentioned on the drawings.

2. Universal Sockets shall be of three pin type, the third in being connected to earth continuity conductor.
3. The universal socket shall be flush modular type.
4. The universal sockets installed in machine room, plant room or wet/damp area shall be metal clad weather proof type.
5. The finishing and make of all the sockets shall be same as light switch.
6. The universal socket shall have fully sprung contacts and solid brass shrouded
7. Terminals to ensure positive electrical connections.
8. The universal sockets shall be provided with automatic shutters, which open only when earth pin of the plug inserts in the socket.
9. The universal socket shall be provided with three pin plug top suitable to the socket and of the same make as socket.

5.0 DRAWINGS & INFORMATION

N.A.

6.0 INSPECTION AND TESTING

6.1 INSULATION RESISTANCE TEST

6.1.1 The insulation resistance shall be measured by applying 500 volt megger with all fuses in places, circuit breaker and all switches closed

6.1.2 The insulation resistance in megohms of an installation, measured shall not be less than 50 megohms divided by the number of points on the circuit

6.1.3 The insulation resistance shall be measured between

1. EARTH TO PHASE
2. EARTH TO NEUTRAL
3. PHASE TO NEURAL
4. PHASE TO PHASE

6.2 EARTH CONTINUITY PATH

6.2.1 The earth continuity conductors shall be tested for electrical continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit-breaker, measured from the connection, with the earth electrode to any point in the earth continuity conductor in the completed installation and shall not exceed one ohm

6.3 POLARITY OF SINGLE POLE SWITCHES

6.3.1 A test shall be made to verify that every no-linked, single pole switch is connected to

one of the phase of the supply system

6.4 COMPLETION CERTIFICATES

6.4.1 All the above tests shall be carried out in presence of client and the results shall be recorded in prescribed forms. Any default during the testing shall be immediately rectified and that section of the installation shall be re tested. The completed test result form shall be submitted to the client for approval

6.4.2 On completion of an electric installation a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form as required by the local electric supply authority.

7.0 INSTALLATION OF THE SYSTEM

7.1 CONCEALED INSTALLATION WITH RIGID PVC CONDUIT

7.1.1 All the rigid PVC conduit used for concealed installation shall be as per IS ; 9537 and its accessories shall be as per IS: 3419 (Small Wire Ropes).

7.1.2 Whenever necessary bends or diversion may be achieved by bending the conduits with the help of bending spring. No other method of bending is allowed

7.1.3 Conduit pipes shall be joined with the help of plain coupler fixed at the end with the help of vinyl solvent cement. No other method of joining is permissible

7.1.4 All other methods, no wires through conduit, bunching, etc. Shall be as specified in the concealed installation

7.1.5 Prior to fixing the conduits, the complete route shall be marked on site for the approval of consultant

7.2 CONCEALED WIRING SYSTEM WITH RIGID PVC CONDUIT

7.2.1 The rigid PVC conduits shall be used for concealed wiring system. The conduits shall be concealed in the concrete slab, floor, walls, beams, columns etc

7.2.2 FIXING OF CONDUIT

1. Conduits embedded in concrete shall be installed in the frame work before pouring concrete. The conduits shall be installed above the bottom reinforcing bars, and shall provide positive wire fastening of the conduit to the reinforcing rods at an interval of not more than one meter, but on either side of couplers or bends or putlet/pull/junction boxes or similar fittings, proper hold fast shall be fixed at a distance of 30 cm from the center of such fittings. Conduits embedded in the wall shall be fixed inside the chase . The chase in the wall shall be neatly made and be fixed in the manner desired. In the case of building under construction, chase shall be provided in the wall at the time of their construction and shall be filled up neatly with cement mortar 1:4 after erection of conduit and brought to the original finish of the wall. Cutting of horizontal chases in walls is prohibited. The conduits shall be fixed inside

the chase by means of staples or by means of saddles not more than 60 cm apart.

2. Conduits shall be so arranged as to facilitate easy drawing of wires through them. Entire conduit layout shall be done in such a way as to avoid additional junction boxes other than light points. The wiring shall be done in a looping manner. All the looping shall be done in either switch boxes or outlet boxes. Looping in junction or pull boxes are strictly not allowed. Where conduits cross building expansion joints, adequate expansion fittings or other approved devices shall be used to take care of any relative movement

3. All conduits shall be installed so as to avoid steam and hot water pipes

4. Conduits shall be installed in such a way that the junction, derivation and pull boxes shall always be accessible for repairs and maintenance work. The location of junction/pull boxes shall be marked on the shop drawings and approved by the client

5. A separation of 200 mm shall be maintained between electrical conduits and hot water lines in the building

6. No run of conduit shall exceed ten mtr. between adjacent draw in points nor shall it contain more than two right angle bends, or other derivation from the straight line

7. Caution shall be exercised in using the PVC conduits in location where ambient temperature is 50 degree cel. or above. Use of PVC conduits in places where ambient temperature is mote than 60 deg. cel. Is prohibited. The entire conduit system including boxes shall be thoroughly cleaned after completion of installations and before drawing of wires. Conduit system shall be erect and straight as far as possible. Traps where water may accumulate from condensation are to be avoided and if unavoidable, suitable provision for draining the water shall be made

8. All jointing method shall be subject to the approval of the client

9. Separate conduits shall be provided for the following system.

- 15 A universal power outlets.
- 5 A outlets and lighting system.
- Low voltage system.
- Telephone/intercom system.
- C.C.T.V. system
- Sound system
- Computer data cabling system
- Equipment wiring

7.3 CONDUIT JOINT

7.3.1 1. Conduits shall be joined by means of plain couplers vinyl and/or solvent cement. Where there are long runs of straight conduit, inspection type couplers shall be provided at intervals , as approved by the client

2. The conduits shall be thoroughly cleaned before making the joints

3. In case of plain coupler joints, proper jointing material like a vinyl solvent cement

(gray in color) or any material as recommended by the manufacturer shall be used.

7.4 BENDS IN CONDUIT

7.4.1 Wherever necessary, bends or diversions may be achieved by bending the conduits or by employing normal bends. No bends shall have radius less than 2.5 times outside dia. of the conduit

7.4.2 Heat may be used to soften the PVC conduit for bending, but while applying heat to conduit, the conduit shall be filled with sand to avoid any damage to the conduit

7.5 OUTLETS

7.5.1 All the outlets for fittings, switches etc. shall be boxes of substantial construction

7.5.2 In order to minimize condensation or sweating inside the conduits, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects , etc.

7.5.3 Fixing between conduit and boxes, outlet boxes, switch boxes and the like must be provided with entry spouts and smooth PVC bushes.

7.5.4 Joints between conduit and any type of boxes shall be affected by means of conduit couplers in to each of which shall be coupled smooth PVC bush from inside the box. In any case all the joints shall be fully water tight.

7.6 BUNCHING OF CABLES

7.6.1 Cables of AC supply of different phase shall be bunched in separate conduits.

7.6.2 The number of insulated wires/ cables that may be drawn into the conduits shall be as per the following table. In this table, the space factor does not exceed 40%. However, in any case conduits having lesser than 19 mm dia. shall not be used.

MAXIMUM PERMISSIBLE NUMBER OF 650 VOLT GRADE SINGLE

CORE CABLES THAT MAY BE DRAWN IN TO RIGID PVC CONDUITS.

CABLE SIZE IN MM SQ.	S I Z E O F C O N D U I T S (MM)			
	MAXIMUM NO. OF CABLES			
	25	32	38/40	51/50
1.5	8	15	---	---
2.5	6	10	---	---
4.0	4	8	12	---

7.7 WIRING WITH RIGID STEEL CONDUIT

7.7.1 All conduits and it's accessories shall be of threaded type and under no circumstances pin grip type or clamp type accessories be used

7.8 FIXING OF CONDUIT

7.8.1 Conduit pipes shall be fixed by heavy gauge spacer bar saddles. The saddles shall be of 3 mm x 19 mm galvanized mild steel flat, properly treated and securely fixed to support by means of nuts and bolts raw bolts, brass machine screws, as mentioned, at an internal of not more than one meter but on either side of couplers, or bends, or junction/pull/outlet boxes or similar fittings, saddles shall be fixed at a distance of 30 cm from the centre of such fittings.

7.8.2 Draw boxes shall be located at convenient location for easy drawing of wires

7.8.3 Every mains and sub mains shall run in independent conduits with an independent earth wire of specified capacity along the entire length of conduit

7.8.4 The conduits to be installed shall be of ample cross section area to facilitate the drawing of wires. The diameter of the conduit shall be selected as per table specified in these specifications. But in no case it shall be less than 25 mm diameter

7.8.5 Entire conduit layout shall be done such as to avoid additional junctions boxes other than for outlet points. Conduits shall be free from sharp edge and burrs. Conduits shall be laid in a neat and organized manner as directed and approved by the client. Conduit runs shall be planned so as not to conflict with any other services pipe, lines/duct

7.8.6 The entire conduit system shall be electrically and mechanically continuous and shall be bonded, together by means of approved type earthing clamp and earthed through a bare copper conductor of 14 SWG to the earthing terminals on the nearest distribution board

7.8.7 If required, connection between PVC and steel conduits shall be through a junction box. Direct connection between PVC and steel conduits are not allowed

7.8.8 Where exposed conduits are suspended from the structure, they shall be clamped firmly and rigidly to hangers of design to be approved by client. Where hangers are to be anchored to reinforced concrete, appropriate inserts and necessary devices for their fixing shall be left in position at the time of concreting, making holes and opening in the concrete will generally not be allowed. In case, it is unavoidable, prior permission of the client shall be obtained

7.9 CONDUIT JOINTS

7.9.1 Conduit pipes shall be joined by means of screwed couplers and screwed accessories, as per IS: 2667

7.9.2 The threads shall be free from grease or oil

7.9.3 In long distanced straight runs of conduit, inspection type couplers two way junction boxes at reasonable intervals shall be provided or running threads with couplers and lock nuts shall be provided. The bare threaded portion shall be treated with anti-corrosive paints. Threads on conduit pipes in all cases shall be between 11mm to 27mm long, sufficient to accommodate pipes to full threaded portion of couplers or accessories. Cut ends of conduit pipes shall have no sharp edges nor any burrs left, to avoid damage to the insulation of conductors while pulling them through such pipes

7.9.4 Brass female bushes shall be used in each conduit termination in a switch box, outlet

box, electrical panel or any other box

7.9.5 Conduit shall be secured in each outlet box switch box, electrical panel or any other ox by means of one brass hexagonal lock nut and bush, outside and inside the box

7.7.6 At each building, expansion joints approved oil tight double wire wound flexible steel conduit or any other approved method shall be used. This shall be united on both sides with the rigid conduits by suitable union

7.9.7 Conduits installed in the plant room for mechanical equipment shall be properly clamped with the mechanical supports, but in no case, it shall be fixed with the body of the equipment

7.9.8 The connection of conduit to the mechanical equipment shall be through oil tight double wire wound flexible steel conduit. In any case the length of the flexible conduit shall not exceed one meter. The flexible conduit shall be properly clamped with the body of the equipment. They shall not in any case be clamped with any cover or any removable parts of the equipment

7.10 BENDS IN CONDUIT

7.10.1 All necessary bends in the system including diversion shall be done by bending pipes or by inserting suitable solid or circular inspection type normal box or similar fittings. Conduit fittings shall be avoided as far as possible on conduit system exposed to weather, where necessary, solid type fittings shall be used. Radius of such bends in conduit pipes shall be not less than 75 mm. No length of conduit shall have more than the equivalent of four quarter bends from outlet, the bends at the outlets not being counted

7.11 PROTECTION AGAINST DAMPNESS

7.11.1 In order to minimize condensation or sweating inside the conduit, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects, as far as possible

7.12 PROTECTION OF CONDUIT AGAINST RUST

7.12.1 The outer surface of the conduits including bends, junction boxes, etc., forming part of the conduit system shall be adequately protected against rust, particularly when such system is exposed to weather. In all cases, no bare/threaded portion of conduit pipe shall be allowed unless such bare threaded portion is treated with anti-corrosive coating or covered with approved plastic compound

7.13 BUNCHING OF CABLES

7.13.1 Unless otherwise specified, insulated conductors of different phases shall be bunched in separate conduit.

Wires carrying current shall be so bunched in the conduit that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit

7.13.2 The number of insulated wires/cables that be drawn into the conduits shall be as per the following table.

MAXIMUM PERMISSIBLE NUMBER OF 650/1100 VOLTS GRADE SINGLE CORE CABLE THAT CAN BE DRAWN INTO RIGID STEEL CONDUITS.

CABLE SIZE IN MM SQ.	S I Z E O F C O N D U I T S (MM)			
	MAXIMUM NO. OF CABLES			
	25	32	38	51
1.5	10	14	---	---
2.5	8	12	---	---
4.0	6	10	---	---

7.14 SWITCH AND SOCKET

7.14.1 Switches shall be installed at 900 mm above finished floor level unless otherwise indicated on the drawings

7.14.2 The switch controlling the light point or fan shall be connected on to the phase wire of the circuit and neutral shall be continuous, having no fuse or switch installed in the line except at the D.B. All fan regulators shall be fixed inside the switch boxes on adjustable flat M.S. strips/plates with tapped holes and brass machine screws, leaving ample space at the back and side for accommodating wires

7.14.3 The cover plates to the switch box shall be fixed by means of sunk head brass cadmium screws

7.14.4 Where two or more switches and fan regulators are installed together, they shall be provided with one gang cover plate with knockouts to accommodate required number of switches, sockets and regulators

7.14.5 The switch controlling the socket outlet shall be on the phase wire of the circuit. The third pin of the socket shall be connected to the earth continuity conductor of the circuit

7.14.6 The switch boxes, installed back-to-back in the same wall shall be offset from each other, 150 mm horizontally, to preclude noise transmission

7.15 DRAWING OF CONDUCTORS

7.15.1 The drawing and joining of copper conductor or wires shall be executed with due regard to the following precautions. While drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. There shall be no sharp bends

7.15.2 Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or ringing

7.15.3 FRLS insulated copper conductor wire ends before connection shall be properly soldered (at least 15 mm length) with soldering flux/copper solder, for copper

conductor. Strands of wires shall not be cut for connecting to the terminals. All strands of wires shall be soldered at the terminals. All strands of wires shall be soldered at the end before connection. The connecting brass-screws shall have flat ends. All looped joints shall be soldered and connected through terminals block/connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. Conductors having nominal cross section exceeding 4 sq. mm shall always be provided with crimping type cable sockets. At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used. Brass nuts and bolts shall be used for all connections

7.15.4 Only certified wire men and cable jointers shall be employed to do joining work.

7.15.5 For all internal wiring FRLS insulated wires of 650/1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in looping system and no joint shall be allowed in the length of the conductors. No wire shall be drawn in to any conduit, until all work of any nature that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduits the conduits shall be thoroughly cleaned of moisture, dust, and dirt or any other obstruction by forcing compressed air through the conduits

7.16 JOINTS

7.16.1 The wiring shall be by looping back system, and hence all joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made inside conduits and junction boxes.

7.16.2 Contractors shall be continuous from outlet to outlet. For joints where unavoidable, due to any specified reasons, prior permission in writing shall be obtained from the client before making such connections. Joints by twisting conductors are prohibited.

7.17 **LOAD BALANCING**

7.17.1 Balancing of circuit in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

7.18 **EARTHING**

7.18.1 All earthing systems shall be in accordance with IS: 3043 - 1985 code of practice for earthing

80 METHOD OF MEASUREMENT

8.1 All the items will be measured as mentioned in Bill of quantity.

9.0 TRANSPORT, DELIVERY AND STORAGE

The wire shall be supplied in the actual length as per detailed purchase order

The wire shall be dispatched at client's stores or at site as per detailed instructions given by client at later stage.

The wire shall be loaded from the main vendor's store and properly stacked as per instruction of client's local representative. All such labour and transportation charges shall be clearly mentioned in the offer.

10.0 GUARANTEE AND WARRENTY

10.1 The quotes values of parameters shall be within given tolerance for given period of service life.

G.) TECHNICAL SPECIFICATIONS FOR LIGHT FIXTURE

TECHNICAL SPECIFICATIONS FOR SUPPLY OF LIGHT FIXTURE

1.0 SCOPE OF WORK

1.1 The scope of work shall cover the supply, installation and testing of various types of light fixtures.

2.0 CODES & STANDARDS

2.1 The following standards and rules shall be applicable :

IS 3646 (1960)	Code of practice for interior illuminator.
IS 1913(1969)	General and Safety requirements for electric lighting fittings.
Indian Electricity Act and Rules issued here under.	

3.0 DESIGN BASIS & SITE CONDITIONS

3.1

Site conditions	
Location MUMBAI	
Ambient temperature	**Relative humidity**
Maximum 45 ^{0} C	Maximum 95 %
Minimum 05 ^{0} C	Minimum 40 %
Design 45 ^{0} C	Design 98 % at 45 ^{0} C
Environmental Tropical/humid/corrosive conditions	**Location of Equipment** Indoor/Outdoor
Wind speed 80 kmph maximum	

Electrical system data:			
Power supply for Equipment			
Voltage 415 V ± 5 %		**Frequency** 50 Hz ± 3 %	
Permissible combined voltage & frequency variation	± 6 %	**System design faultslevel(Symmetrical)**	10 kA for 1 sec. max.
System earthing LV side neutral solidly earthed		**Wiring** 3 phase, 4 wire on 415V system	

4.0 TECHNICAL REQUIREMENTS

4.1 GENERAL REQUIREMENTS

4.1.1 All fixtures shall be complete with accessories and fixings necessary for installation whether so detailed under fixture description or not

4.1.2 Fixture housing, frame or canopy shall provide a suitable cover for the fixture outlet box of fixture opening

4.1.3 Fixture shall be installed at mounting heights as detailed on the drawings or instructed on site by the client's representative

4.1.4 Fixtures and/or fixture outlet boxes shall be provided with hangers to adequately support the complete weight of the fixture. Design of hangers and method of fastening other than shown on the drawings or herein specified shall be submitted to the client's representative for approval

4.1.5 Fixture shall be completely wired and constructed to comply with the regulations and standards for Electric Lighting Fixtures, unless otherwise specified. Fixtures shall bear manufacturer’s name and the factory inspection label unless otherwise approved

4.1.6 Wiring within the fixture and for connection to the branch circuit wiring shall be not less than 1.5 sq.mm. copper for 250 Volt application. Wire insulation shall suit the temperature conditions inside the fixture and wires bypassing the choke shall be heat protected with a heat resistant sleeve

4.1.7 Metal used in lighting fixtures shall be not less than 22 SWG or heavier if so required to comply with specifications or standards. Sheet steel reflectors shall have a thickness of not less than 20 SWG. The metal parts of the fixtures shall be completely free from burrs and tool marks. Solder shall not be used as mechanical fastening device on any parts of the fixture

4.1.8 Ferrous metal shall be bonderized and given a corrosion resistant phosphate treatment or other approved rust inhibiting prim coat to provide a rust-proof base before application of finish

4.1.9 Non-reflecting surfaces such as fixture frames and trim shall be Alluminium die cast

4.1.10 All the fixtures are as per the IP - 54 insulation class

4.1.11 Vendor shall be responsible for measuring the level of illumination after installation

4.1.12 Lighting fixtures shall be designed for minimum glare and for continuous operation under specified atmospheric condition

4.1.13 All fixtures shall be complete with accessories like power factor improvement capacitors, ballast, ignitor etc

4.1.14 Very flat aluminium section with colour highlighted, flush-integrated end caps of anodized aluminium. Visible construction

height 18 mm. With integrated plastic cover of polycarbonate for protection of the indirect optic against soiling. Includes 2-point wire suspension in Y-form and transparent cable for suspension heights to 1500 mm.···01 White.

4.2 OPTICAL SYSTEM

4.2.1 Direct/indirect distribution. 48 high power LEDs, integrated in separate mini LED louvers with UXP-Technology®. 8 LED segments as square cooling units integrated into the luminaire body ensure optimal thermal management, whereby six have indirect, symmetrical light distribution and the remaining 2 on the outside have direct, asymmetrical distribution. LED with constant colour stability and a colour rendering index of Ra > 80 over the complete service life.

4.2.2 Lighting fixture reflectors shall generally be manufactured from sheet steel of aluminium of not less than 20 SWG. They shall be readily removable from the housing for cleaning and maintenance without disturbing the lamps and without the use of tools. They shall be security mounted to the housing by means of positive fastening devices of a capative type.

4.2.3 Polystyrene egg-box type louvers shall be provided whenever specified. Appropriate captive type fixing devices shall be incorporated for securing these.

4.3 BALLAST

4.3.1 Lighting fixtures ballasts shall be designed manufactured and supplied in accordance with the relevant standard IS 6616 and shall function satisfactorily under site conditions specified. The ballasts shall have a long service life and low power loss

4.3.2 Ballasts shall be mounted using self-licking, anti-vibration fixings and shall be easy to remove without removing the fittings

4.3.3 Ballast shall contain a thermosetting type compound not subject to softening or liquefying under any operating conditions or upon ballast failure. The ballasts shall be of the inductive and heavy duty type Filled with polyester of equivalent. They shall be free from hum and protected from the atmospheres. Ballsts which produce a humming sound shall be replaced free of cost by the supplier. HPMV lamp ballasts shall be provided with suitable tappings

4.4 STARTERS

4.4.1 Lighting fixtures starters shall be of the safety type (i.e. if the lamps fails to ignite at the first start, no further starting must be possible without attending to the tube

light. Starters shall have bimetal electrodes and high mechanical strength

4.4.2 Starters shall be replaceable without disturbing the reflector or lamps and without the use of any tool. Starters shall have brass contacts and radio interference capacitor

4.5 CAPACITORS

4.5.1 Lighting fixture capacitors shall have a constant value of capacitors and shall be connected across the supply of individual lamp circuits

4.5.2 Each capacitor shall be suitable for operation at 240 volts ± 5% single phase 50 Hz with a suitable value of capacitor so as to correct the power factor of lists corresponding lamp circuit to the extent of 0.98 lag

4.5.3 The capacitors shall be hermitically sealed preferably in metal container to prevent seepage of impregnating material and ingress of moisture

4.6 LAMP HOLDER

4.6.1 Lamp holders for fluorescent tubes shall be of the spring loaded, low contact resistance, bi-pin rotor type, resistant to wear and suitable for operation at the specified temperature, without deterioration in insulation valve, contact resistance of lamp holding quality. The shall hold the lamp in position under normal condition of shock and vibration

4.6.2 Lamp-holders for incandescent and HPSV lamps shall be of G.L.S. type manufactured in accordance with relevant standards and designed to give long and satisfactory service

4.7 LUMINAIRES

4.7.1 LED suspended luminaire. With 6 LED indirect symmetrical segments, 2 LED segments with asymmetric direct distribution. With 48 high power LEDs, neutral white light colour, colour temperature 4000 K, colour rendering index

Ra > 80, integrated in separate mini-LED louver with UXP technology. Luminaire luminous flux 6000 lm. Total power consumption 102 W. Construction height 18 mm. LED segments flush integrated into the square luminaire body ensure optimal thermal management. With integrated plastic cover for protection of optics against soiling. Luminaire body of flat aluminium profile, white, with colour highlighted, flush integrated end caps of anodized aluminium. Complete with 2-point wire suspension in Y-form and transparent cable for suspension lengths to 1500 mm. Protection rating IP20. With digitally dimmable electronic transformer, Dali.

4.7.2 Street light fixture shall be of single die cast aluminium housing with provision for the easy removal of gear box during maintenance. Acrylic bowl shall be linked to one end and toggle shall be provided. Neoprene rubber and felt gasket shall be provided between acrylic bowl and fixture to prevent entry of insects and moisture

4.7.3 Industrial low bay fitting shall be of die cast aluminium housing, high purity Al. Reflector, acrylic cover and wire guard

4.8 LAMPS

4.8.1 LED Lamps shall be supplied and installed in all lighting fixtures furnished under this contract

4.8.2 Lamps used for temporary lighting service shall not be used in the final lamping of fixture units

4.8.3 LED Lamps shall be of wattage and type as shown on the drawings and schedules. Where not shown, the details shall be ascertained from the client before procurement

4.8.4 LED Lamps for permanent installation shall not be placed in the fixtures until so directed by the Client's representative, and this shall be accomplished directly before the respective portions are ready for occupation

5.0 DRAWINGS & INFORMATION

5.1 As per of the proposal the bidder furnish relevant descriptive and illustrative literature on lighting fixtures and accessories and following drawings/ data for the respective lighting fixtures:-

1. Dimensional Drawings.
2. Mounting details cable entry facilities and weights.
3. Light distribution diagrams (Zonal &Isokandora)
4. Light absorption and utilization factors.
5. Lamp output V/S temp. curves.

6.0 INSPECTION AND TESTING

6.1 Each fixture shall be tested at 1500 volts rms. 50 Hz for one minute and no flashover of breakdown shall occur between current carrying parts and ground

6.2 Insulation resistance of each fixture shall be tested at 500 V.D.C. and the insulation resistances so measured shall not be less than 2 mega ohms between all current carrying parts and ground

6.3 Each fixture complete with its proper lamp/lamps shall be shown to operate satisfactorily at its normal voltage and frequency

6.4 Each fixture shall be examined visually to ensure that it is complete in all respects and satisfactorily finished

6.5 Type and routine test certificates shall be submitted for tests conducted as per relevant IS/BS for the fixture and accessories

7.0 METHOD OF MEASUREMENT

Supply of the fixture including transport to site, loading and unloading etc. as specified will be treated as one unit for measurement and payment.

8.0 TRANSPORT, DELIVERY AND STORAGE

The prices shall be **F.O.R. site basis** including packing & forwarding charges. The quoted price must include all the costs for necessary mode of transportation up to the final location of fixture or site store. The fixture should be supplied with required storage arrangements suitable for placing in open storage yard. All

incidental expenses during transportation shall be part of quoted prices including **transit insurance**. The charges for loading and unloading of equipments at site should form part of offer.

9.0 GUARANTEE AND WARRENTY

9.1 The Bidder shall stand guarantee for the performance of entire fixtures and components for twelve (12) months from the date of commissioning or eighteen (18) months from the date of dispatch, whichever is earlier, as agreed up on and as reproduced in the purchase order within the tolerance specified or as permitted by the relevant standards for the equipment in his scope of supply. The Purchaser also reserves the right to use the rejected equipment or part thereof until the new equipment meeting the guaranteed performance is supplied by the Bidder.

H) TECHNICAL SPECIFICATIONS FOR INSTALLATION OF INTERNAL WIRING

TECHNICAL SPECIFICATIONS FOR INSTALLATION OF INTERNAL WIRING

1.0 SCOPE OF WORK

1.1 This section covers, definition of point wiring, system of wiring and, installation, connection, testing and commissioning of point wiring for light points, ceiling fan points, exhaust fan points, convenience socket outlet points, power socket outlet points, bell outlet points etc. including fixing of light fixtures, ceiling fan, exhaust fan, wall fan, bell etc.

2.0 CODES & STANDARDS

2.1 The following standards and rules shall be applicable :

IS : 732	Code of practice for electrical wiring installation (System voltage not exceeding 650 V)
IS: 1646	Code of practice for fire safety of buildings (General) Electrical installation.
IS: 9537 (Part - 2)	Rigid steel conduits for electrical wiring.
IS: 2667	Fittings for rigid steel conduits for electrical wiring.
IS: 3480	Flexible steel conduits for Electrical wiring.
IS: 3837	Accessories for rigid steel conduit for electrical wiring.
IS: 694	PVC insulated cables.
IS: 9537 (Part - 3)	Rigid non-metallic conduits for electrical wiring.
IS: 6946	Flexible (Pliable) non-metallic conduits for electrical installation.

IS: 1293	3 pin plugs and sockets.
IS: 8130	Specifications of conduits for electrical installation.
IS: 3854	Switches for domestic purpose.
IS: 3419	Fittings for rigid non-metallic conduits.
IS : 4648	Guide for electrical layout in residential buildings Indian electricity act and rules

All standard and codes mean the latest.

3.0 MATERIALS REQUIRED

3.1 As per standard requirement.

4.0 INSTALLATION OF THE SYSTEM

Note: Only FRLS grade conductor wire shall be used; 2. Conduit carrying circuit wiring should not carry point wiring and Conduit carrying point wiring should not carry submain/circuit wiring; 3. Flexible conduits & Elbows are not allowed; 4. The wires from ceiling junction to light points / light fixture shall be drawn in flexible M.S conduit with adptor& cover for junction box & crimp type lugs at both the ends alongwith necessary hardware & accessories, etc. as required; 5. Proper ferrules, lugs, must be used in all cabling and wiring on both load / source end; 6. Each switch board must be provided with respective ferrules representing the respective DB, Phase & Circuit numbers; 7. Looping of Neutral / Earth wire between two seperate Primary / Full Points is strictly not allowed; 8. Looping of Neutral / Earth wire between two seperate circuits on similar or other phase is strictly not allowed; 9. Ferulling / numbering / taggning to wires with circuit number &db name for all lighting & raw / ups power shall be strictly followed at both DB & switch board / switch socket boards ends. 10. Running of conduit in beam and column shall be avoided. 11. All AC, Geyser and Aquaguard etc. socket point location near equipment. 12. Switch boxes should be fixed 200 mm away from the edge of the door opening wall unless noted.

4.1 CONCEALED INSTALLATION WITH RIGID PVC CONDUIT

4.1.1 All the rigid PVC conduit used for concealed installation shall be as per IS ; 9537 and its accessories shall be as per IS: 3419 (Small Wire Ropes).

4.1.2 Whenever necessary bends or diversion may be achieved by bending the conduits with the help of bending spring. No other method of bending is allowed

4.1.3 Conduit pipes shall be joined with the help of plain coupler fixed at the end with the help of vinyl solvent cement. No other method of joining is permissible

4.1.4 All other methods, no wires through conduit, bunching, etc. Shall be as specified in the concealed installation

4.1.5 Prior to fixing the conduits, the complete route shall be marked on site for the approval of consultant

4.2 CONCEALED WIRING SYSTEM WITH RIGID PVC CONDUIT

4.2.1 The rigid PVC conduits shall be used for concealed wiring system. The conduits shall be concealed in the concrete slab, floor, walls, beams, columns etc

4.2.2 FIXING OF CONDUIT

10. Conduits embedded in concrete shall be installed in the frame work before pouring concrete. The conduits shall be installed above the bottom reinforcing bars, and shall provide positive wire fastening of the conduit to the reinforcing rods at an interval of not more than one meter, but on either side of couplers or bends or putlet/pull/junction boxes or similar fittings, proper hold fast shall be fixed at a distance of 30 cm from the center of such fittings. Conduits embedded in the wall shall be fixed inside the chase . The chase in the wall shall be neatly made and be fixed in the manner desired. In the case of building under construction, chase shall be provided in the wall at the time of their construction and shall be filled up neatly with cement mortar 1:4 after erection of conduit and brought to the original finish of the wall. Cutting of horizontal chases in walls is prohibited. The conduits shall be fixed inside the chase by means of staples or by means of saddles not more than 60 cm apart.

11. Conduits shall be so arranged as to facilitate easy drawing of wires through them. Entire conduit layout shall be done in such a way as to avoid additional junction boxes other than light points. The wiring shall be done in a looping manner. All the looping shall be done in either switch boxes or outlet boxes. Looping in junction or pull boxes are strictly not allowed. Where conduits cross building expansion joints, adequate expansion fittings or other approved devices shall be used to take care of any relative movement

12. All conduits shall be installed so as to avoid steam and hot water pipes

13. Conduits shall be installed in such a way that the junction, derivation and pull boxes shall always be accessible for repairs and maintenance work. The location of junction/pull boxes shall be marked on the shop drawings and approved by the client

14. A separation of 200 mm shall be maintained between electrical conduits and hot water lines in the building

15. No run of conduit shall exceed ten mtr. between adjacent draw in points nor shall it contain more than two right angle bends, or other derivation from the straight line

16. Caution shall be exercised in using the PVC conduits in location where ambient temperature is 50 degree cel. or above. Use of PVC conduits in places where ambient temperature is mote than 60 deg. cel. Is prohibited. The entire conduit system including boxes shall be thoroughly cleaned after completion of installations and before drawing of wires. Conduit system shall be erect and straight as far as possible. Traps where water may accumulate from condensation are to be avoided and if unavoidable, suitable provision for draining the water shall be made

17. All jointing method shall be subject to the approval of the client
18. Separate conduits shall be provided for the following system.
    - 15 A power outlets.
    - 5 A outlets and lighting system.
    - Low voltage system.
    - Telephone/intercom system.
    - C.C.T.V. system
    - Sound system
    - Computer data cabling system
    - Equipment wiring

4.3 **CONDUIT JOINT**

4.3.1 4. Conduits shall be joined by means of plain couplers vinyl and/or solvent cement. Where there are long runs of straight conduit, inspection type couplers shall be provided at intervals , as approved by the client

5. The conduits shall be thoroughly cleaned before making the joints
6. In case of plain coupler joints, proper jointing material like a vinyl solvent cement (gray in color) or any material as recommended by the manufacturer shall be used.

4.4 **BENDS IN CONDUIT**

4.4.1 Wherever necessary, bends or diversions may be achieved by bending the conduits or by employing normal bends. No bends shall have radius less than 2.5 times outside dia. of the conduit

4.4.2 Heat may be used to soften the PVC conduit for bending, but while applying heat to conduit, the conduit shall be filled with sand to avoid any damage to the conduit

4.3 **OUTLETS**

4.3.1 All the outlets for fittings, switches etc. shall be boxes of substantial construction

4.3.2 In order to minimize condensation or sweating inside the conduits, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects , etc.

4.3.3 Fixing between conduit and boxes, outlet boxes, switch boxes and the like must be provided with entry spouts and smooth PVC bushes.

4.3.4 Joints between conduit and any type of boxes shall be affected by means of conduit couplers in to each of which shall be coupled smooth PVC bush from inside the box. In any case all the joints shall be fully water tight.

4.4 **BUNCHING OF CABLES**

4.4.1 Cables of AC supply of different phase shall be bunched in separate conduits

4.4.2 The number of insulated wires/ cables that may be drawn into the conduits shall be as per the following table. In this table, the space factor does not exceed 40%. However, in any case conduits having lesser than 19 mm dia. shall not be used.

MAXIMUM PERMISSIBLE NUMBER OF 650 VOLT GRADE SINGLE CORE CABLES THAT MAY BE DRAWN IN TO RIGID PVC CONDUITS.

CABLE SIZE IN MM SQ.	**S I Z E O F C O N D U I T S (MM)**			
	MAXIMUM NO. OF CABLES			
	25	32	38/40	51/50
1.5	8	15	---	---
2.5	6	10	---	---
4.0	4	8	12	---

4.5 WIRING WITH RIGID MS/STEEL CONDUIT

4.5.1 All conduits and it's accessories shall be of threaded type and under no circumstances pin grip type or clamp type accessories be used

4.6 FIXING OF CONDUIT

4.6.1 Conduit pipes shall be fixed by heavy gauge spacer bar saddles. The saddles shall be of 3 mm x 19 mm galvanized mild steel flat, properly treated and securely fixed to support by means of nuts and bolts raw bolts, brass machine screws, as mentioned, at an internal of not more than one meter but on either side of couplers, or bends, or junction/pull/outlet boxes or similar fittings, saddles shall be fixed at a distance of 30 cm from the centre of such fittings.

4.6.2 Draw boxes shall be located at convenient location for easy drawing of wires

4.6.3 Every mains and sub mains shall run in independent conduits with an independent earth wire of specified capacity along the entire length of conduit

4.6.4 The conduits to be installed shall be of ample cross section area to facilitate the drawing of wires. The diameter of the conduit shall be selected as per table specified in these specifications. But in no case it shall be less than 25 mm diameter

4.6.5 Entire conduit layout shall be done such as to avoid additional junctions boxes other than for outlet points. Conduits shall be free from sharp edge and burrs. Conduits shall be laid in a neat and organized manner as directed and approved by the client. Conduit runs shall be planned so as not to conflict with any other services pipe, lines/duct

4.6.6 The entire conduit system shall be electrically and mechanically continuous and shall be bonded, together by means of approved type earthing clamp and earthed through a bare copper conductor of 14 SWG to the earthing terminals on the

nearest distribution board

4.6.7 If required, connection between PVC and steel conduits shall be through a junction box. Direct connection between PVC and steel conduits are not allowed

4.6.8 Where exposed conduits are suspended from the structure, they shall be clamped firmly and rigidly to hangers of design to be approved by client. Where hangers are to be anchored to reinforced concrete, appropriate inserts and necessary devices for their fixing shall be left in position at the time of concreting, making holes and opening in the concrete will generally not be allowed. In case, it is unavoidable, prior permission of the client shall be obtained

4.7 CONDUIT JOINTS

4.7.1 Conduit pipes shall be joined by means of screwed couplers and screwed accessories, as per IS: 2667

4.7.2 The threads shall be free from grease or oil

4.7.3 In long distanced straight runs of conduit, inspection type couplers two way junction boxes at reasonable intervals shall be provided or running threads with couplers and lock nuts shall be provided. The bare threaded portion shall be treated with anti-corrosive paints. Threads on conduit pipes in all cases shall be between 11mm to 27mm long, sufficient to accommodate pipes to full threaded portion of couplers or accessories. Cut ends of conduit pipes shall have no sharp edges nor any burrs left, to avoid damage to the insulation of conductors while pulling them through such pipes

4.7.4 Brass female bushes shall be used in each conduit termination in a switch box, outlet box, electrical panel or any other box

4.7.5 Conduit shall be secured in each outlet box switch box, electrical panel or any other ox by means of one brass hexagonal lock nut and bush, outside and inside the box

4.7.6 At each building, expansion joints approved oil tight double wire wound flexible steel conduit or any other approved method shall be used. This shall be united on both sides with the rigid conduits by suitable union

4.7.7 Conduits installed in the plant room for mechanical equipment shall be properly clamped with the mechanical supports, but in no case, it shall be fixed with the body of the equipment

4.7.8 The connection of conduit to the mechanical equipment shall be through oil tight double wire wound flexible steel conduit. In any case the length of the flexible conduit shall not exceed one meter. The flexible conduit shall be properly clamped with the body of the equipment. They shall not in any case be clamped with any cover or any removable parts of the equipment.

4.8 BENDS IN CONDUIT

4.8.1 All necessary bends in the system including diversion shall be done by bending pipes or by inserting suitable solid or circular inspection type normal box or similar fittings. Conduit fittings shall be avoided as far as possible on conduit system

exposed to weather, where necessary, solid type fittings shall be used. Radius of such bends in conduit pipes shall be not less than 75 mm. No length of conduit shall have more than the equivalent of four quarter bends from outlet, the bends at the outlets not being counted

4.9 PROTECTION AGAINST DAMPNESS

4.9.1 In order to minimize condensation or sweating inside the conduit, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects, as far as possible

4.10 PROTECTION OF CONDUIT AGAINST RUST

4.10.1 The outer surface of the conduits including bends, junction boxes, etc., forming part of the conduit system shall be adequately protected against rust, particularly when such system is exposed to weather. In all cases, no bare/threaded portion of conduit pipe shall be allowed unless such bare threaded portion is treated with anti-corrosive coating or covered with approved plastic compound

4.11 BUNCHING OF CABLES

4.11.1 Unless otherwise specified, insulated conductors of different phases shall be bunched in separate conduit.

Wires carrying current shall be so bunched in the conduit that the out going and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit

4.11.2 The number of insulated wires/cables that be drawn into the conduits shall be as per the following table.

MAXIMUM PERMISSIBLE NUMBER OF 650/1100 VOLTS GRADE SINGLE CORE CABLE THAT CAN BE DRAWN INTO RIGID STEEL CONDUITS.

CABLE SIZE IN MM SQ.	**S I Z E O F C O N D U I T S (MM)**			
	MAXIMUM NO. OF CABLES			
	25	32	38	51
1.5	10	14	---	---
2.5	8	12	---	---
4.0	6	10	---	---

4.12 SWITCH AND SOCKET

4.12.1 Switches shall be installed at 900 mm above finished floor level unless otherwise indicated on the drawings

4.12.2 The switch controlling the light point or fan shall be connected on to the phase wire of the circuit and neutral shall be continuous, having no fuse or switch installed in the line except at the D.B. All fan regulators shall be fixed inside the switch boxes

on adjustable flat M.S. strips/plates with tapped holes and brass machine screws, leaving ample space at the back and side for accommodating wires

4.12.3 The cover plates to the switch box shall be fixed by means of sunk head brass cadmium screws

4.12.4 Where two or more switches and fan regulators are installed together, they shall be provided with one gang cover plate with knockouts to accommodate required number of switches, sockets and regulators

4.12.5 The switch controlling the socket outlet shall be on the phase wire of the circuit. The third pin of the socket shall be connected to the earth continuity conductor of the circuit

4.12.6 The switch boxes, installed back-to-back in the same wall shall be offset from each other, 150 mm horizontally, to preclude noise transmission

4.13 DRAWING OF CONDUCTORS

4.13.1 The drawing and joining of copper conductor or wires shall be executed with due regard to the following precautions. While drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. There shall be no sharp bends

4.13.2 Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or ringing

4.13.3 HFFR insulated copper conductor wire ends before connection shall be properly soldered (at least 15 mm length) with soldering flux/copper solder, for copper conductor. Strands of wires shall not be cut for connecting to the terminals. All strands of wires shall be soldered at the terminals. All strands of wires shall be soldered at the end before connection. The connecting brass-screws shall have flat ends. All looped joints shall be soldered and connected through terminals block/connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. Conductors having nominal cross section exceeding 4 sq. mm shall always be provided with crimping type cable sockets. At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used. Brass nuts and bolts shall be used for all connections

4.13.4 Only certified wire men and cable jointers shall be employed to do joining work

4.13.5 For all internal wiring HFFR insulated wires of 650/1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in looping system and no joint shall be allowed in the length of the conductors. No wire shall be drawn in to any conduit, until all work of any nature that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduits the conduits shall be thoroughly cleaned of moisture, dust, and dirt or any other obstruction by forcing compressed air through the conduits

4.14 JOINTS

4.14.1 The wiring shall be by looping back system, and hence all joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made inside conduits and junction boxes.

4.14.2 Contractors shall be continuous from outlet to outlet. For joints where unavoidable, due to any specified reasons, prior permission in writing shall be obtained from the client before making such connections. Joints by twisting conductors are prohibited.

4.15 **LOAD BALANCING**

4.15.1 Balancing of circuit in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to

4.16 **EARTHING**

4.16.1 All earthing systems shall be in accordance with IS: 3043 - 1985 code of practice for earthing.

I) TECHNICAL SPECIFICATIONS FOR INSTALLATION OF EARTHING SYSTEM

TECHNICAL SPECIFICATIONS FOR INSTALLATION OF EARTHING SYSTEM

1.0 SCOPE OF WORK

1.1 This specification intended to cover assembly, installation and testing of earthing system complete in all respect with all equipments, fittings and accessories for efficient and trouble-free operation. The material to be supplied by the Contractor and work to be carried out by the Contractor shall be in general, but not limited to, conforming to the specification laid down for each item.

2.0 CODES & STANDARDS

2.1 The design, material, assembling, inspection and testing shall comply with all currently applicable statutes, regulations and safety codes in the locality where the system will be installed. The equipment shall also conform to the latest applicable standards and codes of practice as mentioned below.

2.2

Sr.	Item	Relevant IS
1	Code of Practice for Earthing	IS 3043
2	Insulation Co-ordination Application Guide	IS 3716
3	Code of Practice for Protection of Buildings and Allied Structures against Lightning	IS 2309
4	Indian Electricity Rules, 1956	
5	Indian Electricity Act, 1910	

6	National Electrical Code	

3.0 MATERIALS REQUIRED

3.1 All required hardware such as bolts, nuts, washers (round and spring type), anchor fasteners, screws, etc. of sizes and type as required shall be conforming to relevant IS. All hardware shall be hot-dip galvanized or zinc passivated /cadmium plated as per requirement of work either mechanical fabrication or electrical jointing.

3.2 All other items required for installation shall be as approved by site in-charge.

4.0 INSTALLATION OF SYSTEM

4.1 The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case less than 3 M below finished ground level

4.2 The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column

4.3 The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture

4.4 20 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber

4.5 Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe

4.6 The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing

4.7 The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry

4.8 Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS: 3043, Code of Practice for Earthing Installation.

4.9 The earth conductors (Strips / Wires, Hot dip G.I. / copper) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Hot Dip GI screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level/

4.10 The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished

4.11 Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long and bitumen coated.

4.12 The earth conductors shall be in one length between the earthing grid and the equipment to be earthed

4.13 Minimum distance of 2 mtr shall be maintained between other electric conductor, earthing conductor and the conductor laid for the lightning protection system. Earthing and lightning protection system conductors shall be bonded to each other to prevent side flashover in case of non-availability of adequate clearance.

4.14 The earthing met conductors, risers, earthing cables, etc. passing through walls shall be covered with galvanized iron sleeves for the passage through wall. Water stop sleeves shall also be provided wherever the earthing conductor enters the building from outside.

5.0 INSPECTION AND TESTING

5.1 The following earth resistance values shall be measured with an approved earth megger and recorded.

- Each earthing station
- Earthing system as a whole
- Earth continuity conductors

5.2 Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 ohm in each case. In case of more earth resistance, the Contractor shall have to carry out necessary modification in the system without any cost implication to the Client.

5.3 Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed

5.4 All tests shall be carried out in presence of the consultant / client and report should be submitted in two sets.

J.) ERECTION, TESTING & COMMISSIONING OF ELECTRICAL INSTALLATIONS

ERECTION, TESTING & COMMISSIONING OF ELECTRICAL INSTALLATIONS

1.0 SCOPE OF WORK

1.1 The intent of this specification is to define the requirements for the installation, testing and commissioning of the electrical system like H.T VCB panel, transformer, L.T. panels, Cables, earthing network, Internal and External lighting, Light fixtures etc.. Requirement of this project shall be as specified in bill of quantities / approved drawings / general specifications or as per the battery limits fixed by the owner / consultant.

2.0 STANDARDS

2.1 1. The work shall be carried out in the best workman like manner in conformity with this specification, the relevant specification / codes of practice of the Indian Standards Institution, approved drawings and the instructions issued by

the authorised representative, from time to time. Some of the relevant Indian Standards are listed elsewhere in this tender document.

2. In addition to the standards mentioned in 2.1, all works shall also conform to the requirement of the following :
3. Indian Electricity Act and Rules framed there under.
4. Fire Insurance Regulations.
5. Regulations laid down by the Chief Electrical Inspector of the State / State Electricity Board / Union Territory.
6. Regulations laid down by the Factory Inspector of the State / Union Territory.
7. Any other regulations laid down by the local authorities.
8. Installation & operation manuals of original manufacturers of equipment.

3.0 ERECTION

3.1 The contractor shall make his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading / unloading during transportation. Equipment shall not be removed from packing cases unless the floor has been made ready for installing them. The cases shall be opened in presence of the client / consultant or his authorised representative. The empty packing cases shall be returned to the stores and any document if found with the equipment shall be handed over to the client's representative. Any damage or shortage noticed shall be reported to the client / consultant in writing immediately after opening of packing cases.

3.2 ONAN TYPE TRANSFORMER

1. Erection

Transformer complete with radiators, bushings, conservator and miscellaneous accessories shall be thoroughly inspected and any damage noticed shall be reported to the client / consultant. Before erection of transformer, the level of rails on foundation shall be checked and minor corrections if necessary shall be carried out. After the completion of erection, necessary stoppers shall be provided at the wheels. All loosely supplied fittings / accessories shall be cleaned and mounted on the transformer and connections made. After completely assembling & installation, the transformer shall be cleaned and touched up with a paint supplied by the manufacturer applied wherever necessary. All cover bolts shall be checked for proper tightness. (The foundation of transformer and rail fixing will be made by some other agency).

2. Testing

Winding insulation resistance shall be measured from primary and secondary to ground and between primary and secondary.

Test the operation of thermister type sensor relay in accordance with the manufacturer’s instructions.

Check the polarity of terminals and the phase sequence.

Proforma for transformer tests :

3. Proforma for transformer tests :

- Transformer name plate.
- Insulation resistance test with 1000 V meagre.

  a) between primary to earth

  b) between secondary to earth

  c) between primary and secondary
- Operation of the tap changer.

  Operation of the tap at tap No. 1

  Operation of the tap at tap No. 2

  Operation of the tap at tap No. 3

  Operation of the tap at tap No. 4

  Operation of the tap at tap No. 5
- Polarity marking and phase sequence.
- Earth resistance: Body & Neutral tank.

[This proforma shall be jointly signed by the CLIENT/ CONSULTANT and the contractor in duplicate].

3.3 POWER CONTROL CENTER / MOTOR CONTROL CENTER, DISTRIBUTION BOARDS

1. Erection

Electrical panels and bus duct shall be delivered in convenient shipping section by the manufacturer. The contractor shall make his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading / unloading during transportation. The contractor shall be responsible for final assembly and interconnection of busbars / wiring. Foundation channel shall be grouted in the flooring by the contractor. Switchgear shall be aligned and levelled on their base channels and bolted to them as per the instructions of the client / consultant. The earth bus shall be made continuous throughout the length. Loosely supplied relays and instruments shall be mounted and connected on the switchgear. The contacts of the drawout circuit breaker shall be checked for proper alignment and interchangeability.

After erection, the switchboard shall be inspected for dust and vermin proof. Any hole which might allow dust or vermin etc. to enter the panel shall be plugged suitably at no extra cost. If the instrument transformers are supplied separately, they shall be erected as per the direction of the client / consultant. The contractor shall fix the cable glands after drilling the bottom / top plates of all switchboards with suitable holes at no extra cost.

Range of overload relays / timers etc. shall be checked with requirement of motor actually to be connected at site and if the same is undersized / oversized, it shall be brought to the notice of the client / consultant, who shall arrange procurement of corrected components. However, the contractor shall not charge anything extra for labour for such replacements.

The busduct shall be suitably supported between switchgear and transformer. The opening in the wall where the duct enters, the switchgear room shall be sealed to avoid rain water entry. The foundation of the switchgear shall be raised suitably for minor adjustment to ensure proper alignment and connection of the busduct at no extra cost. Expansion joints, flexible connection, etc. supplied by the manufacturer / contractor of the busduct shall be properly connected.

2. Testing

Before electrical panel is energised, the insulation resistance of each bus shall be measured from phase to ground. Measurement shall be repeated with circuit breakers in operating positions and contacts open.

Before switchgear is energised, the insulation resistance of all control circuits shall be measured from line to ground.

The following tests shall be performed on all circuit breakers during erection.

- Contact alignment and wipe shall be checked and adjustment where necessary in accordance with the breaker manufacturer's instructions.
- Each circuit breaker shall be drawn out of its cubicles, closed manually and its insulation resistance measured from phase to phase and phase to ground.
- All adjustable direct acting trip devices shall be set using values given by the consultant/ manufacturer.
- The dielectric strength of insulating oil wherever applicable, shall be checked.
- Before switchgear is energised, the following tests shall be performed one each circuit breaker in its test position.
- Close and trip the circuit breaker from its local control switch push button or operating handle. Switchgear control bus may be energised to permit test operation of circuit breaker with A.C. closing with prior permission of the client / consultant.
- Test tripping of the electrically operated circuit breaker by operating mechanical trip device.
- Test proper operation of circuit breakers latch, check carriage limit switch if provided. Test proper operation of lockout device in the closing circuit. Wherever provided by simulating conditions which would cause a lockout to occur.
- Trip breaker either manually or by applying current or voltage to each of its associated protective release.
- Before switchgear is energised, the tests covered above shall be repeated with each breaker in its normal operating position.
- Capacitor banks shall be tested as per manufacturer's instructions. In addition, test for output and/or capacitance, insulation resistance test and test for efficiency of discharge device shall be carried out.
- All electrical equipment alarms shall be tested for proper operation by

causing alarms to sound under simulated abnormal conditions.

3. Performa For PCC, MCC, DB, Control Panel Test

- Circuit breaker or contactor module designation / bus no.
- Insulation resistance test (contacts open, breaker racked in position)

a) between each phase of bus :Mega ohm

b) between each phase and earth :Mega ohm

c) DC and AC control and auxiliary circuits :Mega ohm

d) between each phase of CT / PT and between CT & PT circuit if any :Mega ohm

- CT checks

a) CT ratio

b) CT secondary resistance

c) CT polarity check

5. Check for contact alignment and wipe.
4. Check / test all releases / relays.
5. Check mechanical interlocks.
6. Check electrical interlocks.
7. Check switchgear / control panel wiring.
8. Check breaker / contactor circuit for :

a) Closing - local & remote (wherever applicable)

b) Tripping - local & remote (wherever applicable)

10. Opening time of breaker / contactor.
11. Closing time of breaker / contactor.

[This proforma shall be jointly signed by the CLIENT / CONSULTANT and the contractor in duplicate].

3.4 INSTALLATION OF CABLE NETWORK

Cable network shall include power, control and lighting cables which shall be laid in underground trenches, hume pipe open trenches, cable trays, G.I. pipes, or on building structures as detailed in the relevant drawings, cable schedules or as per the client / consultant's instructions. Supply & installation of cable trays, G.I. pipes / conduits, cable glands and sockets of both end isolators, junction boxes, remote push button stations, etc. shall be under the scope of the contractor.

1. General requirements for handling cables :

- Before laying cables, this shall be tested for physical damage, continuity, absence of cross phasing, insulation resistance to earth and between conductors. Insulation resistance tests shall be carried out with 500 / 1000 V megger.
- The cables shall be supplied at site, wound on wooden drums as far as possible. For smaller length and sizes, cables in properly coiled form can be

accepted. The cables shall be laid by mounting the drum of the cable on drum carriage. Where the carriage is not available, the drum shall be mounted on a properly supported axle, and the cable laid out from the top of the drum. In no case the cable will be rolled on as it produces kinks which may damage the conductor.

- Sharp bending of cable shall be avoided. The bending radius for PVC insulated and sheathed, armoured cable shall not be less than 10 D, where "D" is overall diameter of the cable.

- While drawing cables through G.I. pipes, conduits, RCC pipes, ensure that size of pipe is such that, after drawing cables, 40% area is free. After drawing cables, the end of pipe shall be sealed with cotton / bituminous compound.

- High voltage (11 KV and above), medium voltage (240 V and above) and other control cables shall be separated from each other by adequate spacing or running through independent pipes / trays.

- Armoured cables shall never be concealed in walls / floors / roads without G.I. pipes, conduits or RCC pipes.

- Joints in the cable throughout its length of laying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed, proper straight through epoxy resin tight joint shall be made, without any additional cost.

- A minimum loop of 3 mtr. shall be provided on both ends of the cable, and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying.

- Cable shall be neatly arranged in the trenches / trays in such manner so that criss-crossing is avoided and final take off to the motor / switchgear is facilitated. Arrangement of cable within the trenches / trays shall be the responsibility of the contractor.

- All cable routes shall be carefully measured and cable cut to the required lengths and undue wastage of cables to be avoided. The routes indicated in the drawings is indicative only and the same may be rechecked with the client / consultant before cutting of cables. While selecting cable routes interference with structures, foundations, pipelines, future expansion of buildings etc. should be avoided.

- All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all PVC insulated cables shall be taped with an approved PVC or rubber insulating tapes. Use of friction type or other fabric type tape is not permitted. Lead sheathed cables shall be plumbed with lead alloy.

- Wherever cable rises from underground / concrete / masonry trenches to motors / switchgears / push buttons, these shall be taken in G.I. pipes of suitable size, for mechanical protection upto 300 mm. distance of concerned cable gland or as instructed by the client / consultant.

- The cable pass through foundation / walls of other underground structures, the necessary ducts for opening will be provided in advance for the same. However, should it become necessary to cut holes in existing foundation of structures the electrical contractor shall determine the location and obtain

approval of the client / consultant before cutting is done.

2. LAYING OF CABLES (UNDERGROUND SYSTEM)

Cables shall be so laid in trench that this will not interfere with other underground structure. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded / diverted as directed by the owner / consultant.

- Cable shall be laid at minimum depth of 750 mm. in case of L.T. and 1200 mm. in case of H.T. from ground level. Excavation will be generally in ordinary alluvial soil. The width of trench shall be sufficient for laying of required no. of cables.
- Sand bedding 75 mm. thick shall be made below and above the cables. Layer of bricks (full size) shall be laid above sand bedding on the sides and above the of cables to cover cable completely. More than one cable can be laid in the same trench by providing a brick on edge between two cables. However, the relative location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction of the client / consultant.

- For all underground cables, route markers should be used :

a) Separate route markers should be used for LT, HT and telephone cables.

b) Route markers should be grounded in ground with 1:2:4 cement concrete pedestal size 230 x 230 x 300 mm..

c) Cable markers should be installed at an interval not exceeding 30 mtr. along the straight routes of cables at a distance of 0.5 mtr. away from centre of cable with the arrow marked on the cable markers plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.

- RCC hume pipe for crossing road in cable laying shall be provided by employer. No deduction shall be made for cable laying in hume pipe for not providing bricks, sand and excavation. RCC hump pipe at the ends shall be sealed by bituminous compound after laying and testing of cables by electrical contractor without any extra charge.

3. LAYING OF CABLE IN MASONRY TRENCHES

- Masonry / concrete trenches for laying of cables shall be provided by employer. However, steel members such as M.S. angles / flats etc. shall be provided and grouted by electrical contractor to support the cables without any extra charge. Cables shall be clamped to these supports with minimum saddles / clamps. More than one tier of cables can be provided in the same trench if the no. of cables are more.
- Entry of cables in trenches shall be sealed with bituminous MASTIC compound to stop entry of water in trenches.

4. LAYING OF CABLES IN CABLE TRAYS

- Cable trays and steel members such as M.S. angle / channel / flats etc. shall be provided and fixed by the erector.
- Cable shall be fixed in cable trays in single tier formation and cables shall be clamped with aluminium flat clamps and galvanised bolts / nuts.
- Earthing flat / wire can also be laid in cable tray alongwith cables.
- After laying of cables, minimum 20% area shall be spare.

5. TERMINATION AND JOINTING OF CABLES

a) For HT cables suitable size of Reychem termination kit shall be used.

b) Use of glands :

All PVC cables upto 1.1 KV grade, armoured or unarmoured shall be terminated at the equipment / junction box / isolators / push buttons / control accessories, etc. by means of suitable size double compression type cable glands. Armour of cable shall be connected to earth point. The contractor shall drill holes for fixing glands wherever necessary. Wherever threaded cable gland is to be screwed into threaded opening of different size, suitable galvanised threaded reducing bushing shall be used of approved type.

In case of termination of cables at the bottom of the panel over a cable trench having no access from the bottom, a close fit holes should be drilled in the bottom plate for all the cables in one line, then bottom plate should be split in two parts along the centre line of holes. After installation of bottom plate and cables with glands, it shall be sealed with cold sealing compound.

- USE OF LUGS / SOCKETS

All cable leads shall be terminated at the equipment terminals, by means of crimped type solderless connectors unless the terminals at the equipment ends are suitable for direct jointing without lugs / sockets.

The following is the recommended procedure for crimped joints and the same shall be followed :

a) Strip off the insulation of the cable and with every precaution, not in severe or damage any strand. All insulation's to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.

b) The cable should be kept clean as far as possible before assembling it with the terminal / socket. For preventing the ingress of moisture and possibility of re-oxidation after crimping of the aluminium conductors, the socket should be filled with corrosion inhibiting compound. This compound should also be applied over the stripped potion of the conductor and the palm surface of socket.

c) Correct size and type of socket / ferrule / lug should be selected depending on size of conductor, and type of connection to be made.

d) Make the crimped joint by suitable crimping tool.

e) If after crimping the conductor in socket / lug, some portion of the conductor remains without insulation the same should be covered sufficiently with PVC tape.

f) For HT cable upto 11 KV the manufacturer's recommendation should be

followed.

- DRESSING OF CABLE INSIDE THE EQUIPMENT

  After fixing of cable glands, the individual cores of cable shall be dressed and taken along the cable ways (if provided) or shall be fixed to the panels with polyethylene straps. Cable shall be dressed in such a manner that small loop of each core is available inside the panel.

  For motors of 20 HP and above, terminal box if found not suitable for proper dressing of aluminium cables, the erector shall modify the same without any additional cost.

  Cables inside the equipment shall be measured and paid for.

- IDENTIFICATION OF CABLES / WIRES / CORES

  Power cables shall be identified with red, yellow and blue PVC tapes. For trip circuits identification, additional red ferrules shall be used only in the particular cores of control cable at the termination points in the switchgear / control panels and control switches.

  In case of control cables all cores shall be identified at both ends by their wire numbers by mean of PVC ferrules or self sticking cable markers, wire numbers shall be as per schematic / connection drawing. For power circuit also, wire numbers shall be provided if required as per the drawings of switchgear manufacturer / supplier.

6. TESTING OF CABLES

- Before energising, the insulation resistance of every circuit shall be measured from phase to ground. This requires 3 measurements if one side is grounded and 6 measurements for 3 phase circuits.
- Where splices or terminations are required in circuits rated above 650 volts, measure insulation resistance of each length of cable before splicing and/or terminating. Repeat measurements after splices and/or terminations are complete.
- DC high voltage test shall be made after installation on the following :

a) All 1100 volts grade cables in which straight through joints have been made.

b) All cables above 1100 V grade.

For record purpose test data shall include the measured values of leakage current versus time.

The DC high voltage test shall be performed as detailed below :

Cables shall be installed in final position with all the straight through joints complete. Terminations shall be kept unfinished so that motors, switchgear, transformer etc. are not subjected to test voltage.

The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution.

- PROFORMA FOR TESTING CABLES

DATE OF TEST

a) Drum No. from which cable taken.

b) Cable from to

c) Length of run of this cable meter

d) Insulation resistance test

i) between core-1 to earth mega-ohm

ii) between core-2 to earth mega-ohm

iii) between core-3 to earth mega-ohm

iv) between core-1 to core-2 mega-ohm

v) between core-2 to core-3 mega-ohm

vi) between core-3 to core-1 mega-ohm

vii) duration used : 1 KV

e) High voltage test Voltage Duration

i) between core an earth.

ii) between individual cores

[This proforma shall be jointly signed by the CLIENT / CONSULTANT and the contractor in duplicate].

4.0 EARTHING NETWORK

4.1 INSTALLATION AND CONNECTION

1. The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 3 M below finished ground level.
2. The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column.
3. The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.
4. 19 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber.
5. Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe.
6. The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber.
7. The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.

8. Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS : 3043, Code of Practice for Earthing Installation.
9. The earth conductors (Strips / Wires copper / Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanised Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conductors outside the building shall be laid atleast 600 mm. below the finished ground level.
10. The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.
11. Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.
12. The earth conductors shall be in one length between the earthing grid and the equipment to be earthed

4.2 EARTH LEADS AND CONNECTIONS

1. Earth lead shall be bare copper or Galvanised steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. G.I. strip buried in the ground shall be protected with bitumen and hessian wrap or polythene faced hessian and bitumen coating. At road crossing necessary hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is atleast 8 mm away from the wall surface.
2. The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

4.3 TEST

1. The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS : 3043.
2. The following earth resistance values shall be measured with an approved earth megger and recorded.
   1) Each earthing station
   2) earthing system as a whole
   3) Earth continuity conductors
3. Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 5 ohm in each case.
4. Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.
5. All tests shall be carried out in presence of the Pmc

5.0 CONCEALED / SURFACE CONDUIT WORKS

5.1 LAYING OF CONDUITS

1. Conduits shall be laid before casting in the upper portion of a slab / in PCC if below flooring or otherwise, as may be instructed in accordance with approved drawings, so as to conceal the entire run of conduits and ceiling outlet boxes. Conduits shall be so laid that they are interconnected. This is required to facilitate pulling of wires from different openings in case of any of the outlet is outlet is blocked during slab casting. Vertical drops shall be cut by the contractor to sufficient depth to allow full thickness of plaster over conduits. The width of the chases will be made to accommodate the required number of conduits. The chases will be filled with cement, coarse
2. When the conduit is to be embedded in a concrete member it shall be adequately tied to the reinforcement to prevent displacement during casting. Tie wire to be supplied by the contractor.
3. Cutting of chases in any RCC member / finished floor / already finished surface is not allowed unless prior approval of Site Engineer is taken in site instruction book. If a chases is cut in an already finished surface, the contractor shall fill the chases and finish it to match the existing finish including painting at his cost to Site Engineer's satisfaction.
4. Contractor shall not cut any iron bars to fix the conduits. Puncher of wooden / steel shuttering for RCC slab / beams / column etc. for conduit work is also not allowed, unless Site Engineer permits in site instruction book under special conditions.
5. Run of conduit pipe through expansion joints in RCC members should be avoided as far as possible and if unavoidable, flexible conduit pipe should be used with ceiling outlet box on both sides of expansion joints.
6. Conduit on surface of RCC walls / RCC members shall be avoided as far as possible and if unavoidable prior approval of Site Engineer on sample saddles, clamps screws and a minimum 5 mtr. conduit laid on surface shall be taken, to achieve best possible workmanship. Distance between 2 consecutive clamps for fixing conduit on surface shall not exceed 900 mm. wooden patties for fixing saddles / clamps shall be used. Use of roll plug / steel fastener with hard setting / sealing compound is recommended.
7. In case of stone masonry, necessary conduits with M.S. boxes should be placed as the masonry is in progress, since after completing masonry, it is very difficult to cut chases in wells. Special location of cement concrete shaft is also recommended to conceal conduit in stone masonry and the same shall be provided by client / consultant.
8. In ground floor conduiting below the flooring should be avoided. Wherever it is unavoidable G.I. pipe should be used with prior approval of Site Engineer.

5.2 CEILING / WALL OUTLET BOXES FOR LIGHTS / FANS

1. Outlet boxes shall be of steel with aluminium cover and so installed as to maintain continuity throughout. These shall be protected at the time of laying by filling with jute / earth / cotton etc. so that no cement mortar finds its way inside during concreting or plastering etc. Typical sketches for such outlet boxes shall be supplied alongwtih other working drags. In beams conduit socket shall be provided in place of outlet boxes. The same shall be used for installation of luminaire.
2. For fixing light fixtures / brackets, outlet boxes complete with check nut for

holding conduits shall be used. For lighting fixture suitable for 20 watts fluorescent tubes / incandescent lamps / mercury vapour lamps, only one outlet box is required. For fixing lighting suitable for 40 watts fluorescent lamps, two numbers outlet boxes should be provided at a distance of 300 mm. away from the centre in the longitudinal direction of the fixture, so that the use of patties / roll plug etc. may be avoided, as well as wiring from outlet box to the light fitting is to be installed in RCC beam and due to heavy reinforcement at the bottom of beam it is not possible to provide outlet boxes simple conduit should be provided. However alternative fixing arrangement shall be made in consultation with client / consultant.

3. For fixing ceiling fans, circular outlet boxes, 100 mm. diameter, complete with 12 mm. dia. Mild Steel rod 300 mm. long, for holding 12 mm. dia. Mild Steel cover 125 mm. dia. at bottom shall be used.

5.3 DRAW OUT JUNCTION BOXES

Steel drawout boxes at angle dimensions shall be provided at a convenient points on walls / ceilings to facilitate pullling of long runs of cables / wires. These shall be completely concealed with AnodisedAluminium, flush with plaster works. These draw boxes should be five sided. The location of these boxes is to be decided prior to fixing, as per site requirement and following should be treated as general guidance for deciding the location of these :

1. These should be provided at a place where these are not in direct view. Recommended place is 400 / 450 mm. below ceiling, if conduits are running vertically.
2. Junction box in the offset of bottom of RCC beam and vertical wall should not be provided.
3. If junction boxes are coming side by side for two or more conduits, one common M.S. box of proper size can be used to act as junction box.
4. If junction box is to be provided in ceiling, its position should be so located that it is in line with other light / fan points.
5. Junction boxes should never be used for splitting one conduit into two or more. Junction box for such functions is avoidable and for this, number of conduits to be connected to one switch board should be calculated correctly as per drawing before laying conduits in ceiling.
6. Locating junction boxes on outer surface of exterior walls of building should be avoided as these are in direct view and are also exposed to weather.
7. Junction boxes should never be closed permanently by plaster. Removable covering of aluminium should be provided for conduit junction boxes for M.S. junction boxes removable hylem plate should be provided. This cover may be painted with wall colour.
8. Junction boxes in important areas should be avoided and can be located in toilets / corridors / service shafts and stores etc.

5.4 SWITCH BOXES

Steel boxes of required sizes, shall be provided to house speed regulators of fans, switches for lights, fans, plug sockets etc. as per requirement of drawings. These should be so designed that accessories on Anodisedaluminium sheet could be mounted with tapped holes and brass machine screws, leaving

ample space at the back and on the sides for accommodating wires and check nuts at conduit entries. These shall be attached to conduits by means of check nuts on all walls of the boxes through which the conduits are entering. These shall be completely connected leaving edges flush with finished wall surfaces. Anodisedaluminium cover should be fixed to these switch boxes by means of brass chrome plated machine screws and cup washers. Utmost care shall be taken by contractor to ensure that all switch boxes are in line and level.

Inside each switch box, one bolt shall be welded to receive earthing wire.

5.5 SWITCH AND SOCKET

Switches shall be installed at 900 mm above finished floor level unless otherwise indicated on the drawings.

The switch controlling the light point or fan shall be connect on to the phase wire of the circuit and neutral shall be continuous, having no fuse or switch installed in the line except at the D.B. All fan regulators shall be fixed inside the switch boxes on adjustable flat M.S. strips / plates with tapped holes and brass machine screws, leaving ample space at the back and side for accommodating wires.

The cover plates to the switch box shall be fixed by means of sunk head brass cadmium screws.

Where two or more switches and fan regulators are installed together, they shall be provided with one gang cover plate with knockouts to accommodate required number of switches, sockets and regulators.

The switch controlling the socket outlet shall be on the phase wire of the circuit. The third pin of the socket shall be connected to the earth continuity conductor of the circuit

The switch boxes, installed back-to-back in the same wall shall be offset from each other, 150 mm horizontally, to preclude noise transmission.

5.6 CLEANING AND PROTECTION OF CONDUIT SYSTEM

The entire conduit system including outlet boxes, junction boxes and switch boxes shall be thoroughly cleaned after completion of erection and tested for not blockage by air / sound or steel wire prior to finishing of building by air / sound or steel wire prior to finishing of building and before drawing in of cables / wires to safeguard conduit system against filling up with the plaster / cement slurry / water etc. all the outlet and switch boxes will have to be provided with temporary jute / cotton filling, covers and plugs etc.. Within tendered cost which shall be replaced later on by hylem / sheet cover after wiring as required.

5.7 TESTING OF INSTALLATION

Before a completed installation is put into service, the following tests shall be complied with:

. INSULATION RESISTANCE

The insulation resistance shall be measured by applying 500 volt megger with all fuses in places, circuit breaker and all switches closed.

The insulation resistance in gegohms of an installation, measured shall not be less than 50 megohms divided by the number of points on the circuit.

The insulation resistance shall be measured between

EARTH TO PHASE

EARTH TO NEUTRAL

PHASE TO NEURAL

PHASE TO PHASE

2. EARTH CONTINUITY PATH

The earth continuity conductors shall be tested for electrical continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit-breaker, measured from the connection, with the earth electrode to any point in the earth continuity conductor in the completed installation and shall not exceed one ohm.

3. POLARITY OF SINGLE POLE SWITCHES

A test shall be made to verify that every no-linked, single pole switch is connected to one of the phase of the supply system.

4. COMPLETION CERTIFICATES

All the above tests shall be carried out in presence of client and the results shall be recorded in prescribed forms. Any default during the testing shall be immediately rectified and that section of the installation shall be re tested. The completed test result from shall be submitted to the client for approval.

On completion of an electric installation a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form as required by the local electric supply authority.

6.0 INSTALLATION OF LIGHTING FIXTURES / FANS

6.1 INSTALLATION OF LIGHTING FIXTURES

Scope of work under this item shall start from light point, with a 5 A bakelite connector, 2 core 1.5 mm.² PVC insulated wires from this connector to the connector inside the lighting fixture, connections, fixing of lighting fixture complete with all accessories, lamps on wall / roof / steel truss etc. testing the lighting fixture and commissioning. If wire length of light point is enough to reach connector of light fitting, connector in light point can be deleted.

6.2 INSTALLATION OF EXHAUST FANS

Scope of work under this system shall start from exhaust fan point, with a ceiling rose, 2 core 2.5 mm.² PVC insulated wire from ceiling rose to connector of exhaust fan, connections, making fan opening in walls including repair / finishing fixing of exhaust fan complete with accessories and louvers on walls with hold-fasts, testing the exhaust fans and commissioning.

7.0 INSTALLATION OF EXTERNAL LIGHT FIXTURES

7.1 BRACKET FOR STREET LIGHT FITTINGS

The brackets shall be made of 38 mm. NB MS class “B” pipe approx. 1.8 mtr. long bent at the centre at an angle 120° C. with necessary holding brackets, hold fasts etc. with special reducer at the end to accommodate type of street light fitting to be fixed. Bracket shall have 1 coat of anti-corrosion paint before despatch to site and

2 coats of approved make and shade of aluminium paint. This bracket shall also be provided with one M.S. water tight box complete with the connector, neutral link, rewireable fuse etc.. See enclosed drawings of street light poles.

7.2 INSTALLATION OF POLES

Installation of poles shall be done as per enclosed drawings of street light poles. The depth of pole to be burried in ground shall be 1/5th of the total pole length or as specified in drawing, whichever is more. Special care shall be taken in erecting poles so that these are not strained or damaged during erection and are firmly stayed till the foundation are secured. The pole shall be grouted inside ground pit (cross-section 600 x 600 mm.) with cement concrete 1:2:4. Before the placement of concrete around pole in the pit, necessary conduit pipes (not less than 25 mm. dia.) shall be placed for facilitating drawing of cables. Separate conduit shall be provided for incoming and outgoing cables. The cement concrete shall be protected from prematured drying by curing for atleast 7 days after pouring. All concrete surface from 150 mm. below ground level to top shall be finished smooth with cement mortar 1:4.

7.3 INSTALLATION OF STREET LIGHT FIXTURES

This includes fixing of street light fittings complete with accessories and lamps at the end of the pole / bracket, connecting it with 3 x 2.5 mm.² aluminium conductor, PVC insulated cable from water tight M.S. box, testing, commissioning. Third core shall be connected with earthing point of light fitting at one end and earthing point of marshalling box at the other end.

7.4 GENERAL NOTES FOR STREET LIGHTING

1. For supplying and laying of cables, technical specification (wiring) shall be applicable reference shall be made under heading Cable Work elsewhere in the tender.
2. For street light poles along roads, nearest finished road level shall be taken as ground level and for poles along compound wall / away from roads, existing ground / finished ground shall be taken as ground level.
3. Distance of 1 mtr. shall be maintained between centre of pole and centre of curb of road. For compound wall poles, distance between compound wall and poles shall be 3 mtrs.
4. A loop of 1.5 mtr. of cable shall be provided near each street light pole for all incoming and outgoing cable.

8.0 COMPLETION TESTS

8.1 After supply and installation of complete project or a particular building / area, following tests shall be carried out by the contractor before switching on the power to installation and the results shall be recorded and submitted to the Site-Engineer. If results are not satisfactory / as per standards set herewith, the contractor shall identify the defects / short coming and shall rectify the same. Nothing extra shall be paid for carrying out these tests and contractor has to arrange all necessary instruments.

8.2 INSULATION RESISTANCE TO EARTH

This is to be measured with all fuse links in place, all switches ON, all lamps and

appliances in position by applying a voltage not less than twice the working voltage (subject to a limit of 500 V). Insulation resistance of the whole or any part of the installation to earth must not be less than 50 mega-ohms divided by the number of outlets (points and switch positions) except that it need not exceed one mega-ohm for the whole installation.

8.3 **INSULATION RESISTANCE BETWEEN CONDUCTORS**

Tests to be made between all the conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or neutral or the other pole or phase conductors of the supply. For this test, all lamps shall be removed and all switches put ON. The result of the test must be 50 mega-ohms divided by the number of outlets (points and switch positions) but need not exceed 1 mega-ohm for the whole installation.

8.4 **POLARITY OF SINGLE POLE SWITCHES**

Tests shall be made to verify that all non-linked single pole switches are on phase conductor (live) and not on neutral or earth conductor. This can be done by connecting test lamps between two terminals of switch and earth. If the lamp lights up when switch is ON and either terminal is touched, the switch is correctly installed.

RESISTANCE OF METAL CONDUITS / SHEETS (EARTH CONTINUITY TEST)

In case of cables encased in metal whether conduit of metallic sheathing, the total resistance of the conduit or sheathing from the earthing point any other position in the completed installation shall not exceed 2 ohms. This can be carried out by following circuit :

One end of the load is connected to the ECC and its connection with the electrode and the other to the farthest point of the ECC. First, current through the circuit is measured with the resistance of 2 ohms short circuited by the link. Next, current is measured through the two ohms resistance by disconnecting the two leads from the ECC and joining them together. If current is more in the first case, the resistance of ECC is less than 2 ohms.

9.0 HANDING OVER / TAKING OVER

9.1 After completion of works and tests specified above, the various building of the project can be taken over by the employer as and when these are ready in all respects. However, the defect liability period of 12 months would start from the date, when all the buildings of the project have been completed and handed over, unless employer agrees for defect liability period in phased due to non-completion of civil work of few buildings for which electrical contractor is not responsible.

10.0 HANDING OVER / TAKING OVER

The Tenderer shall indicate the makes of tools, test equipment and other item listed below:

1. TOOLS

A. Set of spanners of sizes 6 mm to 32 mm width across flat

- Adjustable wrench of 36 mm jaw width

- Adjustable wrench of 23 mm jaw width

B. Heavy duty screw driver with full size insulated handle and blade length of

- 100 mm
- 50 mm
- 200 mm

2. TEST EQUIPMENT

A. 2500 V megger motor operated

B. 500 V megger hand operated

C. Multimeter (Battery operated) satisfying the following

- With 0-1 mA, 0-100 mA, 0-1A and 0-5A, AC & DC current ranges
- With 0-100 mV, 0-3V, 0-30 V, 0-300 V and 0-1000V AC & DC voltage ranges
- The resistance ranges shall be atleast five (0-100) m ohm, (0-1) Ohm, (0-10) Ohm, (0-100) Ohm, (0-100) mega ohm
- The Input impedance shall not be less than one mega Ohms for voltage ranges

3. LADDERS

Ladder shall be made out of light aluminium alloy of good strength. They shall be of step ladder, foldable, self-supporting type with spreader of metallic angles or high strength nylon straps. The ladder shall be provided with shoes on bottom of legs. Rugs shall be flat type having thickness of 30 mm in case of 3 meters long ladders and 60 mm for 6 metres long ladder.

- 3 metres long
- 6 metres long

4. Tong tester - ammeter range 0 to 30, 150 & 300 Amps AC and voltmeter (0-600) V, class 1.0 with leads and leather case.

SR.NO.	ITEM	STANDARD MAKE
1	DISTRIBUTION BOARDS	LEGRAND/HAGER /SCHNEIDER/C&S Electric/ SIEMENS
2	MEDIUM VOLTAGE CABLE	FINOLEX / RRKABLE/ HAVELLS

SR.NO.	ITEM	STANDARD MAKE
3	CABLE TRAY	INDIANA/OBO BETTERMAN/LEGRAND/PROFAB
4	INVERTER	APC/MICROTECH/XSIS
5	LT SWITCHGEAR (ALL RANGE)	SIEMENS / SCHNEIDER ELECTRIC / L & T / ABB
6	LT ACB	SIEMENS / SCHNEIDER ELECTRIC / L & T / ABB
7	LT MCCB	SIEMENS / SCHNEIDER ELECTRIC / L & T / ABB / LEGRAND
8	LT MCB, ELCB	SIEMENS / SCHNEIDER ELECTRIC / HAGER /LEGRAND
9	LT SFU	SIEMENS / SCHNEIDER ELECTRIC / L&T / ABB
10	LT CONTACTORS	SIEMENS / SCHNEIDER ELECTRIC / L & T / ABB
11	CHANGE OVER SWITCH	HPL / SOCOMEC/ L & T
12	METERS (DIGITAL)	AE / ENERCON / SCHNEIDER / MECO / NIPPEN
13	LOAD MANAGER	ENERCON / NIPPEN/ L & T
14	RELAYS	SIEMENS / SCHNEIDER ELECTRIC / GE / L & T
15	INDICATING LAMPS	SIEMENS / SCHNEIDER ELECTRIC / L & T / ABB
16	ELECTRIC TIMER	SIEMENS / EAPL
17	SELECTOR SWITCH	KEYCEE / SALZER
18	APFC RELAY	ENERCON / L & T / TRINITY
19	LT CAPACITORS	L & T / EPCOS / SIEMENS
20	LUGS	DOWELL'S / JAINSON / COMET
21	CABLE GLAND	JAINSON / COMET /SIEMENS
22	PVC CONDUITS AND ACCESSORIES	PRECISION / DIAMOND /
23	CASING CAPING	PRECISION / DIAMOND/MODI

SR.NO.	ITEM	STANDARD MAKE
24	M.S. CONDUIT AND ACCESSORIES	AKG / BEC / STEELCRAFT
25	MODULAR SWITCHES, SOCKETS & OTHER ACCESSORIES	LEGRAND - (ARTEOR MODEL) / MK - (BLENZE MODEL) / SCHNEIDER - (ZENCELO MODEL)/ ELLEYS - (FOTOLIA MODEL)
26	METAL CLAD SOCKET WITH MCB	MDS / SIEMENS / LEGRAND
27	PVC JUNCTION BOX	SINTEX / CLIPSAL / SPELSBERG
28	FRLS WIRES FOR INTERNAL WIRING	FINOLEX / RRKABLE/HAVELLS
29	FLEXIBLE WIRE	FINOLEX / RRKABLE/ HAVELLS
30	TELEPHONE CABLE	FINOLEX/DLINK/AMP
31	COAXIAL TV CABLE	DELTON /POLYCAB/FINOLEX
32	CAT 6	MOLEX/DLINK/AMP/SYSTIMAX
33	FRLS MULTICORE FLEXIBLE CABLE	FINOLEX / RRKABLE/ HAVELLS
34	FIRE ALARM PANEL (UL LISTED)	EDWARDS / NOTIFIER / TYCO/HONYWELL/MORLEY
35	FIRE ALARM & PA SYSTEM	NEOLEX / LAPP INDIA / GEOFLEX / TYCO/HONYWELL
36	CONNECTORS (COLOURS AS PER PHASE & NEUTRAL)	SALZER / ELEMEX / CONNECTWELL
37	LIGHT FIXTURES	HAVELLS / WIPRO / PHILIPS / CGL OSRAM
38	LIGHTING CONTROLLER	DYNALITTE /ANCHOR/LEGRAND
39	BATTERY	EXIDE / AMCO/ROCKET
40	CEILING FAN / EXHAUST FAN/WALL MOUNTED	CROMPTON GREAVES / ORIENT / HAVELLS/ ALMONARD

SR.NO.	ITEM	STANDARD MAKE
	FAN	
41	FLOOR TRUNKING	LEGRAND / OBO / MK
42	PA SYSTEM SPEAKERS	BOSCH/BOSE/AHUJA
43	NETWORK SWITCH	CISCO/SIEMENS/D-LINK
44	NETWORK RACK	PENDUIT/RITAL/PRESIDENT
45	RODENT REPELLENT SYSTEM	MASER / JAY FIRE / ULTRASONIC ELECTRONICS
46	ACCESS CONTROL SYSTEM	SIEMENS/HONEYWELL/HID
47	PATCH PANEL	MOLEX PREMIUM /PENDUIT
48	CCTV MONITOR	SAMSUNG/SONY
49	CCTV	SIEMENS/PELCO/ HONEYWELL / BOSCH
50	MOTION SENSOR	LUTRON/LEGRAND/HONEYWELL /ABB

Note: -1) The contractor should obtain prior approval from SBIIMS/ Consultants before placing order for any specific materials SBIIMS may / delete any of the makes or brands out of the above list.

2) All materials should conform to relevant standards and codes of BIS.

3) Materials with I.S.I. mark shall be used duly approved by the SBIIMS Engineer/Architect.

4) If any material is found to be not up to the mark, the contractor will have to produce original bills/certificate from the manufacturer or his authorised Distributor for authenticity and genuineness of the material for consideration and as per make approved by the SBIIMS. The same will not be considered for payment.

Any additional item as per BOQ specifications or as per the instructions of the bank / Consultants. Any of the above items / other items if any will be as approved by the Consultants & Engineer-in-charge.

APPENDIX HEREINBEFORE REFERRED TO

1)	Name of the organization Offering Contract:		The M.D.& CEO, SBI Infra Management Solutions Pvt. Ltd. Head Office, Ground Floor Raheja Chambers, Free Press Journal Marg, Nariman Point, Mumbai-21.
2)	Consultants	:	M/s. DESIGN AVENUES F-4, LXMI PLAZA, 125, ZONE-II, M.P.NAGAR, BHOPAL, 462011 PH: 0755-2550200
3)	Site Address	:	1st& 6th Floor, Udyan Building, Nepean Sea Road, Mumbai.
4)	Scope of Work:		Interior Renovation/ ELECTRICAL
5)	Name of the Contractor	:	----------
6)	Address of the Contractor	:	----------
7)	Period of Completion	:	60 days from the date of Commencement
8)	Earnest Money Deposit	:	**Rs.3,250/- (Rupees three thousand two hundred fifty Only)** by means of Demand Draft / Pay Order (Valid for a period of 90 Days from the last date of submission of the tender) from any scheduled Nationalized Bank drawn in favor of SBI Infra Management Solutions Pvt. Ltd. and payable in Mumbai.
9)	Retention Money	:	As per clause no. 11(a) of general Conditions

M/s DESIGN AVENUES Signature of Contractor
With Seal

10)	Defects Liability Period	:	Twelve Months from the date of Virtual Completion.
11)	Insurance to be undertaken by the Contractor at his cost	:	125% of Contract Value (Contractor's all risk policy)
12)	Liquidated damages	:	0.5% of the Contract amount shown in the tender per week subject to max. 5% of the contract value or actual final bill value.
13)	Value of Interim Bill (Min.)	:	Rs. 30.00 Lakhs.
14)	Date of Commencement letter	:	7 days from the date of acceptance is issued to the Contractor/ or the day on which the Contractor is instructed to take possession of the site whichever is earlier.
15)	Period of Final Measurement	:	2 Months from the date of Virtual Completion.
16)	Initial Security Deposit Tender. (Clause No. 22)	:	2% of the Accepted Value of the
17)	Total Security Deposit	:	As per clause No. 11 a
18)	Refund of initial Security Deposit Comprising of EMD and ISD.	:	50% of the Security Deposit shall be refunded to the Contractor oncompletion of the work and balance refunded only after the Defect Liability Period is over.
19)	Period for Honoring Certificate	:	1. One Month for R.A. Bills 2. The final bill will be submitted by the Contractor within one monthof the date fixedfor completionwork and the Bill shall be certified within 3 months from the date of receipt of final bill provided the bills are submitted with all pre-requisite documents/test reports etc. prescribed in the tender.

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_____

Signature ofTenderer.
Date:

ROFORMA FOR RUNNING A/C BILL

i. Name of Contractor / Agency :
ii. Name of Work :
iii. Sl.No. of this Bill :
iv. No. & Date of previous Bill :
v. Reference to Agreement No. :
vi. Date of Written order to commence :
vii. Date of Completion as per Agreement :

S.No.	Item Description	Unit	Rate (Rs.)	As per Tender	
				Quantity	Amount (Rs.)
1	2	3	4	5	

Upto Previous R.A. Bill		Up Date (Gross		Present Bill		Remarks
Quantity	Amount (Rs.)	Quantity	Amount (Rs.)	Quantity	Amount (Rs.)	
6		7		8		9

Note: 1. If part rate is allowed forany items, it should be indicated with reasons for allowing such a rate.

2. If ad-hoc payment is made, it should be mentioned specifically.

_____
_____
Net Value since previous bill

M/s DESIGN AVENUES

Signature of Contractor
With Seal

CERTIFICATE

The measurements on the basis of which the above entries for the Running Bill No. ---------- were made have been taken jointly on ---------- and are recorded at pages ---------- to ---------- of measurement book No. ----------.

----------	----------	----------
Signature and date of Contractor	Signature and date of Architects Representative (Seal)	Signature and date of Site Engineer

The work recorded in the above-mentioned measurements has been done at the site satisfactorily as per tender drawings, conditions and specifications.

----------	----------
Architect	Signature and date of Site Engineer

TABLE - XIV

TABLE - XV

MEMORANDUM FOR PAYMENT

R/A BILL NO.

1.	Total value of work done since previous bill (A)	Rs. ----------
2.	Total amount of secured advance due since Previous Bill (B)	Rs. ----------
3.	Total amount due since Previous Bill (C) (A+B)	Rs. ----------
4.	PVA on account of declaration in price of Steel, Cement and other materials and labour as detailed in separate statements enclosed.	Rs. ----------
5.	Total amount due to the Contractor	Rs. ----------

OBJECTIONS:

i)	Secured Advance paid in the previous R/A	Rs. ----------
ii)	Retention money on value of works as per accepted tenders upto date amount Rs.	Rs. ----------
	Less already recovered	Rs. ----------
	Balance to be recovered	Rs. ----------
iii)	Mobilization Advance, if any	
(a)	Outstanding amount (principal + interest) as on date	Rs. ----------
(b)	To be recovered in this bill	Rs. ----------
iii.	Any other Departmental materials cost to be recovered as per contract, if any	Rs. ----------
iv.	Any other Departmental service charges to be recovered if any, as per contract (water, power etc.) enclose statement.	Rs. ----------

M/s DESIGN AVENUES

Signature of Contractor
With Seal

Total Deduction as per contract (F)	Rs. ----------
Adjustments, if any ---------- Amount less received by Contractor in --------- R/A Bill (as per statement of Contractor)	Rs. ----------
P.V.A.	Rs. ----------
Total amount payable as per contract (E+F+G)	Rs. ----------
(Rupees ---------- in words)	

The bill amount to Rs. ---------- (both figures and words) has been scrutinized by us after due checking of the measurements of work as required and is recommended for payment.

Date: ---------- ----------

Signature of Architect
with Seal

The bill amount to Rs. ---------- certified by Consultants has been scrutinized by me after due test checking of measurements of works as required and is recommended for payment for an amount of Rs.....

Date : ----------

Signature of Owners
Engineer

STATUTORY DEDUCTION:

i)	Total Amount due (E)	Rs. ----------
ii)	Less I.T. Payable	Rs. ----------
iii)	Less S.T. Payable	Rs. ----------
	Net Payable	Rs. ----------

These figures given in the Memorandum for payable has been verified and bill passed for payment ---------- (in words and figures)

Date: ---------- ----------

Signature of the MD&CEO

MODE OF MEASUREMENT

1. Unless otherwise stated, all pipes shall be measured net, length as laid and measured overall fittings, such as bends, junctions, etc., and given in running meters. The length shall be taken along the center line of the pipes and fittings.

2. Length of fittings viz, taps, valves, traps etc., which are paid under appropriate items shall not be re-measured under linear measurements as enumerated above.

3. Soil waste and vent pipes shall be measured along the center line of the stack including the connecting bends/tees to W.C. Pan, Nahani trap, etc. and shall be paid as enumerated above.

4. W.C. Pans, Lavatory basins, Sinks, drain boards, Urinals, Mirrors, Glass shelf Toilet paper Holder, shall be measured by number and shall include all accessories as enumerated in detail specification under each item.

5. Unless otherwise specified, all types of taps, valves, etc., shall be measured by number and paid separately.

6. Manholes, inspection Chambers, Gully traps, etc. shall be constructed according to detail specification and measured by number and paid separately. The depth of Manhole shall mean the vertical distance from the top of the Manhole cover to the outgoing invert of the main drain channel.

7. Water meter shall include Y strainer and other appurtenances required by the local bodies and shall include brick masonry chamber, etc., as per detailed specifications and item shall be measured by number and paid for accordingly or as per schedule of quantity.

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TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORK
GENERAL:

These specifications are for work to be done, item to be supplied and materials to be used in the works as shown and denned on the drawings and described herein, to the satisfaction of the Owners / Architects.

1.1 The workmanship is to be the best possible and of a high standard. The contractor shall take all steps immediately to make up deficiency if any noticed by the Owners / Architects. Use must be made of special tradesmen in all aspects of the work and allowance must be made in the rates for the same.

1.2 The materials to be provided by the contractor shall be in accordance with the samples already got approved from the Owners / Architects by the contractor and in conformity with specification and approved list of manufacturers and brand. The contractor shall produce all invoices, vouchers or receipts for any material if called upon to do so by the Owners / Architects.

1.3 Samples of all materials are to be submitted to the Owners / Architect for their approval before the contractor orders or delivers the material to the site. Samples together with their packing are to be provided free of charge by the contractor and should any materials be rejected they will be removed from the site at the contactors expense. All samples will be retained by the Owners / Architects for comparison with materials which will be delivered at site. Also, the contractor will be required to submit specimen finishes of colours, fabrics, etc., for the approval of the Owners / Architects before proceeding with the work.

1.4 The contractor shall be responsible for providing and maintaining temporary coverages required for the protection of finished work. He is also to clean out all wood shavings, cut ends and other waste from all parts of the works before covering or infilling are constructed.

1.5 Contractor shall maintain unformed quality and consistency in workmanship throughout the execution of the work.

SECTION - XI

TECHNICAL SPECIFICATIONS (Electrical – part I)

The Electrical installation work shall confirm to the following I.S. Standards (latest additions), Local Supply Authorities Rules and Regulations and Fire Safety Norms.

1)	IS:732	Code of Practice for Electrical wiring installation. (System Voltage not exceeding 650V)
2)	IS:1646	Code of Practice for fire safety of buildings (General Electrical Installation).
3)	IS:9537 (PART-II) 1981	Rigid steel conduits for electrical wiring.

4) IS:2667 Fittings for rigid steel conduits for electrical fittings.

5) IS:2509 Rigid non-metallic conduits for electrical installations.

6) IS:1293 Pin Plugs and Sockets.

7) IS:694 PVC insulated cables with copper conductors for voltages up to 1100 volts.

8) IS:9532 Specification for conduits for Electrical Installation.

9) IS:3854 5A & 15A Switch socket and accessories.

10) IS:3043 (1981) Earthing.

11) IS:2026 Specification for power transformer.

12) IS:3639 Specification for fittings and accessories for power transformers.

13) IS:2099 Specification for high voltage porcelain bushings.

14) IS:335 Specification for insulating oil.

15) Indian Electricity Act, 1956 and Rules and Fire Insurance Regulations.

A-01. POINT WIRING

a) METAL CONDUITS

All conduit pipes shall confirm to IS 9537, PART-II 1981. Metal conduits shall be ERW black enameled 20mm/25mm as the case may be depending upon the number of wires permitted as table-1. The conduits shall be fixed to walls/ceiling with MS saddles and spacers at an interval of 0.45 meter and on either side of bends, junction boxes, pull boxes etc.,

All conduit accessories shall be 16 gauge & bends shall be of inspection type. All bends, couplers, threaded portions etc., shall be painted with anti-corrosive paint. Bends in the pipes shall be done with bending hickies.

All pipes shall be cleaned for sharp burrs. Switch boxes shall be of GI 16/14 gauge. The switch boxes shall be concealed as per site requirement & as per Architect's/Consultant's Instructions.

Point shall be controlled with 5A switch or directly from DB as specified in schedule of quantities. Where plate type switches are not specified the switch board shall have 3mm thick hylum sheet on which switches shall be mounted.

The point wiring shall be carried out with multi stranded PVC insulated copper wires of 1.5 sq.mm. 2nos (for Phase & Neutral) & 2.5sq.mm. (for Earth). In all cases the earth shall be

of green colour and neutral shall be of black colour. All wires used shall be of 660 V grade. The point wiring shall be inclusive of circuit wiring from Distribution Board to the switch board unless otherwise stated in schedule of quantities. The circuit wiring shall be with 3 nos. of 2.5 sq.mm. PVC insulated multi stranded copper conductors colour coded as detailed above. The rate shall also be inclusive of any chasing as directed by the Architects/Consultant/Client's Engineer to conceal the drops and finishing the same.

In case of group control directly from Distribution Board, the primary point shall be considered from DB to the first point and secondary point shall be from first point to the next looped point. The point shall terminate into the 3 plate-ceiling rose.

While laying the conduits in the slab before casting the slab, all drops shall be laid accurately to fall in position of the switchboard. Junction boxes shall be fixed with sand-cement mortar. All joints shall be airtight. Conduits shall be fastened to the re-enforcement properly so that the conduits do not get dislocated while casting the slab. All conduits shall have 18 SWG fish wire.

b) PVC CONDUITS

The PVC Conduits shall confirm to latest IS standards and shall be of medium gauge unless otherwise specified. The conduits shall be joined with PVC adhesive at Joints. The Conduits shall be fixed to walls/ceilings with GI spacers and saddles at an interval of 45 cms& on either side of bends, junction boxes, pull boxes etc., The number of wires drawn in the conduits shall be as per table 1. The point wiring shall be controlled as in (a) above. The wiring shall be done with 2 nos. of 1.5 sq.mm. (for Phase & Neutral) &1.5sq.mm. (for earth) PVC insulated, copper conductors, multi stranded and colour coded with green as earth and black for neutral.

The circuit main wiring shall be with 3 nos. of 2.5 sq.mm.PVC insulated, copper conductors, multi stranded wires laid from distribution board to switch board and the rate shall be included in the point wiring unless otherwise stated in the schedule of quantities. All other details shall be as per metal conduits.

C) CASING CAPPING/ TRUNK AND TRUNKLING

PVC casing shall be fixed to wooden partitions by means of screws spaced not more than 45 cms apart. Holes for fixing the PVC capping shall be done by drilling machine only and these holes shall be plugged with PVC plugs or grips to which the screws shall be fastened. Nowhere less than 1 inch PVC casing shall be used. All bends, tees, joints etc., shall be done in workman like manner with standard accessories. The number of wires in PVC casing capping shall be limited to a fill factor of not more than 60%. The point shall be controlled by 5amp switch. The switch boards shall either be flush mounted with partitions or surface mounted or concealed mounted as per site requirements and as directed. The wiring shall be carried out as described in (a) and (b) above.

Casing Capping wiring shall not be done for concealed wiring & for wiring over the false ceiling work.

A.2. DISTRIBUTION BOARDS

This specification covers the design, manufacture, assembly, testing at works, supply, installation and commissioning of distribution boards at site.

The system and accessories shall be complete in all respects and any device not included specifically in this specification, but essential for proper operation of the equipment and also to meet statutory requirements shall deemed to be within the scope of the specification whether it is mentioned in the Technical Specification, or not.

If the vendor finds that it is required to undertake any work which is not sufficiently defined in this specification or discovers that this specification conflicts with any other codes, standards and regulations which shall be required to comply, the same shall be clarified in writing from the Owner/Consultant before undertaking the work involved for avoiding the delay.

These shall be of sheet metal and of standard design with copper bus bars. The board shall be fixed at accessible heights. The boards shall be solidly fixed on MS brackets to walls/partitions, concealed or open as directed. All connections inside the distribution board shall be neatly arranged and tied with PVC strings. The MCB's shall be of 9KA for fault level. The distribution boards shall be suitably earthed. Legend shall be written on DB with paint for identification of DB & Circuits.

A.2.1 CONSTRUCTION

The distribution boards shall be fabricated out of 14/16 swg CRCA sheet steel, metal clad, totally enclosed dust damp and vermin proof, dead front, hinged door type of bolted/welded construction suitable for wall or floor mounting.

A.2.2 BUSBARS

The busbar shall be air insulated and made up of high conductivity high strength aluminum or copper busbars liberally sized with high safety factor for the required rating. The neutral busbars shall have adequate number of terminals for all number of outgoing single-phase circuits and the holes shall be suitable for multi strand wires. In the same way suitable earth bus shall be provided inside each distribution board for earthing of the lighting/power circuits and also earthing of distribution board. In the case of 3 phase distribution boards used for single phase outgoings, three independent neutral bars shall be provided.

A.2.3 MINIATURE CIRCUIT BREAKERS

Miniature circuit breakers (MCB) shall be of heat resistant, moulded type designed, manufactured and tested as per IS-8828.

The MCBs shall have inverse tripping characteristic against overloads and instantaneous trip against short circuits. The MCB shall be of fault current limiting device also.

The MCB shall be slip on type to the DIN rail. The ON & OFF positions of the switch handle shall be clearly marked. The MCB shall be suitable for operating in an ambient temperature of 45 deg centigrade without de-rating. The MCB shall be suitable for 415V, 3 phase, 415Volts, 50Hz system with a fault level of 9-10KA (rms) symmetrical. The terminals of MCBs shall be suitable for use with eye lugs. The 4 pole, 3 pole and 2 poles MCBs knobs shall be trunked with adequate strength tandem pin.

Each distribution board shall have individual hinged/bolted gasketed doors with suitable screws. Removable conduit entry plates shall be provided at top and bottom of the DB to facilitate drilling the conduit holes at site to suit individual requirements or knock out shall be provided.

Protective hylem / Bakelite insulated cover plate shall be provided inside the panel to shroud all the live parts. Only the operating handle of the switch and the operating knob of the miniature circuit breakers shall be projecting outside the cover plate in case of ordinary IP20 DB and shall be inside the front door in case of dust tight IP42 DB. The unused outgoing holes / knockouts / cutouts of DB shall be suitably blanked with PVC plates at no extra cost. The incoming switch terminal should be suitably shrouded to avoid accidental contact. Each outgoing in the MCB DB shall have shrouding between Phases. The distribution board shall be factory wired and assembled and local fabricated DB shall not be accepted.

For TPN Distribution Board, four pole isolators shall be provided as incomer. For single phase and neutral Distribution Board, double pole isolator / ELMCB shall be provided as incomer. Earth leakage circuit breaker(s) to be provided wherever called for.

Suitable labels shall be provided to mark the circuit numbers of outgoings circuits.

Wiring Diagram shall be provided inside the DB.

A.2.4 EARTHING

The DB's shall be provided with two numbers of brass earthing terminals with suitable nuts, washers, etc., for connecting to earth bus. The Earth terminals shall be brought outside the DB. In case of flush mounting DB, these shall be provided inside the DB.

A.2.5 PAINTING

The DB sheet steel surface shall be chemically cleaned to remove scale etc., rinsed dried and shall be finished with two coat of powder coat paint over two coats of red oxide / epoxy zinc primer.

A.2.6 TESTS

All necessary factory routine tests shall be performed on the equipment before dispatch. The test results shall be sent along with the supply of DB.

A-03. CABLES

Cables shall confirm to IS 1554-1976. Cables shall be heavy duty, armored, PVC insulated &PVC sheathed 1.1 KV grade aluminum or copper. Cable shall be fixed with GI spacers & saddles at an interval of 30/45 cms and on every side of bends. The bending radius of cables shall be as per manufacturer's instructions and in no case, it shall be less than 12 times the overall diameter of the cable. Cable shall be so installed that they are not subject to any mechanical damage. If there is a bend in the cable enclosed in a conduit, care has to be taken to prevent undue compression of insulation. This applies also to the top of vertical runs of length longer than 5 meters where there could be compression caused by the weight of unsupported vertical cables. Cables may rest without fixing in horizontal runs or ducts or trunkings. The cables run in cable trays shall be fixed with cable ties at intervals of not more than 30 cms. No joints in the cables shall be permitted unless the cables exceed the standard drum length. Joints, if so necessary shall be located in accessible position. Termination of the cables shall be done with heavy duty copper/Aluminum lugs and brass cable glands.

Cables laid underground shall be to a minimum depth of 750 mm. It shall be ensured that cables laid underground are free of water lines, sewage lines etc. The trenches shall be at least 30 cm wide & filled with 10 cms thick of layer of dry sand on which the cable shall be laid. Further, 10 cms thick sand layer shall be put on the cable over which a brick layer shall be provided. The trench shall than be back filled with soft earth, rammed and consolidated to its original level. Cable route indicators shall be laid at intervals of 15 meters and at all change in directions.

For cables laid on walls aluminum tags shall be fixed showing the size of the cable and the feeder number of the cable. These tags shall be provided at each end and at least one or two places at intermediate positions.

The mode of measurement of the cables shall be as follows:

i) For top entry of the cable, the measurement shall be taken up to the bottom of that switch- gear.

ii) For bottom entry of the cable, the measurement shall be taken up to the top of that switch board. No wastage shall be allowed for measurements.

A-04. SWITCH FUSE UNITS

Switch Fuse Units shall be of sheet metal or iron clad with HRC fuses as described in schedule of quantities. The unit shall be of robust construction of standard specified make, design to withstand adverse working conditions. It shall have quick break type mechanism with ON and OFF position indicators of the operating handle. The switch shall be interlocked so that the unit cannot be opened in ON condition. The interior shall be so arranged that clearances from live parts are adequate and shrouded. Manufacturer's instructions shall be followed for installation of switch fuse units. The switch shall be solidly earthed. The switch shall be mounted on walls on angle iron support grouted to wall. The supports shall be treated for rust treatment & painted with 2 coats of synthetic

enamel paint. The height of the switch board shall be such that it is accessible for operation & maintenance.

A-05. POWER PANELS

The Power panels shall be fabricated from MS sheet steel 14/16 gauge and shall be of compartmental design. The main supporting framework shall be of angle iron or of heavier gauge sheet metal. The panel shall be self-supporting design, dust and vermin proof, dead front and fully inter locked with isolating switches. The panel-mounted switches shall have Interlock defeat arrangement for testing and inspection.

The panel shall be designed so as to facilitate inspection, cleaning and repairs. The clearance between phase to phase and phase to earth or metal parts shall be as per relevant IS standards. The metering instruments like volt meter, ammeter etc. shall be flush mounted and shall be of 1.0 class accuracy and of standard design size of 96 mm x 96. All indication lamps shall be of neon /LED type.

The busbars shall be air insulated and made up of high conductivity, electrolytic aluminum / copper bars complying with the requirement of IS 5082:1981 and shall have a fault withstand capacity of 50 KA/1 Sec. All busbars shall be fully screened by means of PVC heat shrinkable sleeves in their own compartment running throughout the length of the Panel. Suitable allowance should be made for bus expansion.

The panel shall have separate cable ally and a bus bar chamber. The bus bars shall be rigid hard drawn tinned electrolytic copper wherever specified & sleeved with heat shrinkable sleeves. The current density shall not exceed 1.25 amp per sq.mm and the neutral bus shall be rated for capacity of phase bus unless otherwise stated in schedule of quantities/drawings. However, the minimum size of bars shall be 25mmx3mm. Minimum electrical clearance shall be maintained between phases, neutral and body as per IS 4237:1982.All outgoing feeders shall have neutral link of appropriate capacity at cable termination end. For Incomers as MCCBs wherein cable is directly connecting at switchgear end the neutral link to be mounted adjacent to switchgear.

The panel shall be powder coated comprising of degreasing and de-scaling in sulphuric acid etc. with synthetic enamel paint for smooth finish. The color of paint shall be battleship grey or as directed. The Panel shall be tested at site before commissioning. The Panel drawings shall be got first approved from Consultants before taking up for fabrication.

All wiring inside the panel shall be done with switchboard copper conductors/cables and/or with solid copper links. The insulators for supporting the Bus-Bars shall be epoxy based cast resin. All hinged doors shall be earthed with flexible braided copper earth. An earth bus of copper shall be fixed along the length of the panel at the lower section. Adequate ventilation for the panel shall be provided. Logic diagram of operation of switches shall be painted on the panel. The name plates for each feeder shall be of engraved design and pasted to the respective switch gear. The letters shall not be less than 10 mm size for individual feeders and not less than 18 mm for the main feeders. All switchgear to be mounted in the panel shall be as per schedule of quantities.

A-06. EARTH PITS/STATION

The Earthing station shall be done as per IS 3043 (1981) and as per drawing no. E1. The earth pit shall be at least 2.5mtrs deep with CU/GI Plate electrode. The GI plate electrode shall be hot dipped of 600x600x6 mm thick. The size for copper plate electrode shall be

600x600x3mm thick. An alternate layer of salt and charcoal shall be filled up to 200 mm above the top of the electrode. The electrode shall be connected with 32x6 mm thick GI Flat (for copper earth electrode size of flat shall be 25x3 mm) which shall be terminated with nuts and bolts into brick masonry chamber on top. The brick masonry chamber shall be of size 300x300x450mm deep which will carry the funneling arrangement for watering. A GI Flat of 32x6 mm from brick masonry chamber to the switch gear inside the switch room shall be laid underground and/or fixed to walls. The rate for laying GI/ CU strip from earth pit to switch room shall be paid under separate item.

All the main earth conductor above the ground level shall be painted with two coats of enamel paint. The following colour codes have to be followed:

(a) Main body earth bus	-	Green colour
(b) Main neutral earth bus	-	Black colour
(c) Lightning protection earth bus	-	Red colour or as preferred by Owner/Consultant.

Earthing system of equipment earthing, neutral earthing, Data Networking earthing and lightning protection earthing should not be mixed together above the ground. These systems/connections shall be tested in accordance with IS 3043-1987. Earth resistance of the individual system shall be measured after connecting all the electrodes to the bus and the combined value shall be less than 1 ohm (One ohm).

A-07. INSTALLATION OF ELECTRIC FITTINGS

All electrical fittings shall be fixed with down rods or on round blocks as stated in schedule of quantities. The down rods shall be of 19/20 mm dia. and with 1.6mm wall thickness of ERW black enameled MS or GI. The down rods shall be fixed with ball and socket joints, check nuts etc. Special fixtures like spot lights etc.; shall be fixed to the false ceilings as per manufacturer's recommendations. The fittings shall be connected with 3 core 0.5 sq.mm flexible copper cord/cable from ceiling rose and suitable earthed.

A-08. POWER FACTOR CORRECTION PANEL

The power factor correction panel shall be fabricated from sheet steel & powder coated. The panel shall be compartmentalized with tinned copper bus bars TP as described for power panels.

The power capacitors shall be APP type, low loss, 3 phase, delta connected & self-discharged type.

The power factor control shall be done by automatic power factor control relay for controlling the power factor within the set limits by auto switching of required capacitor Banks. The required Capacitors / PF Banks shall be as per schedule of quantities. The P.F. shall be automatically corrected to near Unity.

The C.T. ratio given in the Schedule/diagram is indicative. The same shall be matched for correct operation depending upon the operating load. The relay shall be totally microprocessor based for setting the desired target power factor band. The APFC relay shall have indications like power ON, low current etc.& shall be of required stages as per schedule of quantities. The P.F Panel shall have Auto Manual switching facility.

The general specification shall be as follows:

i) System supply voltage 415 volts.
ii) C.T. secondary rating 5A, 5VA Burden.
iii) Output switching capacity 5A at 230 V AC & 2A at 440V AC, Operating temperature 10 degree Centigrade to 50 degrees Centigrade. Accuracy better than 1%. Low current release 10% of full rated C.T.
iv) Switching time between stages 4 to 6 seconds.
v) Range of indications of PF 0.5 lag to 0.5 lead digital.
vi) Display LED indications.
vii) Range of target P.F. setting 0.7 to 0.99.
viii) Switch for auto/manual operation.
ix) Indications for selection of stages.
x) Selection of dead band.

A-09. TESTING OF ELECTRICAL INSULATION

The following tests shall be carried out during execution and after completion of the electrical installation work.

1) Insulation Resistance Test.
2) Polarity Test of Switches.
3) Earth Continuity Test.

1) Insulation Resistance Test: The insulation resistance shall be measured by applying between earth and whole system of conductors or any section thereof with all fuses in place and all switches closed (except in earthed concentric wiring) all lamps in position & both poles electrically connected together, or direct current pressure of not less than twice the working pressure, provided that it need not exceed 500 volts for medium voltage circuits, be applied. Where the supply is derived from 3 wire DC or Poly phase A.C. System, the neutral pole of which is connected to the earth either direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured in mega-ohms between all conductors connected to one pole of phase conductor of the supply and all the other conductors and switches in off position it's value shall be not less than as specified below:

The insulation resistance measured in mega ohms shall not be less than 50 mega-ohms divided by the number of outlets or when PVC insulated cables are used for wiring, 12.5 mega-ohms divided by the outlet subject to a minimum value of 1 mega-ohm.

A preliminary and similar test may be made before lamps etc. are installed and in this event the insulation resistance to earth shall not be less than 100 mega ohms divided by the number of outlets or when PVC insulated cables are used 25 mega ohms divided by the number of outlets subject to a minimum of 1 mega ohm.

2) Polarity Test of Switches: In a 2-wire system a test shall be made to verify that all switches in every circuit are fitted in the same conductor throughout and such conductors shall be labeled or marked for connection to the phase conductor or to the non-earthed conductor of supply.

In a 3 wire or 4 wire insulation a test shall be made to verify that every non-linked single pole switch is fitted in a conductor which is labeled or marked to one of the phase conductors of supply.

3) Earth Continuity Test: The Earth Continuity Conductor including metal conduits and metallic envelopes of cables in all cases shall be tested for electric continuity and electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit breaker measured from connection with earth electrode to any point in the earth continuity conductor in the completed insulation shall not exceed 1 ohm.

TECHNICAL SPECIFICATION OF TESTING AND COMMISSIONING

The scope of work for testing and commissioning of the total installation shall be for the capital equipment like transformers, switchgears, cables etc., and also for the associated equipment like relays CTs, PTs, etc.

The scope of work for testing and commissioning of electrical equipment for the above shall include but not be limited to the following:

a) Providing sufficient number of experienced Engineers, Supervisors, Electricians so that the installation can be commissioned in stipulated time.
b) All the instruments, tools and tackles required for carrying out the testing and commissioning shall be provided by the bidder.
c) The testing of electrical equipment shall be carried out as per the relevant Indian Standards/Code or Practices/Manufacturer's instructions.
d) Cleaning of electrical equipment, contacts cleaning and greasing etc. All the equipment and material required for above shall be supplied by the bidder.
e) Connecting the panel/equipment wiring for proper functioning of the schemes required/called for.
f) Installation and wiring of additional equipment on panels like auxiliary contactors, timers, etc. which may be additionally required for proper functioning of the schemes.
g) Checking of equipment earthing and system earthing as a whole.

h) Testing of all the cables.
i) Co-ordination with other contractors for testing and commissioning of interface cables.

TESTS TO BE CONDUCTED

4. All tests shall be performed in the presence of the bidder and customer/consultant. For all types of visual inspections, checking, pre-commissioning, commissioning test and acceptance tests, IS Code to be followed for the tests given therein in addition to the instructions in this technical specification. The intention of giving the few test procedures, described below, is to provide a guideline for the bidder. However, bidder shall not restrict themselves in carrying out only the tests described in this document.
5. Bidder shall submit their proposed test procedures for approval and shall not commence testing such approval is given.
6. Bidder shall check and test all electrical equipment and systems installed and supplied them, including equipment supplied by the Owner.
7. Bidder shall supply all necessary test equipment and personnel both craft and supervisory category to carry out the work without danger to personnel or damage to equipment.
8. Bidder shall ensure that no tests are applied which may stress equipment above the limits for field testing recommended by the manufacturer. Bidder shall be responsible for any damage to personnel or equipment resulting from improper test procedure.
9. All defective materials furnished by the bidder and defects due to poor workmanship revealed through field testing, shall be corrected at bidder expense without affecting the completion of the project.
10. Client/Consultant reserves the right to interpret and approve all test results prior to energization of circuits or apparatus.
11. Bidder shall visually inspect all equipment for defects immediately upon arrival at site including those supplied by the Owner.
12. Relay coordination chart and final setting before/commissioning.

<u>MECHANICAL CHECKOUTS</u>

After installation, but before any power supply is connected, the contractor shall make a complete mechanical check of all installed electrical equipment and systems. This shall include but not to be restricted to the following:

- Check equipment numbers against drawings/documents.
- Check name plates of transformers, switch gears etc., for conformity with the data given in the drawings and specifications.
- Check all equipment bus joints and connections for tightness.
- Check all cable and wire connections for tightness.
- Check phase sequence.
- Check all bushings/insulators to ensure they are clean and unchipped. Inspect tank cooling tubes and radiators for leaks.
- Check silica gel for dryness where breathers are supplied. If the colour of the silica gel is pink, remove from the breather and dry out following manufacturer's recommended procedure, until a light blue colour is restored and then replace it.

- Check valve in the connecting pipe between the conservator and transformer tank to ensure that valve is in 'open' position.
- Check interlocking on access doors for mechanical and electrical safety. Check that key and electrical interlocking system functional and accomplish their purpose.
- Check all plug-in contacts for alignment and 'grip'.
- Check all contactors for free manual operation.
- Remove all locking devices installed for shipment.
- Check all the coils for their continuity and proper voltages.
- Check the arc chutes, arcing horns, main contacts of breakers are clean and undamaged. Check the carriages ride smoothly and reliably on their guide-rails. Check for proper operation of circuit breaker operation mechanism, controls and adjustments.
- Check for the fuses whether correctly rated and installed, undamaged and fit for operation.
- Check all relays and instruments are clean, correctly connected and undamaged. Check test plugs are installed in all protective relays. Check relays for free manual operation, if applicable.
- Check instrument transformer ratings against drawings. Check for proper installation and connection.
- Check interlock and auxiliary devices and the operation of the circuit breaker with the protection relay circuit.
- Clean the equipment by vacuum cleaner before energizing.

EARTHING

6. Bidder shall test the buried earth grid and shall record the values.

7. Bidder shall inspect and test all earthing work carried out by him, including all interconnections between ground loops, grounding of equipment and ensure all connections are permanent and that the earthing circuit is continuous.

8. Bidder shall megger and record earth resistance at various earth connection points.

SWITCHGEAR

- Switch gears rated 433 volts or more shall be tested with a 1000 volts megger.

- Auxiliary wiring rated less than 415 volts shall be tested with a 500 volts megger.

- All protective relays shall be tested at sufficient points to establish their proper functioning in accordance with the manufacturer's specification and curves.

- Operation checks and functional checks on all switchgear panels.

- For current transformers insulation test, polarity test, ratio test, secondary injection test, operating current check, service setting in consultation with Client / Consultant.

- For potential transformers, ratio test, insulation test, etc.

- Contact resistance for breaker contacts between male and female.

WIRES AND CABLES

- Continuity testing of all cables.

- Wires and cables rated for 433 volts or more shall be tested with a 1000 volts megger. Cables rated less than 433 volts shall be tested with a 500 volts megger.

- No wires or cable having resistance between conductors or between conductors and ground of less than 100 mega-ohm shall be accepted.

FUNCTIONAL TESTING

7. All circuit breakers, contactors, relays, remote devices, etc.,

PRECOMMISSIONING TESTS

- All pre-commissioning tests stated as per IS for respective items.