

**GOVERNMENT OF INDIA
PLANNING COMMISSION**

UNIQUE IDENTIFICATION AUTHORITY OF INDIA



BID DOCUMENT

for

**Providing interior works including partitions, flooring, false ceiling
& Civil works, furniture and electrical/AC works, etc.
at UIDAI, Regional Office - Bangalore**

TENDER No: UIDAI/RO/BLR/INTERIORS/RE-TENDER/01

dtd:12/05/2011

**Regional Office : 3rd Floor, Khanija Bhavan, South Wing, #49, Race Course Road,
Bangalore – 560 001**

Ph: 080-22340863/22340864 Fax : 080-22340310 Email :leninashok@uidai.gov.in

UNIQUE IDENTIFICATION AUTHORITY OF INDIA

(Government of India, Planning Commission)

3rd Floor, Khanija Bhavan, South Wing,
#49, Race Course Road, Bangalore-560001

Tender Schedule No:

Re-Tender for Interior Works and other allied Works

Name of the Work:

**Tender for Interior Works and other allied Works at UIDAI Regional
Office Bangalore**

Issued to M/s.....

Received Rs.1,050/- (Rupees One thousand fifty only) towards the cost of
Tender document as per the details give below:

D.D. No..... dated

Name of the Bank:

Branch:.....

SECTION - I
BID FORM

NIT No: UIDAI/RO/BLR/INTERIORS/RE-TENDER/01 dtd:12/05/2011

To, Deputy Director
Unique Identification Authority of India
Bangalore – 560001

Dear Sir,

Having examined the conditions of contract and specifications, the receipt of which is hereby duly acknowledged, we, undersigned, offer to execute the work of **Interior Works and other allied Works at UIDAI Regional Office Bangalore** in conformity with said drawings, conditions of contract and specifications as may be ascertained in accordance with the schedule of prices attached herewith and made part of this Bid.

We undertake, if our Bid is accepted, we will execute the work in accordance with specifications, time limits & terms and conditions stipulated in the tender document. If our Bid is accepted, we shall submit the securities as per the conditions mentioned in the contract.

We agree to abide by this Bid for a period of 240 days from the date fixed for Bid opening and it shall remain binding upon us and may be accepted at any time before the expiry of that period.

Until a formal Agreement is prepared and executed this Bid together with your written acceptance thereof in your notification of award shall constitute a binding contract between us.

Bid submitted by us is properly sealed and prepared so as to prevent any subsequent alteration and replacement. We have enclosed DD/Pay Order towards Bid Security (EMD), as per the details given below.

EMD particulars	D.D.No. _____	dated _____	
	Name of the Bank: _____		
	Branch: _____		

Dated thisday of.....(the year)

Signature of Authorized Signatory.....
In capacity of.....
Duly authorized to sign the bid for and on behalf of.....

Witness.....
Address.....

Signature.....

SECTION-II
TENDERER'S PROFILE

Passport size
photograph of
the tenderer
/authorized
signatory
holding power of
attorney

General :

1. Name of the tenderer/firm _____
2. Name of the person submitting
the tender whose photograph is
affixed Sri/Smt _____

**(In case of Proprietary/partnership firms, the tender has to be signed by
Proprietor/Partner only, as the case may be)**

3. Address of the firm

4. Telegraphic Address

e-mail id : _____

5. Telephone No. (With STD Code) (Off) _____
(Fax) _____
(Res) _____
(Mobile) _____

6. Registration & Incorporation particulars of the firm :

**(Please attach attested copies of documents of registration/incorporation of
your firm with the competent authority as required by business law)**

- i) Proprietorship _____
- ii) Partnership _____
- iii) Private Limited _____
- iv) Public Limited _____

7. Name of the Proprietor/Partners/Directors
8. Permanent Income Tax Number, Income Tax circle (**Attach a copy of PAN card**)
9. Service Tax Registration No.
10. EPF Registration No.
11. VAT/ TIN Registration No,
12. License No. issued by Labour officer
13. Tenderer's bank, its address and his current account number
14. Details of Technical and Supervisory Staff :

CERTIFICATE
(FOR DOWNLOADING OF TENDER DOCUMENT FROM WEB SITE)

"I.....(authorized signatory) hereby declare that the tender document submitted has been downloaded from the website" www.uidai.gov.in and no addition / deletion / correction has been made in the proforma downloaded. I also declare that I have enclosed a DD for Rs.....towards the cost of tender document along with the EMD.

Place : Signature of tenderer/Authorized Signatory

Date : Name of the Tenderer

Seal of the Tenderer

DECLARATION
(FOR EPF & Misc provisions Act 1952)

I(name of the contractor/agency) hereby declare compliance towards conditions of the EPF and Misc provisions Act 1952 and authorise UIDAI to recover any payment that arises due to failure to comply with any of the Labour legislations and statutory conditions viz., Labour, EPF,ESI etc., or any other acts dealing with the same and all other acts mentioned in the tender document.

Place : Signature of tenderer/Authorized Signatory

Date : Name of the Tenderer

Seal of the Tenderer

**GOVERNMENT OF INDIA
PLANNING COMMISSION
UNIQUE IDENTIFICATION AUTHORITY OF INDIA**



TENDER DOCUMENT

for

**Providing interior works including partitions, flooring, false ceiling
& Civil works, furniture and electrical/AC works, etc.
at UIDAI, Regional Office - Bangalore**

TENDER NO.UIDAI/RO/BLR/INTERIOR/RE-TENDER/01 DTD.12/05/2011

**Regional Office : 3rd Floor, Khanija Bhavan, South Wing, #49, Race Course Road,
Bangalore – 560 001**

Ph: 080-22340863/22340864 Fax : 080-22340310 Email : leninashok@uidai.gov.in

UNIQUE IDENTIFICATION AUTHORITY OF INDIA

NAME OF THE WORK: Providing interior works including partitions, flooring, false ceiling & Civil works, furniture and electrical/AC works, etc. at

**UNIQUE IDENTIFICATION AUTHORITY OF INDIA
3rd Floor, Khanija Bhavan, South Wing,
#49, Race Course Road,
Bangalore - 560001**

CONTENTS

		<u>Page Nos.</u>
1.	Notice Inviting Re-Tender	.. 9
2.	General Instructions and Tender conditions	.. 14
3.	Articles of Agreement	.. 18
4.	General Specification for Interior, Civil, AC, Electrical Works	.. 24
5.	Technical Specification for Electrical Works	.. 27
6.	Technical Specifications for Air-Conditioning Works	.. 83
7.	Conformity of Technical Specifications	.. 106
8.	Commercial Bid	.. 107

UNIQUE IDENTIFICATION AUTHORITY OF INDIA

No.UIDAI/RO/BLR/INTERIOR/RE-TENDER/01

Date:12/05/2011

NOTICE INVITING RE-TENDER

Item rate Tenders under **two cover bid system** are invited from eligible and reputed interior contract firms who have got adequate financial resources, state of the art technology, suitable construction equipments, technical man power & sufficient past experience for the following works as per the schedule given below:

Sl. No.	Name of the work	Approx cost put to tender (Rs.)	EMD (in Rs.)	Cost of tender documents (Non-refundable) (Rs.)	Time for completion
1	Providing interior works including partitions, flooring, false ceiling & Civil works, furniture and electrical/AC works etc. at UIDAI premise , III Floor, Race course road, Khanija Bhavan, Bangalore – 560 001.	1,90,00,000/-	3,80,000/-	1,050 / -	10 Weeks from the date of work order

- a) Last date for receiving requisition for tender documents :**upto 1500 hrs on 01/06/2011**
- b) Issue of blank Tender documents :**upto 1700 hrs on 01/06/2011**
- c) Last date for receipt of Tender documents : **1500 hrs on 02/06/2011**
- d) Opening of Technical Bid : **1530 hrs on 02/06/2011**

Note :

1. Participating bidders/contractors have to quote the rate for Part I and Part II of the tender document.
2. Participating bidders/contractors in the tender should submit the following documents along with bid:
 - a. E.M.D. in the form of Demand Draft/Pay order (DD/PO) for Rs.3,80,000/- (Rupees Three lakh eighty thousand only) drawn in favour of DDO, UIDAI, Bangalore.
 - b. Work done certificate for having successfully executed similar works totaling more than Rs.1 crore, in each of the financial year during block period of previous 3 years and they should have experience in this line of activity for last 2 years and must produce work done certificate from the clients. The work done certificate should mention the details of work executed and the date of commencement & date of completion of the work.
 - c. The Bidder must have an annual turnover not less than 2.0 crore in each of past three consecutive financial years, which shall be duly certified by a Chartered Accountant.
 - d. Copies of Annual Returns for last 3 years, Permanent Account Number, Service Tax Registration Certificate & VAT Registration Certificate should be submitted alongwith the Tender document.
 - e. Conformity of Technical Specifications

All the copies of the above documents except (a) shall be **attested** by a Gazetted Officer or a Notary, otherwise, the bids are liable for disqualification. The original documents should be produced for verification at any stage of tender process as and when sought for, failing which, the bids are liable for disqualification.

3. The tender documents could be downloaded from our website www.uidai.gov.in. The cost of the tender document of Rs.1,050/- (Rupees one thousand fifty only) in the form of Demand Draft or Pay Order drawn in favour of DDO, UIDAI, Bangalore payable at Bangalore on or before 01/06/2011, can be submitted alongwith the tender document. Document without this cost of tender document shall be summarily rejected.

ELSE

The bidders/contractors should make a request for tender document after payment of cost of tender documents in the form of Demand Draft or Pay Order

for Rs.1,050/- (Rupees one thousand fifty only) in favour of DDO, UIDAI, Bangalore payable at Bangalore on or before 01/06/2011.

The **requisition** for tender documents along with the DD/PO towards tender document fee, should be handed over to the office of the undersigned, manually, before the end of request date for tender documents. Failure to submit any of the above documents, the requisition for tender documents will not be considered.

4. The Tender comprises of **two cover bid system** as follows:

Cover 1 - Technical Bid containing details of information & documents as per 2 (a) to 2 (e) above.

Cover 2 – Commercial Bid Part 1 and Part 2 containing the commercial tender. The Commercial bid of only those tenders, who fulfill the eligibility criteria and qualify in the Technical Bid, shall be opened.

Kindly note that if the Technical and the Commercial Bids are not submitted separately in two different sealed covers, the bids shall be summarily rejected.

5. Tendering through Joint Venture is not allowed.
6. EMD shall be paid only in the form of Pay order / Demand draft for Rs.3,80,000/- (Rupees Three lakh eighty thousand only) drawn in favour of DDO, UIDAI, Bangalore and scanned copy shall be enclosed.
7. The item rates shall be clearly and legibly typed both in figures and words in English only and lowest item rate quoted between figures and words for each item shall be taken into consideration during short listing of the tender.
8. The successful tenderer will have to execute an agreement within one week from the date of Letter of Intent.
9. The work shall be commence with all earnestness within one week from the date of issue of work order, failing which it would be presumed that he is not interested in the work and action will be taken to get the work executed through alternate agency at the risk and cost of the former tenderer.
10. The contractor must carry out the sound oriented works without disturbing the neighbours in working hours and hence, the contractor should make arrangements to carry out such works during holidays and probably during nights and complete the work in all manner within stipulated time.
11. Corrigendums / modifications / corrections, if any, will be published in the website.
12. Conditional tenders, incomplete tenders, tenders without EMD and late submission of tenders shall be rejected.

- 13.If any of the dates mentioned above is declared a holiday, the next working day will hold good without any change in the timings indicated.
- 14.UIDAI, Bangalore reserves the right to accept / reject any or all tenders without assigning any reasons.
- 15.Further details of work can be obtained in the office of the undersigned Office, Bangalore or Tendering support office Ph No.080-22340863/864 on all working days.

Sd/-
Deputy Director

SUMMARY OF NOTICE INVITING RE-TENDER

- 1.** Date of Commencement : Within one week from the date of issue of Work Order
- 2.** Time for Completion : 10 Weeks
- 3.** Earnest money Deposit : Rs.3,80,000/-
- 4.** Penalty : 1 % of the Project cost per day (refer clause 14 of general instructions/conditions)
- 5.** Retention amount (Security deposit) : 10 % of running/final bills after adjusting the E.M.D amount
- 6.** Billing Cycle/Payment : First running bill after completion of approximate 50% of the total work and second and final bill after completion of the work.
- 7.** Defects liability period. : 12 months from the Date of completion of work.
- 8.** Period of submission of final bill by contractor. : One week from the date of completion of work.
- 9.** Release of retention amount & E.M.D. : After the expiry of defects liability period of 6 months counted from the date of completion of the work
- 10.** Escalation : No Escalation.

General Instructions and Tender conditions

PROJECT : Providing interior works including partitions, flooring, false ceiling & Civil works, furniture and electrical/AC works, etc. at Unique Identification Authority of India, Bangalore

CLIENT : **Unique Identification Authority of India ,
3rd Floor, Khanija Bhavan , South Wing,
#49, Race Course Road,
Bangalore - 560001**

ARCHITECTS: **M/s Aesthetics Interior Designers
No.232, 2nd Main ,Domlur 2nd Stage ,
Bangalore 560 071**

: GENERAL INSTRUCTIONS/CONDITIONS :

1. Tender called for Interior works for Office of Unique Identification Authority of India (UIDAI) Bangalore, from well reputed Interior Contract Firms who have previous experience of executing one similar office interior work costing more than Rs. 100 lakhs each in one financial year during block period of previous 5 years.
2. Every Tenderer is expected before quoting his rates to inspect the site of the proposed work. He must go through all the drawings, Specifications and tender documents. Any further clarifications regarding drawings and documents can be got from the UIDAI. The schedule of probable quantities for various items accompanies this tender. It shall be definitely understood that the UIDAI does not accept any responsibility for the correctness of this schedule in respect of probable is liable to alterations by omissions, deductions or additions at the discretions of the UIDAI without affecting terms of the Contract.
3. The quoted rates are for the finished work including the cost of transportation of material to the site, all taxes including sales tax, octroi, works contract tax and any other taxes as applicable, ESI, PF and wastage of materials etc. The rates quoted shall be inclusive of labour accomodation and food throughout the contract period. The quoted rate shall be firm and shall not subjected to any variations arising from cost of material or labour for the entire duration of the contract. The contractor needs to give the proof for statutory payments, like A/C No, Challans, etc., failing which "UIDAI" will deduct such amounts from the bills and remit the same to the concerned authorities. The contractor must comply with E.S.I. P.F. and other statutory requirements and submit of same to UIDAI.

4. No alteration shall be made by the tenderer in the Notice inviting tenders, instructions to the contractor, contract for, condition of contract, drawings and specifications or quantities and if such alterations are made or any special conditions attached, the tender is liable to be rejected.
5. Every Tenderer shall furnish along with his tender the latest income-tax clearance certificate, without which his tender is likely to be rejected.
6. **The contractor must to carry out the sound oriented works without disturbing the neighbours in working hours and hence, the contractor should make arrangements to carry out such works during holidays and probably during nights and complete the work in all manner within stipulated time.**
7. The "UIDAI" reserves the right to delete/add any items listed/not listed in this contract to the contractors scope of work. The UIDAI also reserves the right to split the work into separate quantum of work could then be awarded to separate contractor if UIDAI so desires.
8. The work shall be carried out under the direction and supervision and in stages, as desired by the UIDAI. On acceptance of the tender, the contractor shall intimate the name of the accredited representative who would be responsible for taking instructions from the UIDAI and for carrying out the work.
9. Matters not covered by the specifications given in the contract as a whole shall be covered by the relevant Indian Standard Codes. If such codes on a particular subject have not been framed, the decision of UIDAI shall be final.
10. The contractor shall not be entitled to any claim/compensation for any loss, by him on account of delay in commencing or executing the work whatever the cause for such delays may be including delay in procuring Government controlled other materials.
11. No part of the contract shall be sublet without the written permission of the UIDAI nor shall the power of attorney be transferred thereby authorizing others to receive payment on behalf of the contractor.
12. The UIDAI decision with regard to the quality of material and the workmanship will be final and binding and any material rejected by the UIDAI shall be immediately removed from the site and execute the work with the approved materials by the contractor.
13. Defects liability period shall be for one year from the date of virtual completion of the work and any defects developed within defects liability period will have to be rectified by the contractor at their own cost within the reasonable time and incase the defects are not rectified by the contractor, the Architects with the concurrence of the UIDAI can get the work done from other agency and the same cost shall be deducted from the bills or security deposit of the contractor.

14. **PENALTY**: UIDAI shall levy penalty at the rate of 1% of the estimated cost of the whole work as shown by the tender for every day that the work remains uncommenced or unfinished, after the proper dates.
15. **DAMAGE**: Any damage caused to the property and premises by the contractor or his representatives will have to be rectified by the contractor at his cost.
16. **COMMENCEMENT AND COMPLETION**: The work shall *be* started within one week from the date of work order at the site. The work shall be in accordance with programme of work approved by the UIDAI and shall be completed in all respects within 10 weeks from the day the Work order is issued.
17. **DAMAGE TO PERSONS AND PROPERTY**: The contractor shall indemnify and keep indemnified the employer against all losses and claims for injuries or damages to any person or property whatsoever which may arise out of or in consequence of the construction and maintenance of works and against all claims, demands, proceedings, damages, costs, charges, expenses, whatsoever in respect thereof in relation thereto.
18. **SITE ORDER BOOK**: Sites order book must be maintained and always be available at the site to record the instructions by the UIDAI or its representative. The contractor must see that the instructions noted therein are properly carried out.
19. **INSURANCE**: The contractor shall follow rules as prescribed by GOK and GOI.
20. **MEASUREMENTS**: Measurements will be taken jointly by the UIDAI and the contractor. In case of difference of opinion, UIDAI decision shall be final and binding on both parties.
21. **MATERIALS AT SITE**: Material will be stored at the premises entirely at the contractor risk and cost. The complete materials shall be insured against fire and theft. The contractor shall buy the contractors- "All Risk Policy" jointly in the name of the UIDAI and it should be deposited with UIDAI.
22. **PAYMENTS**: Contractor can claim the first running bill during the execution of work (after completing 50% of the approximate total work) and second and final bill payment from UIDAI only after the completion of the project after submitting the certified bill duly certified by the UIDAI.
23. **COPIES OF DRAWINGS TO BE KEPT AT SITE**: One copy of the approved drawings furnished to the contractor shall be kept at the site and same shall at all reasonable times be available for inspection during execution by UIDAI.
24. **COMMUNICATION TO BE IN WRITING**: All references, communication, correspondence made by UIDAI, the Architect, the Architects representative or the contractor concerning the works shall be in writing and communications or complaints which are not in writing shall not be considered.

25. LABOUR:

- a. Government of Karnataka (GoK)/Government of India (GoI) LABOUR RULES SHALL BE FOLLOWED:
- b. PROVISIONS OF WORKMEN'S COMPENSATION ACT: PREVAILING GoK/GoI RULES BE FOLLOWED.

26. COST OF SAMPLES: The Contractor at his cost shall supply all samples as desired and instructed by the UIDAI.

27. EXTENSION OF TIME OF COMPLETION: UIDAI DECISION IS THE FINAL

28. WORK TREATED AS COMPLETE:

The work shall not be treated as virtually completed until and unless:

- a. The site is clear from all unused, excess, waste material.
- b. The contractor has returned all equipment, tools and plant taken from UIDAI
- c. Any other material, taken on loan, transfer from other agencies have been returned by the contractor.
- d. The contractor to the satisfaction of the UIDAI rectified any damage caused by the contractor to the work executed.
- e. The Architect certifies in writing that the contractor has virtually completed the works. The defects liability period shall commence from the date of issue of certificate of virtual completion.

29. METHOD OF MEASUREMENT: The work shall be measured in accordance to relevant IS codes not withstanding any general or local custom, except where otherwise specially described or prescribed in the contract.

30. MODE OF SUBMISSION OF RUNNING AND FINAL BILLS: The first running bill & second and final bill measurements for the work done need to be submitted in following format:

- a. ONE SOFTCOPY IN MS WORD / MSEXCEL.
- b. THREE SIGNED HARD COPIES OF ABOVE.

ARTICLES OF AGREEMENT

Articles of Agreement made this daybetween UNIQUE IDENTIFICATION AUTHORITY OF INDIA, 3rd Floor, Khanija Bhavan, South Wing, #49, Race Course Road, Bangalore – 560001 represented by Deputy Director and the contractor represented by Whereas the UIDAI desires to carryout **interior works including partitions, flooring, false ceiling & Civil works, furniture and electrical/AC works, etc. at** UNIQUE IDENTIFICATION AUTHORITY OF INDIA, 3rd Floor, Khanija Bhavan, South Wing, #49, Race Course Road, Bangalore – 560 001 and as caused drawings, specifications and schedule of probable quantities describing the works, to be prepared and whereas, the said drawings as issued from time to time, the notice of tender general, instruction, to contractor, the contract Agreement along with. the special conditions, the specifications and schedule of probable quantities have been signed by or on behalf of the parties hereto, and whereas the contractor has agreed to execute the work shown on the said drawing and/ or describe in the specifications and included in the said schedule of probable quantities at the rates herein after set forth and so on the terms and conditions and general conditions (both herein after referred to as the said conditions) hereto annexed.

NOW IT IS BY AND BETWEEN THE PARTIES AS FOLLOWS:

1. In consideration of payment to be made to the contractor has herein after provided, he shall act upon and subject to the said conditions, execute and complete the work shown upon the said drawings and such further detail drawings as may be furnished to him by the said UIDAI and described in the said specifications and the said schedule of probable quantities, within the time specified in the tender and in accordance within said conditions.
2. The UIDAI shall pay the contractor such other sums as shall become payable hereunder at the end in the manner specified in the said conditions. The invitation and notice of tender, tender agreement, acceptance of tender drawings/specifications and general conditions and schedule of probable quantities, together with summary shall be read forming part of this agreement and parties hereto shall respectively abide by and submit themselves to the conditions and stipulations and perform the agreement on their part respectively as contained in the above mentioned document
3. The contract is neither a fixed not a lump sum contract nor a piece contract, but it is a contract to carry out the work in respect of the entire works to be paid for according to actual measured quantities at the rates contained in the schedule of rates and probable quantities or as provided in- the said conditions.

GENERAL CONDITIONS

1. The conditions herein before referred to, in construing these conditions and interpretations, specifications, schedule of quantities and contract agreement, the following works shall have the meaning herein assigned to them except where the subject or context otherwise requires.

UIDAI	shall mean	UNIQUE IDENTIFICATION AUTHORITY OF INDIA 3rd Floor, Khanija Bhavan, South Wing, #49, Race Course Road, Bangalore - 560001 & shall include any officer nominated by Deputy Director General, UIDAI
Architect	shall mean	M/s Aesthetics Interior Designers 232, 2 nd Main, Domlur 2 nd Stage Bangalore 560 072
Contractor	shall mean	The Bidder or Party to whom the contract is awarded and shall include his/her legal representative / assignee/ or successor
Site	shall mean	3 rd Floor, Khanija Bhavan, South Wing, #49, Race Course Road, Bangalore-560001
This Contract	shall mean	General instructions/Conditions to the contractor. Note to Schedule – B, Summary of inviting tenders, General specification for interior works Articles of Agreement, The general conditions of contract, the Similarly approved drawings if any, the schedule of quantities and specifications attached hereto duly signed.
Notice in writing	shall mean	notice written, typed or printed characters sent by Registered Post/ Courier/ Fax/ E-mail to the last known private or business address of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered.

2. SCOPE OF CONTRACT:

The contractor shall carryout and complete the said work in every respect in accordance with this contract and with the directions of and to the satisfaction of the UIDAI. The UIDAI may in their absolute discretion and from time to time issue

further drawings and or written instructions, details, directions and explanations that are hereafter connectively referred to as " UIDAI Instructions" in regard to

- a. The variation or modification of the design, quantity or quality of works or the additions or omissions or substitutions of any work.
- b. Any discrepancy in the drawings or between the schedule of probable quantities and or drawings or specifications.
- c. The removal from the site of any materials brought thereon by the contractor and the substitute of specified material.
- d. The dismissal from the works of any persons employed there upon by the contractor.
- e. The removal/re-execution of any works executed by the contractor.
- f. The opening up for inspection of any works covered up.
- g. The amending and making good of any defects after completion clause.

The contractor shall forthwith comply and fully execute any work comprised in such UIDAI instructions provided always that verbal instructions, directions and explanations given to the contractor or his representatives upon the works by the UIDAI shall if involving be confirmed in writing by the contractor within 3 days, and if not within further 7 days by the UIDAI, such shall be deemed to be UIDAI instructions within the scope of the contract.

3. ASSIGNMENT AND SUBLETTING :

The whole of the works included in the contract shall be executed by the contractor and the contractor shall not directly or indirectly transfer, assign or underlet the contract or any part or share thereof or interest therein without the written consent of the UIDAI, and no undertaking shall relieve the contractor from the full and entire responsibility of the contractor or from active superintendence of the works during the progress.

4. VARIATION NOT TO VITIATE CONTRACT:

No alterations omission, variation shall vitiate this contract but incase the UIDAI think proper at any time during the progress of the works to make any alterations in or additions to or omissions from the works or any alterations in the kind of quality of the materials to be used therein and shall give notice thereof in writing under his band to the contractor, the contractor shall alter, and add to or omit as the case may require in accordance with such notice but the contractor shall not do any work extra to or make any alterations or additions to or omissions from the works or any other deviations from any of the provision of the contract stipulations, specifications or drawings without the prior consent in writing of the UIDAI and the value of such extras, alterations, additions or omissions shall in all

cases be determined by the UIDAI and the same shall be added to or deducted from the contract amount accordingly.

5. PRICES FOR EXTRA ITEM ASCERTAINMENT OF:

Should it be found after the completion of the works from measurements taken in accordance with the previous clause that any of the quantities or amounts for the works in schedule of quantities and /or tender or that any variation made, the valuation of such quantities amount or variation, unless previously or otherwise agreed upon, shall be made in accordance with the following rules:-

- a. The net rates or prices in the original tender shall determine the valuation of the extra work where such extra work is of similar character & executed under similar condition as the works period therein.
- b. If it is not possible to determine the rate for any item in accordance with (a) above the rate for the same shall be determined in accordance in the following rules:-
 - i) The rates for the extra item shall be derived from the rate of appropriate item of similar class for which *the* rate has already been accepted, where the same can be directly derived.
 - ii) Where the rates cannot be worked out by any of the methods given above, the Contractor shall be given market rate material (including any taxes that may be applicable), cartage of material to site, labour for construction or fabrication and placing or fixing in position plus 10% of the total amount towards Contractor's profit, his overhead charges and works contract on sales tax .No additional amount will be payable beyond the 10% for any reason whatsoever.

6. DISMANTLING MATERIALS FOR BUY BACK:

The Contractor shall treat all material obtained during dismantling of the site for work etc., as the UIDAI's property and such material shall be bought by the contractor on a buy back basis , which is included in the commercial bid.

7. DEFECTS AFTER COMPLETION:

Any defect shrinkage, settlement or other faults which may appear within the Defects liability period stated in the summary hereto or, if none stated within one year after the completion of the Work, arising in the opinion of the UIDAI from material or workmanship not in accordance with the contract shall at the discretion of the UIDAI in writing and within such reasonable time as shall be specified therein be amended and made good by the contractor at his own cost unless the UIDAI decides that he thought to be paid for such amending and making good. In case of default, the UIDAI may employ and pay other persons to amend and make good such defects at the contractor expense and deduct the same from the contractor's bill.

8. CERTIFICATE OF VIRTUAL COMPLETION:

The works shall not be considered as completed until the Architects have certified in writing that they have been virtually completed and the Defects Liability Period shall commence from the date of such certificate. Such certificate of virtual completion shall not be issued until the contractor complete the work in all manner and clear the site of all materials, remove all dirt and dust from the wood work and the floors, clean all doors and windows, ventilators etc., of all splashes of white wash, colour wash, distemper paint etc.,

9. WATER AND POWER:

UIDAI shall make available to the contractor electricity and water for the purpose of Construction work at the already available source point. However it is responsible of the contractor to arrange for further distribution as required and the costs of power and water consumed shall be borne by the contractor only.

10. ARBITRATION :

In case of any dispute of difference arises between the contractor and UIDAI on any matter within the scope of this contract, except on any matter left entirely to the discretion of the UIDAI under the provisions of the Agreement, then either party shall forthwith give to the other of such dispute or difference and such dispute or difference shall be referred to arbitration of an Arbitrator, one to be nominated by UIDAI and the other by the contractor, or failing agreement between the said arbitrators by an Umpire appointed by them and such award shall be binding on both the parties. The procedure shall be as laid down by the Indian Arbitration and conciliation Act 96 and statutory modifications thereof

11. TERMINATION:

If in the opinion of the UIDAI felt that the work is highly unsatisfactory or the progresses is so slow that the Contractor shall not be able to complete the work in the schedule date, then the UIDAI shall have the right to terminate the contract at the contractor risk by giving one notice in writing to that effect. The UIDAI shall then have the right to award the contract to such other agencies it may deem fit and any loss or expense incurred on this account as certified by the Architect will be deducted from the amount, due to the contractor without assigning reason.

12. REPRESENTATIVE AT SITE:

The Contractor shall depute persons technically qualified and experienced in this field as a site representative as soon as the work is allotted to them and they are required to inform the UIDAI of the name of their representatives who shall be responsible for the day-to-day supervision of the work at site and to take instructions and official letters from the UIDAI.

13. PROGRESS REVIEW MEETINGS:

Twice the week meetings will be held for which the contractor should prepare progress report indicating progress of work compared to the planned Schedule. The contractor is accepted to attend these meetings regularly with a report of the project

14. TIME SCHEDULE:

As soon as the work is allotted, the contractor is required to submit the time schedule for completing the work in time within 3days of the receipt of award of works and get it approved by the UIDAI. There should be proportionate progress according to the completion time allowed to the contractor. He should adhere to the time schedule failing which the UIDAI either penalize as per the clause 13 of General Instructions/Conditions or Terminate the contract as per the clause 11 of general conditions and get the remaining work done from other agencies at the cost and risk of the default contractor.

15. ADDITIONAL CONDITIONS:

Any of the additional terms and conditions agreed upon between UIDAI and the Contractor shall also form a part of this tender document.

GENERAL SPECIFICATIONS FOR INTERIOR, CIVIL, A/C, ELECTRICAL WORKS

A. GENERAL

The contractor is advised to study all the drawings in detail, including the intend of the design. All the clarification should be sought by the contractor prior to filling in the tender. All works shall be carried -out in the best workmanship and wherever specification for any item are not given, the relevant Indian Standard Institution specifications shall be applicable and followed. Wherever the words "Approved" occurs in these specifications it shall mean that the competent authority for such approval is the UIDAI. Any materials found not confirming to the relevant specifications shall have to be removed by the contractor from the site at his *own* expense and complete the work by using materials confirming to the relevant specifications.

B. TECHNICAL SPECIFICATIONS FOR INTERIOR & CIVIL WORKS

A. CARPENTRY:

1. Plywood or block board shall be of approved make only.
2. C.P.T.W. of good quality i.e. without knots shall be used or second hand Burma teakwood without holes shall be used for door frames, partitions etc.
3. Plywood, wood sections, veneer strictly should be used after applying white ant anti-termite liquid by spraying method only.
4. Too many joints in any furniture pieces shall not be considered.
5. Wooden sections for furniture as mentioned shall not be in pieces.
6. Any veneer finish sheets of 8'0"x4'0" in matching set should be considered but not in small size & thickness shall be 3.5 to 4mm unless otherwise as specified.
7. Nails or screws shall be fixed to the ply or veneer shall be fixed in equal spaces i.e. correct horizontal or vertical style only.
8. Scratches on veneer before or after furnishing shall be considered damaged piece.
9. The half check in plywood, wood joint should be made wherever necessary.
10. While fixing any fixtures on fittings such as lock, hinges etc. Rough finishing at sides shall not be considered.
11. Marine ply side wherever they are visible whether a side/rear or front shall be covered with beading Patti.
12. Any skirting shall be fixed with marine ply along with approved finishing.

13. **Procedure of Work:** The registered firm shall arrange the operations that are convenient and agreed to the UIDAI. He shall adhere to the time schedule presented by him and agreed by the UIDAI and shall complete all works allotted to him in time, giving best workmanship to the entire satisfaction of the UIDAI.
14. **Built-in Joinery:** Where the joinery work is specified to be built-in it shall be the responsibility of the registered firm to ensure that the joinery works are set i.e plumb and true in line and shall not be damaged or displaced by subsequent operations.
15. **Make Good Defective Work:** The registered firm shall be responsible for any shrinkage or any other defects which may appear in any joinery works, All defective or damaged work shall be taken and repaired to the satisfaction of the UIDAI without any extra charges.

B. LAMINATE: (1.0mm)

1. Shall be used as per mentioned make only, (Refer List of materials)
2. Color shade as mentioned shall be used.
3. Lower quality of laminate shall not be considered otherwise rates shall be deducted.
4. All grooves of ¼" or ½" as mentioned in the drawings shall be finished with laminate only.
5. Pressing and fixing of laminate shall be to the mark.
6. Normally front side elevation of finish laminate shall not be visible with thickness of laminate but instead at side only.
7. Where joints of laminate shall be made at counter. It shall be finished with ¼" groove three sides laminate or as per instructions of the Architect.
8. No scratch or patches on laminate shall be considered while delivering goods.

C. HARDWARES:

As per list of materials

Screws: All screws shall be of steel screws or nettle fold make or equivalent confirming to IS – 1365.

D. VENEER:

Lower quality of veneer shall not be considered, otherwise rate shall be deducted.

E. CIVIL WORK: Removing debris and thrown out of the site shall be Contractor's duty and if Local authority such as ward office etc. is interfering, Contractor shall on mutual understanding solve the matter at their end, without putting financial burden to the employer.

1. "First Grade" quality of Ceramic tiles of approved make as mentioned in list of materials.
2. Mortar sand cement shall be as per PWD's code for specified items.
3. Cement such as "Birla, ACC or L T" shall be used.
4. Smoother's and leveling in plastering shall be achieved by using plaster of Paris for treatment as finishing materials to the exposed surfaces Internal plaster.
5. Tile joints shall be filled up properly and cleaned with mild acid liquid UIDAI before giving the possession.
6. Temporary water, electricity, cleaning, debris, removing of existing ceiling along with materials etc. Shall be arranged by the contractor by himself without sharing any extra amount to the employer/owner on supplementary bill, instead they should be considered in individual items itself while quoting in the tender.

F. POLISHING/FINISHING:

1. Smooth finish polishing shall be required either from outside and or inside the cabinets for all furniture items.
2. Melamine finish shall not have any spots, marine ply and goglines while delivering goods.
3. There shall not be scratches on the existing floor/ new floor tiles or corners breakage but instead it is requested to the contractor's that they should either cover the flooring with thick polythene or plaster of paris thick layer till work is completed. Otherwise payments of the same shall not be made till last stage.
4. Painting finishing shall be made to the mark without any brush mark on finish good and no spots on furniture/glass etc.
5. On completion of the Interior Work the main contractor shall clean the entire premises, tiling, toilets etc. to the employer/Architect's satisfaction prior to delivery possession of the premises.
6. All the surplus material shall be removed from time to time and all wood work, hardware, floors or other adjacent work shall be cleaned upto the satisfaction of UIDAI. All glass throughout having any paint or varnish, marks, shall be washed. Any damage to glass may be replaced by the registered firm at his own cost.

TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS

SECTION-A

1.0 LT SWITCHGEARS & DISTRIBUTION BOARDS:

1.1 SCOPE :

This section shall cover supply, assembly, installation, connection, testing and commissioning of medium voltage cubicle type MV Switchgear and Distribution boards as described in these specifications, drawings and schedule of quantities. The distribution boards are designated as:

Main Distribution Boards

Sub Main Distribution Boards.

1.2 MEASUREMENT:

The unit rate per item shall include design supply, assembly, installation, connection, testing and commissioning of MV Assembly Distribution boards, with all the components in place, internal cabling, as specified in this specification, and shown on the drawing, and load schedule complete with supply and fixing of M.S. channel/ angle iron support on wall/floor etc.

In case of switchgears and panels issued by owner for erection the unit rate shall include inspection, receiving, storage, installation, field testing and commissioning activities including co- ordination with the suppliers of the switchgears. The rate shall be quoted per set of switchgears/panels as identified in the BOQ. The details of design/Constructional features of these switchgears are specified here below.

1.3 GENERAL :

1.3.1 SYSTEM RATING:

All the Main Panels/Motor control centers Distribution boards, Sub-Main Distribution boards, shall be suitable for operation on three phase/ single phase, 415/230 volts, 50 Hz neutral solidly grounded at transformer and short circuit level not less than 415 Volts at 50 KA / 35 KA.

The Distribution boards shall be designed to withstand heaviest condition at site, with maximum expected ambient temperature of 40°C, 90-95 percent humidity and dusty weather.

1.3.2 **STANDARDS AND CODES :**

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

IS 1394 -	L.V. switchgear and control gear Part-I – 1993 General rules
IS 5578-85	Guide for marking of insulated conductors.
IS 11353-85	Guide for uniform system of marking and identification of conductors and apparatus terminals.
IS 2147-62	Degree of protection provided by enclosures for low voltage switchgear and control gears.
IS 2675-83	Enclosed distribution fuse boards and cutouts for Voltages not exceeding 1000 V.
IS 2551-82	Danger notice plates.
IS 13947-1993	Circuit breakers.(Part-II)
IS 13947-1993	Switches, Disconnectors, switch disconnector (Part - III) and fuse Combination units.
IS 1818-72	Alternating current isolators (disconnectors) and earthing switches.
IS 8623-77	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC & 1200 V DC.
IS 8828	Miniature air break circuit breakers for voltages not exceeding 1000 V.
IS 9926	Fuse wires used in rewirable type Electric fuses upto 1100 Volts.
IS 2208	HRC fuse links
IS 2705	Current Transformers(Part- I,II & III)
IS 3156	Voltage Transformers(Part- I,II & III)
IS 1248	Indicating Instruments
IS 722	Integrating Instruments
IS 13947-93	Control devices and switching elements.(Part - 5)Section-1
IS 13947-93	Contactors and motor starter section 1 (Part - 4) Electromechanical. Section – 1 Section-1
IS 3231	Relays
IS 375	Marking and arrangement of busbars Indian Electricity Act and Rules.

1.3.3 **SHOP DRAWINGS:**

Prior to fabrication of the Switchgears, Distribution boards, the contractor shall submit for Construction manager/Consultants approval the shop/ vendor drawing, and design calculations, indicating type, size, short circuit rating of all the electrical components used, details & schedule of components & model Nos. type, rating etc., busbar size, internal wiring size, Distribution board dimension, color, mounting detail etc., The contractor shall submit manufacturer's catalogues of the electrical components installed in the distribution.

1.3.4 **INSPECTION:**

At all reasonable times during production and prior to transport of the distribution boards to site, the contractor shall arrange and provide all the facilities at their plant for inspection by Construction manager/Consultant or authorized representative.

1.3.5 **TEST CERTIFICATES:**

Testing of Distribution boards shall be carried out at factory and or at site as specified in Indian Standards in the presence of Construction manager/Consultants. The test results shall be recorded on prescribed forms. The test certificates for the test carried out at factory or at site shall be submitted in six copies to the Construction manager/Consultants for approval.

1.4 **CONSTRUCTION :**

1.4.1 CUBICLE TYPE MV SWITCHGEARS & DISTRIBUTION BOARDS:

1.4.1.1 **STRUCTURE:**

The MV Switchgears panels and Distribution boards shall be sheet steel enclosed cubicle pattern, floor mounted free standing, totally enclosed dead front, compartmentalised multitier formation design. The panels shall be extensible type with provision for bus bar extensions. Generally all Switchgears, Panels, MDB's, SMDB's & DB's shall be of front access only & suitable for top entry of cables unless otherwise specifically specified for bottom entry.

All MS sheet steel used in the construction of Distribution boards shall be 2mm thick and shall be folded and braced as necessary to provide a rigid support for all components. Sheet steel shrouds and partitions shall be of minimum 2 mm thickness. Joints of any kind in sheet steel shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal. The height of the panels should not be more than 2200 mm. The operating levels of the top most cubicle shall not be more than 1800 mm. The operating level of the lower most cubicle shall not be less than 500 mm.

The Panels / Distribution boards shall be totally enclosed, completely dust and vermin proof. 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 foam rubber and/or rubber strips and shall be lockable. Doors shall have concealed hinges.

All panels and covers shall be properly fitted and secured with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with bolt and nuts. Self threading screws shall not be used in the construction of the panels/DBs etc.

A base channel of 75mm x 40mm x 5mm thick shall be provided at the bottom. A clearance of 300mm between the floor of the Panels/ Distribution Board and the bottom of the lower most units shall be provided.

The Panels/ Distribution boards shall be preferably arranged in multitier formation. These shall be of adequate size with a provision of 20 Percent spare space to accommodate possible future additional switch gear. The size of the boards shall be designed in such a way that the internal space is sufficient for hot air movement, and the electrical component do not attain temperature more than 40 degree Celsius.

Knockout holes of appropriate size and number shall be provided in the Panels/Distribution board in conformity with the number, and size of incoming and outgoing conduits/cables.

Alternatively the Panels/Distribution boards shall be provided with removable undrilled sheet steel gland plates (3mm thick) at top to drill holes for cable/ conduit entry at site.

The switch boards shall be designed to facilitate easy inspection, maintenance and repair.

The Panels/Distribution boards shall be sufficiently rigid to support the equipment without distortion under normal and short circuit condition. They shall be suitably braced for short circuit duty. Provision shall be made for permanently earthing the frames and other non current carrying parts of the switchgear by two independent earth connections.

1.4.1.2 **PROTECTION CLASS:**

All indoor Panels/Distribution boards shall have degree of protection conforming to class IP 52. While outdoor panels shall be weather proof dust and water tight IP-55.

1.4.1.3 **METAL TREATMENT & FINISH:**

All sheet steel work used in the construction of switchboard shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating and then spraying with a high corrosion resistant primer. The primer shall be baked in an oven followed by finishing treatment of two coats of epoxy paint alternatively these shall be powder coated to the specified shade of IS.5 of approved color and shade. Inside the doors shall be painted ivory white, matt finished. The total thickness of paint shall not be less than 25 microns.

1.4.1.4 **BUS BARS :**

The Bus bars shall be of three phase four wire system with separate neutral and earth bar. The busbars, and interconnection between busbars and various components shall be of high conductivity, high strength aluminium alloy complying with the requirement of grade E91E of IS 5082. The busbar shall

be of rectangular cross section designed to withstand full load current for phase busbars and half rated current for neutral busbars and shall be extensible on both sides. The bus bar shall be rated for the frame size of the main incoming breaker, but in any case not less than 200 amp capacity. The busbars shall have uniform cross section through out the length.

The busbars and interconnections shall be coated with heat resistant sleeves & colour coding. The busbars shall be supported on unbreakable, non hygroscopic insulated supports of FRP SMC supports at sufficiently close intervals to prevent busbar sag and shall effectively withstand without damage electromagnetic stresses in the event of short circuit. The neutral as well as earth bar shall also be capable of withstanding the fault level.

The busbars shall be housed in a separate compartment. The busbar shall be isolated with 3mm thick bakelite sheet to avoid any accidental contact.

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

All connections between busbars and circuit breakers/ switches and between circuit breakers/switches and cable terminals shall be through solid copper strips of proper size to carry full rated current. These strips shall be insulated with insulating heat resistant paint with color coding.

1.4.1.5 CIRCUIT COMPARTMENTS:

Each circuit breaker 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 units in "ON" and "OFF" positions. Safety interlocks shall be provided for air circuit breaker to prevent the breaker from being drawn-out when the breaker is in "ON" position.

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

1.4.1.6 INSTRUMENT COMPARTMENT:

Separate and 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 units, bus bars and connections.

1.4.1.7 TERMINALS :

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 terminal blocks. No direct connection of incoming or outgoing cables to internal components of the Panels/Distribution board is permitted; only one conductor may be connected in one terminal.

1.4.1.8 **WIREWAYS:**

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

1.4.1.9 **CABLE COMPARTMENTS:**

Cable compartments of adequate size shall be provided in the Panels/Distribution Boards 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.

1.4.1.10 **EARTHING:**

Copper earth bars of suitable size but not less than 25 mm x 3 mm shall be provided in the Panels/Distribution Boards for the entire length of the panel. The frame work of the Panels/Distribution board shall be connected to this earth bar. Provision shall be made for connection from this earth bar to the main earthing bar coming from the earth pit on both sides of the Panels/Distribution board and to take tapping to the outgoing earthing strips to connect to the main distribution boards.

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. CT earthing also shall be connected to this earth bar.

1.4.1.11 **LABELS:**

Engraved PVC labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the Panels/DBs shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.

1.4.1.12 **INTERNAL COMPONENTS:**

The Panels/ Distribution boards shall be equipped complete with all type of required number of circuit breakers, contactors, relays, fuses, meters, instruments, indicating lamps, push buttons, equipment, fittings, busbars, cable boxes, cable glands etc., and all the necessary internal connections /wiring as required and as indicated on relevant drawings. Components necessary for proper complete functioning of the Panels/Distribution boards, but not indicated on the drawings shall be supplied and installed on the distribution boards.

All parts of the Panel/Distribution boards carrying current including the components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the permissible values as per the relevant specifications at any part of the Panel/Distribution boards.

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

1.4.2 **MCB DISTRIBUTION BOARDS:**

1.4.2.1 **SCOPE:**

This section relates to specifications for design supply, assembly, installation, connection, testing and commissioning of lighting and power distribution boards (LPDB's), using Miniature Circuit Breaker (MCB), Earth Leakage Circuit breaker (ELCB), Contactor, Neutral link, Earthing terminals, control switch terminals, cubicle of CRCA sheet steel housing and complete the item installation.

1.4.2.2 **SYSTEM:**

The MCB distribution boards shall be suitable for operation on 400/440 volt, 3 phase, 4 wire, 50 Hz A.C. supply system or 220/250 volt, 1 phase, 2 wire, 50 Hz A.C. supply system.

1.4.2.3 **CONSTRUCTION:**

- a) The DB's shall be factory made and preferably of those manufacturers whose MCBs, ELCB's are to be used. General arrangement layout of the DB's shall be approved by the Construction manager/Consultant before manufacture.
- b) The DB shall be metal clad duly fabricated from 2mm (14/16 SWG) thick high quality CRCA sheet.
- c) The DB shall be cubicle, compartmentalized, wall/floor mounted and dead front operated.
- d) The DB shall be totally enclosed and made dust, vermin and weather proof such that it meets IP 54 of IS 2147 protection classification.
- e) A detachable cover plate of 2mm 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.

Further, the cover plate shall also, have suitable cut out so that dolly of the MCB's can be operated even if the cover plate is in position. A transparent plastic protection cover shall be provided on the cut-out portion of the cover plate.

The cover plate shall also provide right above the respective cut-outs a suitable arrangement to label the electrical circuit details of the MCB's mounted on it as well as to affix a danger plate in legible manner.

The cover plate shall be fixed to the board with adequate size zinc passivated machine screws.

Above the detachable cover plate, one additional hinged door of 2mm thick CRCA sheet covering the MCB's etc., 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 meet degree of enclosure protection IP 54 as per IS : 2147. The DB's shall undergo the process of painting as described under cubicle type main/submain distribution boards.

- f) The DB shall have top/bottom entry arrangement for incoming and outgoing cables/conduits.
- g) All hardware to be used in manufacture of the DB shall either be of mild steel zinc passivated or otherwise be treated to prevent corrosion due to humid atmosphere.
- h) All internal electrical connections shall be carried out using 1100 volt grade, PVC insulated, Copper conductor of ISI approved make, having rated current carrying capacity to carry continuous full current of respective switch/MCB rating at operating conditions prevailing at the project site.
- i) The DB internals shall be earthed with use of copper strips running through out the length. Size of the earthing strip shall be as shown in the respective drawing.
- j) The earthing strip shall be brought out on two sides of the DB's with bolted type earth terminating arrangement, for connecting to the building earthing grid. The earth terminal shall be of either brass or zinc passivated mild steel.
- k) All non current carrying metal surfaces of the DB's shall be adequately treated with seven tank pretreatment process to render it free from grease, oil, oxide, dirt, etc., to make them ready to receive and hold coats of zinc chromate primer.
- l) The DB's shall be provided with electric components and accessories as per the details shown in the drawing/BOQ for the respective electric distribution board.

1.5 **INSPECTION:**

- 1.5.1 The DB's shall be inspected and checked as per inspection manual of the DB manufacturer.
- 1.5.2 Various electrical components and accessories of the DB's shall be checked as per drawing for the respective DB's.
- 1.5.3 The DB's shall be checked for rigid mounting, earthing connection, proper rating & size of components, internal wiring etc.,
- 1.5.4 All mechanical fasteners and electrical connections shall be checked and tightened before installation.

1.6 **INSTALLATION:**

- 1.6.1 The DB's shall be assembled and aligned together and be installed at site as per installation manual/ instruction of the DB manufacturer.

The installation shall conform to relevant Indian Standard specification and requirement of local site conditions.

- 1.6.2 The DB shall be installed in surface/concealed manner at the location as shown in the respective drawings.
- 1.6.3 All minor electrical and mechanical work required to be attended to on the DB shall be completed in an approved manner after installation but before energizing the DB's.

1.7 **TEST:**

Prior to commissioning of the DB's following tests shall be carried out.

- 1.7.1 Mechanical endurance test shall be carried out by closing and opening of all the MCB's, switches etc.
- 1.7.2 Insulation resistance test shall be carried out between phases and between phase to earth bus, keeping the isolating switch in open position. Similar test shall be carried out keeping the isolating switch in closed position.
- 1.7.3 All the interlocks, controls and tripping mechanisms of the switch gears shall be tested for their proper functioning.
- 1.7.4 Each panel shall be provided with a thermostatically controlled space heater of adequate rating and single phase plug point and cubicle illumination lamp with switch operated at 240V AC, 50 Hz. Heaters shall have individual ON-OFF switches.

1.8 **COMPONENTS:**

1.8.1 **GENERAL:**

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 room temperature shall be allowed for, the thermal and magnetic trip rating shall be compensated for the ambient temperature.

The rating indicated on the drawings are ratings anticipated at prevailing site condition.

1.8.2 **AIR CIRCUIT BREAKERS:**

The air circuit breaker 3pole or 4 pole(the neutral rating shall be 100% rated & should be settable at site to 50% or 100% rating)shall comply with the requirements of IS:13947-2 (1993) and shall have:

- i) A service short circuit breaking capacity shall be as specified and equal to short circuit withstand values. All short circuit ratings shall be I_{cs} values.
- ii) A short circuit making capacity of 143 KA
- iii) A short time withstand capacity of 50 KA for 1 second.
- iv) Mechanical and electrical endurance without maintenance, shall be at least for 1000 operating cycles and 8000 operating cycles respectively.
- v) Electrical overload performance at 6 times the rated current, 110% of the rated voltage as recovery voltage and 0.5 power factor.
- vi) Dielectric test of 2.5 KV applied for one minute on main circuits. Test evidence from a recognized independent laboratory/institution shall be furnished for compliance of the breakers with the above requirements.
- vii) The integral microprocessor based protection release of the ACB's shall have adjustable overload protection settable from 40% to 100% I_n (nominal rating) with time delay option. The short circuit protection shall be settable from 2 to 10 times I_r (Set current) with time delay option. Earth-fault (wherever specified)- settable with time delay.

For TPN breakers with E/F protection, external neutral CT to be provided to prevent tripping on unbalance.

The settings should be settable through membrane key-pad or through rotary potentiometer dial. Also, it should be possible to change the protection settings when the breaker is 'ON'.

The integral microprocessor based release shall have true rms sensing with thermal memory, EMC & zone selective interlocking feature for discrimination. There shall be segregated LED alarm indication for type of fault & self diagnostics in the Integral microprocessor release (O/S, S/C, E/F, mP failure)

The integral release shall display the continuous current measurements i.e Ir, Iy, Ib, Ig or I-leakage on LCD display.

Display of Phase wise load to identify the unbalance in the network is preferred.

Display of Phase wise load to identify the unbalance in the network is preferred.

The ACB's shall be equipped with under voltage trip, shunt trip & closing coil and the coils shall be continuous rated.

All breakers shall be provided with COM port.

- viii) Disconnecting devices of approved type shall be provided to facilitate the removal of the circuit breakers from the housing for test and maintenance purposes.
- ix) The ACB's shall be fitted with detachable type re- quenching device on each pole. The ACB's shall have auxiliary contacts for signalling, interlocking etc which shall be mounter on front & top of the breaker. The ACB's shall have slow close facilities for checking contact operation erosion and contact gap adjustment.
- x) All contacts subject to arcing shall be tipped with arc resisting material. Main contacts shall be silver plated to ensure reliability in service.
- xi) Isolating contacts shall be of the silver plated, multifinger, spring loaded type. Facilities shall be provided to isolate the circuit breaker for inspection purpose. Feature of contact wear inspection indicating the life of contacts shall be provided. The ACB shall have double insulation (class-II) with moving and fixed contacts totally enclosed for enhanced safety and inaccessibility to live parts. The breaker shall have three distinct positions (should be possible to lock in either position) with in the cassette as follows:
 - a) 'Service Position' - with main and auxiliary contacts connected.
 - b) 'Test Position' - with power contacts fully disconnected and control circuit contacts connected.
 - c) 'Isolated position' - With both power and control circuit contacts fully disconnected.

- xii) Interlocks shall be provided to:
 - a) Prevent the breaker from being isolated unless it is in the OFF position.
 - b) Prevent the breaker from being racked into the service position unless it is in the OFF position.
 - c) Prevent the breaker from being accidentally pulled completely OFF the guide rail.
- xiii) Safety shutters of an insulation material shall be provided to prevent access to all live contacts, when the breaker is in the inspection position or completely withdrawn.
- xiv) Facilities for pad locking the safety shutters when breaker is completely withdrawn shall be provided.

Facilities shall be provided for earthing the circuit breaker.

- xv) Air circuit breaker shall be capable of clearing the maximum fault current which can occur.
- xvi) All electrical closing of breaker should be with Electrical motor wound stored energy spring closing mechanism with Mechanical indicator to provide ON/OFF status of ACB.

For all ACBs the operating handle should be provided for charging the spring in continuous action. The spring shall be released with ON/OFF push button command in one operation at the correct speed independent of operator speed. A direct mechanical coupling should indicate the ACB in ON to OFF position thus qualifying to disconnection as per the IS/IEC indicating the true position of all the contacts. One set of NO/NC potential free contacts to be provided for operation on building management system. All accessories like shunt, under voltage motorised mechanism etc shall be front mounted, requiring no adjustments and can be fitted at site.

1.8.3 **MOULDED CASE CIRCUIT BREAKERS (MCCB):**

MCCBs shall satisfy the requirements of IS-13947-2 and shall be of current limiting type cat A Let through energy values shall be furnished. MCCBs of rating 800A & above shall be cat B type. MCCB shall provide type 'C' protection to the contactors as per IEC 158-1B for motor feeders. MCCBs shall be quick make, quick break, independent manual type with trip free feature with mechanical ON, OFF, and TRIP indications. A trip button shall be provided for tripping the breaker. The MCCBs shall have no Line-Load restriction & shall have double insulation (class-11)

All MCCBs above 100A rating shall necessarily have adjustable overload and adjustable short-circuit protection. For ratings upto 100A the settings can be fixed. Wherever earth fault protection specified in SLD/BOG, the MCCB shall

have the same as integral release of O/C, S/c & E/F for TPN breakers with E/F protection, external neutral CT to be provided to prevent tripping on unbalance.

MCCB shall have thermal, magnetic, undervoltage and earth fault releases. Alarm and auxiliary contacts, terminal shrouds, sliding type front operation kit with facility for door interlocking and pad locking shall be provided. Wherever specified, Motor mechanism shall be provided.

For Motor protection/Starter feeders MPCBs shall be used.

The MPCB shall comply with the latest IEC 947-1 (general rules) IEC 947-2 (for circuit breakers) and IEC 947-4 (motor starters).

The MPCB should have built in phase loss and phase unbalance prevention.

The MPCB if with Integral S/C & O/L protection shall have continuously adjustable thermal overload setting from 60% -100% of frame ampere and the magnetic pick-up (for short circuit protection).

For Chiller Motors of 55KW and above, the MPCB shall have selectable tripping class (10A, 10 or 20). The MPCB should be capable of 100% discrimination and Type 2 coordination, and the manufacturer shall furnish a selection chart for the same.

The MPCB shall have built in facility for padlocking in 'OFF' position.

Change over contact block should be provided for O/L & S/C fault indication.

The MPCB shall have provision for mounting electrical auxiliaries like ON/OFF indication, TRIP indication, Remote switch-OFF through shunt or under voltage coil and panel building accessories like door interlock, common bus bar, etc. the addition of electrical control or rotary control must neither hide nor lock the adjustments of the breaker.

1.8.4 FUSE SWITCH UNITS:

The fuse switch units shall be 3 pole double break type suitable for load break duty, quick make and break action. Separate neutral link shall be provided in the switch. All fuse switch units shall be provided with hinged doors duly interlocked with operating mechanism so as to prevent opening of the door when the switch is in "ON" position and also prevent closing of the switch when the door is not properly secured. All contacts shall be silver plated and all live parts shall be shrouded. The incoming and outgoing terminals of switch shall be adequately sized to receive proper size of cables. High rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall be in accordance with IS: 2208-1962 and having rupturing capacity of not less than 35 MVA at 415 volts. HRC fuse links shall be provided with visible indicators to show that they have operated. The switch fuse unit shall be manufactured in accordance with IS: 4047-1967 as amended to date.

1.8.5 **MINIATURE CIRCUIT BREAKER:**

Miniature circuit breakers shall be quick make and break type and conform to IS:8828-1996/EC898-1995. The housing of MCBs shall be heat resistant and having a high impact strength and shall be preferably of thermo-plastic housing. The Breaking Capacity of MCBs shall not be less than 1000 amps, at 230/415 volts and it shall be of energy limiting Class 3. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "ON" and "OFF" indications.

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

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. MCB's shall be provided with magnetic fluid plunger release for over current and short circuit protection.

The over load or short circuit devices shall have a common trip bar in the case of DP and TPN Miniature Circuit Breakers. All the MCB's shall be tested and certified as per Indian Standards, prior to installation.

'C' curve type MCB should be used for lighting loads and 'D' curve type for SMPS/ UPS circuits & control transformer protection.

Power loss per pole shall be in accordance with IS8828 – 1996 and the same shall be furnished by the manufacturer.

1.8.6 **FUSE:**

Fuses shall be of high rupturing capacity (HRC) fuse links and shall be in accordance with relevant ISS and having rupturing capacity of not less than 35 MVA at 415 volts. The back up fuse rating for each motor/ equipment shall be so chosen that the fuse does not operate on starting of motors/equipment.

1.8.7 **EARTH LEAKAGE CB/RESIDUAL CURRENT CB :**

The ELCB/RCCB shall comply with IS:12640-1988/IEC:1008. The ELCB/RCCB shall be current operated independent of the line voltage. ELCB/RCCB shall work on the principle of core balance transformer. The ELCB/RCCB shall be rated for current sensitivity of a min of 30mA for human protection and a max of 300 mA for fire protection & suitable at 240/415 V AC.

The terminals shall be protected against finger contact to IP:20 degree of protection. The ELCB/RCCB shall have a minimum of 20,000 electrical operations.

Testing Provision

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB and the operating handle shall move to the "OFF" position.

1.8.8 **CONTACTORS:**

Contactors shall comply ISI3947-4-1 for standards pertaining to contactors and motor starters. The contactor shall be capable of withstanding bearing & making capacities per following:

<u>AC3 Category</u>	<u>AC4 Category</u>
Making current-10times Rated Current	12 times rated current
Breaking current-8times Rated Current	10 times rated current

The impulse voltage withstand will be 8KV and insulation voltage 1000V.

The contactors should operate without any deration at 55deg. C for AC3 application.

The coil insulation class shall be preferably B class, to sustain frequent switching operations, The auxiliary contact block shall have a switching capacity of 240V at 2A.

Contactors shall have one auxillary in-built and it shall be possible to have additional NO & NC contacts in steps of two.

Contactors used for capacitor application shall have built in damping resistors & block of early make poles.

1.8.9 **VOLTMETER:**

Voltmeter shall comply with IS-1248 (Latest edition) requirements. The dial of the meter shall be square in shape 96 x 96 Sq.mm for sub-panels & 144 x 144 Sqmm size for main panels. The voltmeter shall be moving iron type, flush pattern, with dust and moisture proof enclosure.

The voltmeter selector switch shall be arranged to provide line to line voltage reading and line to neutral voltage reading.

1.8.10 **AMMETER:**

Ammeter shall comply with IS-1248 (Latest edition). The dial of the ammeter shall be square in shape of 96 x 96 Sq.mm and 144 x 144 Sq.mm size for main panels. The Ammeter shall be moving iron type, flush pattern with dust and moisture proof enclosure. The range of the ammeter shall be in accordance with 1 to 1.5 times the feeder full load current. Separate current transformer shall be provided for all ammeters. Three way ON and OFF selector switch shall be provided for measuring current in different phases.

1.8.11 **CURRENT TRANSFORMER:**

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 as amended up to date.

1.8.12 **ENERGY MANAGEMENT SYSTEM:**

The system shall monitor the energy consumption at the individual distribution boards for centralized billing. The requirements are as follows:

1. To monitor each supply Line & Phase Voltage, Current, Power, Energy, reactive power, P.F., Frequency etc. the trend of consumption, maximum demand in KVA time plot with an accuracy class of 0.5 Should be provided with RS 485 port option.
2. Should monitor Demand parameter (KVA or KW) instantaneous demand & maximum demand, Day, Date, Time of MD occurrence.
3. Each outgoing feeder shall be provided with electric 3 phase 4 wire/1 phase Energy meters to monitor energy parameter with tamper proof cover. Accuracy class 1.0.
4. **Computer System :**

Data so collected from the incoming and outgoing shall be integrated and recorded in the PC Pentium-IV, 1.1 GHz, 256 MB RAM, 40 GB HDD, 3.5" FDD, CD Drive – 52X, serial port and parallel port, 17" colour monitor, mouse and standard keyboard, Windows-98 version & MS-OFFICE-97.

132 Column Dot Matrix printer, UPS (Min 2 KVA), High speed control and graphic low loss data communication cable including required software for demand representative of the same. The required window based software shall also be provided for having pre-configured with screens which show mimics, trends, history, alarms and shall generated MIS reports.

Required high speed data cable/control cable and other network accessories like data converter, repeaters etc shall also be included by the bidder.

SECTION-B

1.0 CABLES AND CABLE TRAYS:

1.1 GENERAL SCOPE :

Supply, installation, storing, laying, fixing, jointing / termination, testing and commissioning of Medium Voltage PVC insulated PVC Sheathed armoured aluminium/ copper conductor cables laid in built up trenches, directly buried underground, on cable trays, in pipes, clamped directly to wall or Structures etc. as called for in the drawing.

a) Type :

Medium voltage cables shall be circular, multicore annealed copper or aluminium conductor, XLPE/PVC insulated, PVC sheathed and steel wire armoured or steel tape armoured construction or unarmoured. The conductors of cable shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq.mm size and above. The cables shall conform to IS:1554 part-I in all respects.

MV power cables shall be 2, 3, 3.5 or 4 cores, as required and shall have conductors made from electrical purity aluminium conductors conforming to IS:8130-84.

Conductors shall be insulated with high quality XLPE/PVC base compound. Insulation and outer sheathing compounds shall conform to IS:5831 - 84.

A common covering shall be applied over the laid-up cores by an extruded sheath of un-vulcanised rubber compound.

Armouring of galvanised round steel wires or galvanised flat steel strips shall be provided over the inner sheath.

Outer sheath of PVC shall be extruded over the armouring cables shall be manufactured and tested in accordance with IS 1554 Part I.

Unless otherwise specified, all control cables shall be multicore, 1100V grade PVC insulated, armoured and overall PVC sheathed with stranded copper conductors of 2.5 sq.mm, conforming to IS 1554 Part I. Cores shall be identified by colour scheme of PVC insulation.

b) Rating :

The cables shall be rated for a voltage of 1100 Volts.

c) Core Identifications :

Cores shall be provided with the following colour scheme of PVC insulation

1. Single Core : Green yellow for earthing.
2. Two Cores : Red and Black, Blue & Black, Yellow & Black.
3. Three Cores : Red, Yellow & Blue
4. Four Core : Red, Yellow, Blue & Black

d) **Selection of Cable:**

1. Cables sizes shall be selected considering the current carrying capacity, voltage drop, maximum short circuit duty and the period of short circuit to meet the present and future anticipated loads.
2. While deciding cable sizes, the derating factors for type and depth of laying, grouping, ambient temperature, ground temperature and soil resistivity shall be taken into account.

1.2 **STANDARDS :**

The following standards and rules shall be applicable.

- | | | |
|---------|---|---|
| IS 1554 | ⇒ | PVC insulated (heavy duty) electric cables Part I for working voltages upto and including 1100 V. |
| IS 8130 | ⇒ | Conductors for insulated electric cables and flexible cords. |
| IS 3961 | ⇒ | Recommended current ratings for cables:(Part 2) PVC Insulated and PVC sheathed heavy duty cables. |
| IS 5831 | ⇒ | PVC insulation and sheath of electric cables. |

The individual cores shall have continuous numbering of the core all along its length and also be provided with identification ferrules at both ends. Individual control cables shall have 20% spare cores.

FRLS cables shall be used for fire protection system controls to prevent flame propagation, smoke reduction and to avoid toxic gas emission in the event of a fire. FRLS compound shall be tested rigorously for oxygen index as per ASTM D2863, acid gas generation to IEC 754-1, smoke density to ASTM D 2843 and flammability SS 424 1475 class F3, IEEE 383 and IEC 332-1.

Manufacturer's name, ISI Mark, cable size and type shall be clearly embossed at regular intervals on all cables.

1.3 **INSPECTION :**

All cables shall be tested inspected at manufacturers works. However upon receipt at site cables shall be checked for physical damages during transit.

1.4 **JOINTS IN CABLES :**

The contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilisation and avoidance of straight cable jointing. This apportioning shall be got approved by the Construction manager/ Consultant before the cables are cut to lengths.

Where straight joints in cable are unavoidable, the use and location of such straight joints shall be got approved by Construction manager/Consultant.

1.5 **JOINTING BOXES FOR CABLES :**

Cable joint boxes shall be of appropriate size and installed with heat shrinkable sleeve of suitable size suitable for XLPE armoured cables suitable for PVC insulated armoured cables of particular voltage rating.

1.6 **JOINTING OF CABLES :**

All cable joints shall be made in suitable, approved cable joint boxes, jointing of cables in the joint boxes and the filling in of compound shall be done in accordance with manufacturer's instructions and in an approved manner. All straight joints shall be done in epoxy mould boxes with epoxy resin (Tropolin/M-Seal resin or approved equal). All jointing accessories shall be of CCI/INCAB or approved equal. All terminal leads of conductors shall be heavy soldered upto at least 50mm length.

All cables shall be joined colour to colour and tested for continuity and insulation resistance before jointing commences. The seals of cables shall not be removed until preparations for jointing are completed. Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged. The conductors shall be efficiently insulated with high voltage insulating tape and by using spreaders of approved size and pattern. The joints shall be completely filled with epoxy compound and tapped so as to ensure that the box is properly filled.

Epoxy compound shall be filled as follows:

Equal quantities of resin and hardener shall be mixed thoroughly by hand until the mixture is free from white patches and has uniform colour. No water, oil or any other liquid shall be added to the mixture to make it soft as this will affect the properties of the compound. The mixture shall be used within 30-40 minutes of mixing. The surface on which epoxy compound is to be used, shall be free from dust, rust, oil, grease and shall be dry. The joint shall neither be

disturbed nor moved till the epoxy compound is completely hardened. A smooth surface can be made by rubbing a damp cloth smoothly on the compound before it sets. The joints shall be painted after it has completely hardened.

Alternatively, ready mix of epoxy cable jointing compound may also be used.

1.7 CABLE MARKERS/CABLE TAGS :

1.7.1 **Cable Markers:**

All underground cables and cable joints shall be marked on the surface by markers generally manufactured and tested to the requirements of relevant ISS. Approved CI cable markers shall be provided at every 30m along the route of the cables and at both ends of road crossing, indicating cable joints and cables as applicable. Special CI markers shall be provided at all buried cable joints indicating "Electrical Cable Joints". CI plates duly engraved with the size of the cable and the place it serves shall be tied to the cable at regular intervals of 5m for easy identification of cables.

1.7.2 **Cable Tags:**

Cable tags shall be made out of 2 mm thick aluminium sheets, each tag 32 mm in dia with one hole of 2.5 mm dia. 6 mm below the periphery shall be provided for clamping the same with cables.

Cable designation are to be punched with letter/number punches and the tags are to be tied to cables with piano wires of approved quality and size. Tags shall be tied inside the panels beyond the glands as well as below the glands at cable entries. Along trays, tags are to be tied at all bends on straight lengths, tags shall be provided at every 5 meter.

1.8 **TERMINATION OF CABLES :**

Cable termination shall be done in terminal box or cable end box or distribution boards, or apparatus/equipments. Terminations are to be made with mechanical gland and of the tinned nickel plated, anti- corrosive, three piece improved pattern which is to grip inner and outer PVC sheaths as well as the armour of the cable. The cable ends or the core conductor are to be connected by solderless lugs or sockets using crimping tool of approved make for all cables.

All terminations of cable conductors and base conductors shall be mechanically and electrically sound and shall comply with the requirements of relevant Standards and Indian electricity regulations.

The connectors or connecting sockets are to have such dimensions so as to limit temperature rise.

When required the water tightness of the terminal boxes may be obtained by filling with a compound preferably plastic flame retarding and non-dripping type within the normal range of temperatures.

When the cable is cut during the course of installation the open ends are to be sealed immediately by means of self-adhesive non hygroscopic tape over a wax water seal to make an air and watertight joint.

1.9 **INSTALLATION OF CABLES:**

Cable shall be laid in a manner as indicated on the drawings. Generally cables are laid in the following manner.

- i. In the underground masonry trench.
- ii. On the cable tray/or on cable ladders.
- iii. Buried underground.
- iv. Through pipe sleeves.

Various installation methods are discussed in the following paragraphs.

Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable. The cable drums shall be placed on jacks before unwinding the cable. The cable drums shall be rotated in a direction as indicated by the manufacturer. Care shall be exercised in laying cables to avoid forming kinks. The drums shall be unrolled and cables run over wooden rollers, placed at intervals not exceeding 2 meters.

1.9.1 **General :**

All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of service.

When cable pass through holes in metal work, precautions shall be taken to prevent abrasion of the cables on any sharp edges.

In every vertical cable ladders, channel or duct or trunking or cable trench containing cables and exceeding three meters in length, internal barriers shall be provided so as to prevent the air at the top of the unit from attaining an excessively high temperature. In every vertical cable shaft, cable trench or any passage of cable through wall, ceiling, floor barriers against spread of fire and smoke shall be provided for compliance with IEE regulations. 'Viper' CABLEMASTIC fr 903 fire resistant painting shall be applied on all PVC power cables.

Where cable passes through walls, ceiling, floor, it shall run through sleeve of PVC pipes or hume pipes of adequate diameter. After pulling the cable through sleeve, both the ends of the sleeve shall be sealed water tight with fire resistance material to prevent spread of fire and seepage of water.

Generally along each cable route either in trench or in cable trays/ladders or in pipe separate Two Nos. of earth strips/wires shall run exposed.

Where an installation comprises medium voltage cables as well as extra low voltage circuits, precaution shall be taken in accordance with relevant regulations and shall be physically separated by minimum of 300mm distance.

Metal sheaths and armour of all cables, metal conduits, ducts, trunking, and bare earth continuity conductors associated with such cables, which might otherwise come into fortuitous contact with other fixed metal work shall be effectively bonded there to earth so as to prevent appreciable potential difference at such possible points of contact.

1.9.2 **Underground Installations :**

The cables shall be laid in an excavated trench. The depth of the trench shall be minimum 750 mm below the final ground level but shall be decided on the number of cables to be laid in the trench so that the vertical distance between two adjacent layers of cables shall not be less than 350mm. The width of the trench shall be decided on the number of cables to be laid in the trench so that the distance between two adjacent cables shall not be less than one cable diameter.

a) **Width of Trench:**

- i) The minimum width of trench for laying single cable shall be 350 mm.
- ii) Where more than over cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the inter axial spacing between the cables, except whether otherwise specified shall be at least 200 mm.
- iii) There shall be clearance of at least 150 mm between axis of the end cables and the sides of the trench.

b) **Depth of Trench:**

- i) Where cables are laid in single tier formation, the total depth of the trench shall not be less than 750 mm.
- ii) When more than one tier of cables is unavoidable and vertical formation of laying adopted, depth of trench in (i) above shall be increased by 300 mm for each additional tier to be formed.

In addition to above, where gradients and changes in depth are unavoidable, these shall be gradual the bottom of the trench shall be level and free from stone brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 100mm depth The cables shall be protected by placing precast concrete tiles or burnt bricks over the cables on top layer of sand and for the full length of underground cables. Where more than one

cable is running in the same trench, the concrete tiles/bricks shall cover all the cables and shall project a minimum of 150mm on either side of the cables. Prior to laying of cables, the core shall be Tested for continuity and insulation resistance

In any case the top layer of the cables shall be minimum 600 mm below the finished level of the ground.

Cable laid in trenches in a simple tier formation shall have a cover of clean & dry sand of not less than 150mm.

The top of the cable trench shall be well compacted till the finished level of the ground and shall be approved by the Construction manager/Consultant. If required a laboratory compaction test shall be carried out in presence of the Construction manager/Consultant.

H.V., M.V., cables shall not be laid in the same trench/cable tray and/or along side of water main.

Cables under road crossings and any surfaces subjected to heavy traffic shall be protected by running them through hume pipes of suitable size.

Where cables cross one another, the cables of higher voltages shall be laid at lower level than the cable of lower voltage.

The relative position of the cables laid in the same trench shall be preserved and the cables shall not cross each other as far as possible. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius of bend not less than 15 times the diameter of the cable.

Minimum 3 meters long loop shall be provided at both sides of every straight joint and 5 meters at each end of the cable. Distinguishing marks shall be made at the cable ends for identification.

Proximity to Communication Cables:

MV Cables and communication cables shall as per as possible cross at right angles where power cables are laid in proximity to communication cables the horizontal and vertical clearance shall not normally be less than 600 mm.

Insulation tapes of appropriate voltage and in red, yellow, and blue colors shall be wrapped just below the sockets for phase identification.

All the excavation and back fill including timbering, shoring, and pumping required for the installation of the cables shall be carried out as indicated on the drawing and as per requirements laid down elsewhere or as per Construction manager/Consultant direction. Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layers not exceeding 150mm. At each layer compaction test shall be carried out in presence of Construction manager/Consultant. Each layer shall be properly rammed and consolidated before laying the next layer. The contractor shall restore all surfaces, roadways, side walls, curbs, walls, landscaping or other works cut for excavation to their original condition, the satisfaction of the Construction

manager/Consultant. Suitable approved type cable markers shall be installed along the cable route & wherever change of direction takes place. It shall be cast iron painted with aluminum paint. The size of the marker shall be 100mm dia. With "Cable" and voltage grade inscribed on it.

1.9.3 Cables Installed Inside the Building :

The cables inside the building shall be installed in one of the following manner, as indicated in the drawing and approved by the Construction manager/Consultant.

1.9.3.1 Installed in Built-up Trench :

The cables laid on the bottom of the structural trenches shall not lay freely upon the trench bottom. They shall be raised to prevent the possibility of their coming into contact with deleterious materials.

The cables laid in the trench shall be laid on angle iron brackets/cable tray/cable ladder/cable troughs/cable racks as indicated on the drawings, and as approved by the Construction manager/Consultant. Where cables are clamped to the wall a minimum clearance of 100mm shall be maintained between wall and cable and minimum 150mm vertical clearance shall be maintained between two cables. Where cables are laid on brackets the brackets shall not be fixed more than 500mm apart to avoid sag in the cables. Where the cables are laid on cable tray/ladder/troughs /racks, minimum 300mm distance shall be observed between adjacent tier of tray/ladder/troughs/racks, and cable shall be fixed minimum 25mm away from the wall, and minimum of one cable diameter distance shall be observed between two adjacent cables. Cables shall be properly fixed with the tray/ ladder/ troughs/ racks with cable tie or saddles or straps.

1.9.3.2 Cables on Cable Trays/Ladders under the Ceiling or on Wall :

Where cables are installed under above suspended ceiling or below ceiling or on wall, they shall be laid on a ladder/perforated G.I. cable tray and shall be run in such positions that they are not liable to be damaged by contact with the floor or the ceiling or other fixtures.

The ladder/perforated cable tray shall be properly fixed with channels, angles, tie rod, flats to the ceiling. The metal inserts for fixing channels, angles, tie rod, flats shall be put in place while casting the slab. If insert plates are not placed in position, Anchor fasteners shall be used to support cable trays if required. The cable tray route shall be co-ordinated with other services to avoid crisscross of all the services. While laying the cables on the tray minimum one cable diameter distance shall be observed between two adjacent cables about 20% space shall be kept spare for any future installation.

The trays shall be made of 2mm thick perforated sheet having minimum 75 mm depth. The width of perforation shall be maximum 10mm spaced at maximum 20mm distance. The width of the cable tray shall be selected so as to accommodate required number of cables to be laid on it, with minimum

separation of minimum one cable diameter between two adjacent cables. The cables shall be tied with the cable tray with nylon strip/ Aluminium clamps/GI clamps.

All steel work shall be treated in accordance with the following procedure and in accordance with IS : 6005 "Code of Practice for Phosphating Iron and Steel".

Oil, grease, dirt and swab shall be thoroughly removed by emulsion cleaning. Rusting and scale shall be removed by Pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and over drying.

The phosphate coating shall be sealed by the application of two coats of ready mixed stoving type zinc chromate primer.

After application of the primer, two coats of finishing stove enameled paint shall be applied.

The final finished thickness of paint film on steel shall not be less than 50 microns and shall not be more than 100 microns.

Finish painted surface of steel shall present an aesthetically pleasing appearance free from uneven surface.

The finish painting shall be black matt as per ISS or as approved by consultants.

1.9.3.3 Cables Installed in the Mechanical Room :

The cable reaching the motors in the mechanical room or plant room or machines room or service area shall be laid on cable tray except where indicated in masonry underground trenches.

The cable reaching the motors shall be protected by rigid galvanized conduits up to a height of 300mm above the floor. Above that height, the cable shall be protected by means of oil tight flexible metallic G.I. conduits to the terminal box of the motor. The connection between the rigid conduit and the flexible conduit shall be done by a screwed coupling of an approved type. The flexible conduit shall be properly fixed with the terminal box of the motor by means of double hexagonal check nut.

1.10 CABLE TRAY SPECIFICATION :

- 1.10.1 GI Cable tray shall be manufactured to comply with the specifications of National Electrical Code (NEC) and National Electrical Manufacturer's Association (NEMA).

Cable trays shall be of steel as per IS 226 and galvanised and the thickness of galvanization shall be not less than 80 microns. It shall be factory fabricated.

Cable trays shall generally be of the following type :

- i. for power cables of medium - ladder type with voltage and high voltage slotted channels.
- ii. for control cables and - perforated sheet extra low voltage cables steel sheet type.

Perforated cable trays shall be generally of channel type and the perforations in the trays shall be either 8 x 15mm or 10 x 20 mm oval holes. Control cables, extra low voltage cables and instrument cables shall be laid on perforated cable trays.

Ladder type cable trays shall be made out of perforated hot dip galvanised M.S. Sheet 2 mm thick. The size of the side channel/rails shall be 75x20x2mm hot dip galvanised M.S. Sheet. The size of the rungs shall be 35x15x2 mm hot dip galvanised M.S. sheet. The pitch of the rungs shall be not more than 250mm centre to centre. Rungs shall be welded to the side rails as per requirement.

Cable trays shall be of standard sizes :

Length 2500 mm

Width 150/300/450/600/800/1000mm as required

Flange of perforated tray 75 x 20 x 2 mm

Rail/Flange of ladder type tray 75 x 20 x 2 mm

Cable trays shall be hot dip galvanised, the thickness of galvanising shall be not less than 80 microns. Quality of zinc used for galvanising shall be 98.8% purity.

1.10.2 **Accessories for Cable Trays**

Following accessories of cable trays, as required, shall be supplied with the cable trays.

Coupler plates

Circular bends - Horizontal and Vertical.

Tees - Horizontal and Vertical.

Reducers

4-way cross

Tray covers

Fasteners

Accessories also shall be galvanised, thickness of galvanising being not less than 80 microns.

1.11 **TESTING** :

Prior to laying cables, and prior to energizing the cables, following tests shall be carried out:-

1.11.1 Insulation Resistance test between phases and phase to neutral and phase to earth with a 500V megger.

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

1.11.3 Sheathing continuity test.

1.11.4 Earth resistance test of all the phases and neutral.

Test shall also be carried out at site for insulation between phases and between phase and earth for each length of cable before and after joining.

All tests shall be carried out in accordance with relevant Indian Standard Code of practice and Indian Electricity Rules. The Contractor shall provide necessary instruments, equipments and labour for conducting the above test and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Construction manager/Consultant and results shall be recorded in the prescribed forms.

1.12 **STORING** :

All the cables shall be supplied in drums. On receipt of cables at site, the cables shall be inspected and stored in drums with flanges of the cable drum in vertical position. The end of the cable shall be sealed for water tightness.

SECTION-C

1.0 WIRING SYSTEM :

1.1 SCOPE:

The scope of work under this section covers supply and wiring for lights, fans, exhaust fans, call bells, fan coil units, geysers and power sockets etc., The wiring shall generally be done using PVC insulated copper conductor wires in M.S./PVC conduits as called for including providing switches, sockets, plug tops, electronic fan regulators, outlet boxes etc.

1.2 STANDARDS :

The following latest standards and rules shall be applicable:

IS : 732	Code of practice for electrical wiring installation (System voltage not exceeding 1100 V).
IS : 1646	Code of practice for fire safety of buildings (General) Electrical installation.
IS : 9537	Conduits for Electrical installations (Part 1-4)
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 : 6946	Flexible (Pliable) non-metallic conduits for electrical installation.
IS : 1293	Plugs and sockets outlets of rated voltage upto and including 250 V.
IS : 8130	Specifications for conduits for electrical installation.
IS : 3854	Switches for domestic and similar purposes.
IS : 3419	Fittings for rigid non-metallic conduits.
IS : 4648	Guide for electrical layout in residential building.
IS : 4649	Adapters for flexible steel conduits.
IS : 5133	Boxes for enclosures of the Electrical.
IS : 4615	Switch socket outlets.
IS : 8884	Code of practice for installation of Electric bells and call system.
IS : 2551	Electric Danger notice plates.
IS : 3646	Code of practice for interior illumination.
IS : 371	Ceiling Roses.
IS : 302	General and safety requirements for household and similar electrical appliances.
IS : 3043	Code of practice for earthing.
IS : 5216	Guide for safety procedures and practices in electrical work.

Indian Electricity Act and Rules.

Regulations for the electrical equipment in buildings issued by the concerned Electrical Authorities.

All standards and codes mean the latest.

1.3 **POINT WIRING FOR LIGHTS, FANS, EXHAUST & 6 AMPS CONVENIENCE SOCKETS:**

- 1.3.1 A point wiring shall consist of the branch wiring from the distribution board together with a switch/electronic fan regulator as required, including providing conduit & accessories, pendant holder or a swan holder, or ceiling fan hook box or socket tc., with suitable termination. A point wiring shall include, in addition, the earth continuity conductor/wire from the distribution board to the earth pin/stud of the outlet/switch box/ light fitting & fans & all other such non current carrying metals shall be earthed and to the outlet points. No tee jointing or looping of wires shall be done anywhere except at a switch box or a light fitting or a plug socket outlet.

The point wiring shall be carried out in the under mentioned manner :

- 1.3.1.1 Supply, installation, fixing of conduits and Steel wire/ G.I. pull wire with necessary accessories, junction/pull/ inspection/switch boxes and outlet boxes/Fan hook box etc. However Switches, Switch plates & switch boxes are not required for the lights which are controlled directly from the MCB DB's.
- 1.3.1.2 Supplying and drawing of wires of required size including earth continuity PVC insulated wire.
- 1.3.1.3 Supply, installation and connection of flush type switches, sockets, cover plates, switch plates & fixing fan regulator, lamp holder, ceiling rose etc.,
- 1.3.1.4 The point shall be complete with the branch wiring from the distribution board to the outlet point, through switch board, conduit with accessories, junction, pull/inspection boxes, control switch, socket, outlets boxes, ceiling roses, lamp holder, connector, extension cord wire, flexible conduits etc.

1.3.2 **POINT RATE :**

For the purposes of installation the rate for point wiring shall include the following:

- i) Circuit Main
- ii) Point Wiring.

And for the purpose of measurements and payments the points shall be designated as follows:

- i) One light controlled by one switch.

These points are light/fan points of any length from the distribution boards via switch to the first point. i.e. this includes circuit wiring also in its scope which will not be paid separately.

- ii) Two nos. of lights controlled by one switch and so on.

These point include wiring for first point as mentioned above and subsequent points looped from the first point to next light points and are controlled from the same switch as the first point.

a) **The Circuit Main:**

The circuit main for lights/fan/6A sockets (where 6 A sockets connected to light circuit) shall include the wiring from the MCB distribution boards upto the first switch/light point/fan point. The scope of work shall include the following:

- i) Supply and wiring in concealed/surface conduit from DB's to first switch/light/fan point.
- ii) Providing PVC insulated copper conductor earth wire.
- iii) Providing Steel/G.I. fish wire (pull wire) in the conduit.
- iv) Termination of wires in DB's & switches using proper tinned copper lugs of soldering/crimping type.
- v) Providing necessary pull/junction boxes where necessary.
- vi) Identification of circuits shall be done with ferrule nos.

b) **Point Wiring:**

The point wiring shall include supply, installation, connection, testing and commissioning of point wiring in conduit. The exact scope of work included in the point wiring is enumerated as stated below:

- i) Wiring from the first switch/light/fan point, where the circuit main is terminated to the various lights/fans/sockets (where 6A sockets connected to light circuit loop), and then looping between the switches/lights/fans/6A sockets etc.
- ii) Providing all necessary switches, switch plates, sockets, outlet boxes/pull/junction /fan hook boxes etc.
- iii) Providing insulated earth continuity wire with each circuit in the conduit along with the wiring system.
- iii) Providing G.I. fish wire (pull wire) in the conduits.
- v) Providing & installing lamp holders where ever necessary.
- vi) Providing PVC insulated, PVC sheathed flexible three core 2.5 sq.mm extension cords including flexible conduits from outlet points mounted at false ceiling point to the light outlet.

NOTE:

The point shall be measured in nos/sets/group of lights controlled from DB as mentioned in the BOQ.

c) **Wiring for 6/16 Amps Power Sockets for Equipment Wiring**

The work for wiring of 6A/16A sockets and wiring for power outlets shall include following:

- a) Supply & installation of conduits from DB (concealed/ surface) with its accessories up to the 6/16 A power point in required size of conduit.
In laying of conduit it is important that not more than two right angle bends are provided for each circuit and as far as possible no junction box shall be provided in entire length of conduit run for drawing of wire.
- ii) Wiring from DB to the 6/16 A power point including earth wire of specified size.
- iii) Supply and installation of the socket outlet with outlet boxes of approved make and Control switch of approved make.

All 6/16 A, power socket outlets shall be measured in numbers.

1.4 **SYSTEM OF WIRING:**

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

The system of wiring shall consist of single core, PVC insulated, 1100 Volt grade, stranded copper conductor wires/cables laid through concealed or exposed PVC/MS conduits as mentioned elsewhere or as directed by Construction manager /Consultant.

1.4.1 **GENERAL:**

Prior to laying and fixing of conduits and light outlet boxes, contractor shall carefully examine the layout drawings and prepare detailed shop drawings, indicating the exact location of light outlets, with distances marked, conduit routing, with sizes, No. of wires run in each conduit, control switch location etc. The contractor shall obtain the approval of all shop drawings by the Construction manager/Consultant prior to the installation of conduits. Any discrepancy noticed in the design drawings shall be brought to the notice of the Construction manager/ Consultant. Any suggestions or modifications suggested by the contractor shall have the approval of Construction manager/Consultant before execution.

LOAD BALANCING:

Balancing of circuits in three phase installation shall be planned by the consultants and shall be checked by the contractor before commencement of wiring and shall be strictly adhered too.

1.5 CONDUITS :

1.5.1 Type of Conduit :

Unless otherwise specified all conduits for concealed/ surface/exposed installation including conduits running above false ceiling shall be of heavy gauge rigid black enameled MS conduits.

All conduits installed below ground level or in the damp/wet area shall be 'A' Class G.I. pipes.

All conduits for fire alarm system irrespective of surface or concealed shall be of MS conduits painted with post office red colour as specified in the BOQ.

1.5.2 PVC Conduits :

If specified to be provided in any special area the Non metallic conduits and accessories shall conform to IS 9537 (part 3), IS 3419 and each conduit shall bear the ISI Mark. PVC conduits shall be of black, round, heavy gauge polyvinyl chloride (PVC). The conduit shall be plain end type as specified in IS:9537 (Part-3). The conduits internal surface shall be smooth. Only approved quality factory made bends/accessories shall be used unless otherwise stated. Minimum size of conduits shall be 20 mm diameter PVC conduits shall be rigid unplasticised, heavy gauge having 1.8mm wall thickness upto 20 mm diameter conduit and 2.0 mm wall thickness for all sizes above 20mm diameter.

1.5.3 Metal Conduits :

Conduits and Accessories shall conform to IS:9537 (Part-2). Solid drawn 16 gauge screwed steel conduits protected by black bituminous enamel shall be used in all situations except where galvanised steel conduits are called for. Where conduits for buried wiring are passing underground they shall be of galvanised steel conduit. Joints between conduits and accessories shall be securely made to ensure earth continuity.

No steel conduit less than 20mm in diameter shall be used. Conduits shall be solid drawn, lap welded, with minimum wall thickness of 1.6mm for conduits upto 20mm diameter and 2mm wall thickness for conduits having 25mm 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 the manufacturer & ISI Mark (Engraved Markings) or painted markings.

Conduit accessories such as bends, coupling etc., shall be conforming to relevant Indian Standard Specifications.

The number of 1100 volt grade PVC insulated copper conductor wires that may be drawn in the conduits of various size shall be in conformity with code of practice for electrical wiring installation IS 732.

1.6 CONDUIT ACCESSORIES

1.6.1 PVC Conduit Bends & Collars:

If PVC conduits are used then the PVC conduit bends & collars shall preferably be of the same make as of conduit. This shall conform to IS 9537/3412 with ISI Mark where necessary bends or diversion may be achieved by means of using bends and or circular inspection boxes with adequate and suitable inlet and outlet termination. In case of recessed installation system, the bends shall be properly secured & flush with the finished wall surface. Elbows shall not be used. No bends shall have radius less than 2 1/2 times the outside diameter of the conduit. Ready made factory bends shall be used where required.

1.6.2 M.S. Conduit Bends & Collars:

The M.S. conduit bends and collars shall be of M.S. black enameled coated having internal threading for screwed joints of the conduits. The bends and collars shall conform to IS 2667 & having ISI mark. The conduit bends & collars shall preferably be of the same make as of conduit. The minimum radius of conduit bend shall be 2 1/2 times the outer diameter of the conduit pipe. Where necessary conduit bends with inspection door shall be used, only factory made ready made bends shall be used.

1.6.3 PVC/Inspection/Junction/Pull Boxes:

The Inspection/pull box/junction boxes where used with PVC conduit installation shall be of heavy gauge PVC & conform to IS specification and shall match with the conduit sizes. The box shall be of round/square rectangular shape with conduit stub projection for termination of conduit. The box shall be minimum 50mm deep and the size of box shall be suitable to pull/make necessary joints of wires inside the boxes. Extra deep boxes are preferred. The boxes shall have flush type cover. The colour of plate shall match the colour of paint of the surface where installed. The boxes shall have concealed screwed socket for fixing the ceiling rose.

1.6.4 M.S. Conduit/Junction/Pull/Inspection Boxes:

The boxes for junction/pull/inspection boxes to be used with M.S. conduit installation shall be heavy gauge black enameled M.S. boxes. These boxes shall be manufactured in conformity with ISI specification and to match the type of conduit used. The boxes shall be of round/square or rectangular shape and shall have minimum 50mm depth. The box shall have threaded

stub projection to terminate M.S. conduits. The boxes shall have concealed screwed sockets for fixing the ceiling rose or cover plate.

1.7 SWITCH OUTLET & SOCKET OUTLET BOXES

1.7.1 Concealed Type outlet Boxes :

The concealed outlet boxes for switches, sockets, power outlets, telephone outlet, fan regulator etc., shall be of same make as of switches/sockets etc. to match the exact requirement of combination of outlets. The boxes shall be fabricated out of heavy gauge CRCA cold rolled carbon alloy sheet steel with zinc plating (G.I). The size of boxes should match the type of outlet/switch plate to be mounted on the box. The adequate No. & size of knockout holes shall be provided to terminate the conduits in the box. These boxes shall be standard factory made product of same make as of switch plates & sockets. Separate screwed earth terminal shall be provided in the box for earthing.

The outlet box shall be of minimum depth of 50mm. Boxes shall be suitable for grid mounting type of accessories. Long screw shall be provided to take care of the extra plaster thickness to mount the switch plates. Provision shall be made in the box & switch plate to have the minor adjustment of alignment of switch plate to plumb level.

1.7.2 Surface Type Boxes:

The boxes for mounting switches, sockets and other wiring devices shall be either moulded plastic or heavy gauge CRCA sheet steel painted to match the colour of wall. The box shall be suitable to terminate the M.S. surface conduit into the box. The size and shape of box shall match the exact type and combination of switch plates, receptacles & wiring devices. Deep boxes shall be used to facilitate easy termination of conduit & wires/cables. Separate screwed earth terminal shall be provided in the box for earthing.

1.7.3 Light Outlet Boxes :

For concealed PVC conduit installation the light outlet box shall be of PVC (round/square) with knock out holes, conduit projection suitable to terminate the conduit to the box. The box shall be made of heavy gauge PVC & the sample to have the approval of Construction manager/Consultant before use. The boxes shall have concealed screwed socket to fix the ceiling rose. The boxes shall be minimum 50 mm deep.

For surface conduit installation the light outlet box shall be of black enameled M.S. boxes. The boxes shall have threaded stub projection having internal threading to terminate the conduit of different sizes. The boxes shall be minimum 50mm deep.

1.7.4 Ceiling Fan Hook Boxes:

The ceiling fan hook box shall be fabricated of 2mm thick M.S. with adequately sized M.S. rod/hook to fix the ceiling fan. The hook shall be concealed within

the fan hook box. The side extensions of rod shall be sufficiently long enough to provide adequate anchorage in the concrete. The size of the box shall be such that it should be totally covered by the plastic canopy of the ceiling fan. The box shall have anticorrosive primer coating.

1.8 COVER PLATES FOR SWITCHES & OUTLETS :

Switches/socket/wiring devices plates shall be the same product as of switches/sockets/wiring devices. This shall be of best quality moulded plastic grid mounting type device plates/frames and shall match with the type of switches/sockets & boxes.

1.9 COVER PLATES FOR INSPECTION/JUNCTION/PULL BOXES :

The cover plate for PVC boxes shall be minimum 3mm thick of perspex/formica sheet cover. For M.S. boxes cover plate shall be black enameled M.S. plates. The shape of the plate shall match that of the box.

1.10 RECEPTACLES :

The sockets shall conform to IS 1293. Each socket shall be provided with control switch of appropriate rating. The sockets shall be molded type rated for 250 volts and of full 6 Amp or 16 Amp capacities as mentioned on the drawings. The 6/16 Amps sockets shall be multi pin (6 pin) automatic shutter type suitable for plugging 6 Amps/16 Amps tops. The shutter shall open when the earth pin of the plug top inserts in the socket. Where called for the 16 Amps socket shall have indicating lamp. The socket outlets & switches shall be of grid mounting type. Where called for sockets shall be provided with three pin plug top suitable to the socket & of the same make as of socket. The socket outlets installed outside the building/open to sky or in damp/wet areas shall be of weather proof water tight type. The switch controlling the socket shall be on phase wire of the circuit and only one socket outlet of 16Amps shall be connected on one circuit. An earth wire connected to earthy screw inside the box, All sockets shall be shuttered Type.

1.11 INDUSTRIAL TYPE SOCKETS :

The socket outlets single phase or three phase installed in basement area, kitchen etc., shall be three pin or 5 pin industrial type with MCB (Single phase or three phase) control. The socket & MCBs shall be mounted in a sheet steel enclosure and shall be the standard factory made product.

1.12 CONDUCTORS :

All PVC insulated Copper conductor wires shall conform in all respects to standards as listed under sub-head 'Regulations and Standards' and shall be of 1100V Grade.

1.12.1 **PVC insulated wires (for light & small power wiring) :**

- a) The PVC cables shall conform to IS : 694/1977. For all internal wiring PVC insulated cables of 1100V grade, single core shall be used.

The conductors shall be plain annealed copper conductors complying with relevant ISS.

The conductors shall be circular stranded copper conductor.

- b) The minimum number and diameter of wires for circular stranded conductor shall meet the requirements set out in the relevant Indian Standards.
- c) The insulation shall be PVC compound complying with the requirements of relevant ISS. It shall be applied by an extrusion process and shall form a compact homogeneous body.

The thickness of PVC insulation shall be as set out in the relevant standards.

- d) The cores of all cables shall be identified by colors in accordance with the following sequence.

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

A means of identifying the manufacturer shall be provided throughout the length of cable.

1.12.2 **Wire Sizes :**

Unless otherwise specified in the drawings the size of the cable/wires used for internal wiring shall be as follows :

In case of circuit wiring for lights, exhaust fans, ceiling fans, bell, convenience socket outlet points:-

2.5 Sq.mm - From DB's to the junction boxes, FCU, first switch board etc. with no joints. In between joints may be at switches, socket outlet, light points only.

2.5 Sq.mm - From junction boxes to lights/fan/ 6 A sockets outlets etc.

In case of power socket outlet circuit.

6.0 Sq.mm - From D.B. 20/30 Amps Industrial type sockets.

4.0 Sq.mm - From DBs to 16/20 Amps sockets.

The earth continuity conductor size as indicated in the drawing/BOQ shall be drawn through conduit along with other circuit cables/wires. For general guidance the size of the earth continuity conductor shall be as follows :-

UNLESS OTHERWISE SPECIFIED MINIMUM SIZE OF EARTH CONTINUITY CONDUCTOR WIRES NOT FORMING PART OF THE SAME CABLE AS THE ASSOCIATED CIRCUIT CONDUCTOR.

NOMINAL Cross-sectional area of largest associated copper circuit conductor in Sq.mm	NOMINAL Cross-sectional area of earth continuity Conductor in sq.mm (PVC insulated green colour wire).
1.5	2.5
2.5	2.5
4.0	4.0
6.0	6.0
10.0	10.0
16.0	16.0
25.0	15
35.0	25
50.0	25

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

1.13 **INSTALLATION OF CONDUIT:**

1.13.1 **Concealed Conduit System with PVC Conduit:**

- a) Unless otherwise Specified all wiring shall be in heavy gauge black enameled MS conduit embedded in wall, or ceiling and concealed in the false ceiling as specified in case of PVC conduit the size of the conduit shall be selected in conformity with I.S. code and as specified in the table given below. Factory made conduit bends and accessories shall be used. PVC Conduit shall be joined using coupler as supplied by the conduit supplier. The conduit in ceiling slab shall be straight as far as possible. Before the conduits are laid in the ceiling, the position of the outlet points, controls, junction boxes shall be set out clearly as per the dimensions and to minimise off-sets and bends. Before the reinforcement rods are kept in position electrical contractor should mark in paint the position of outlet points and conduit drop on the shuttering. When the outlet boxes are kept in position & before pouring the concrete, all outlet boxes shall be filled with paper to avoid entry of concrete inside the box. Conduits in ceiling shall be bonded to the reinforcement rods with Steel wire bonding wire at intervals not more than 1000mm, to secure them in position. PVC deep light outlet / pull boxes shall be provided as required. The conduit in ceiling slab shall be laid above the first layer of reinforcement rods to avoid cracks in the

ceiling surface. In general the conduit shall not be laid directly on the shuttering surface to avoid cracks in the ceiling surface.

- b) Conduits Concealed in the wall shall be secured rigidly by means of steel hooks / staples at min. 750 mm intervals. Before conduit is concealed in the walls, all chases, grooves shall be neatly made to proper required dimensions using electrically/manually operated groove cutting tools to accommodate number of conduits. The outlet boxes for control switches, inspection and draw boxes shall be fixed as and when conduits are being fixed. The recessing of conduits in walls shall be so arranged as to allow atleast 12mm plaster cover on the same. All grooves, chases etc. shall be refilled with 1:4 cement mortar and finished upto wall surface before plastering of walls is taken up by the general civil contractor. Horizontal chase in walls are not allowed. Where, unavoidable prior permission of Construction manager/Consultant shall be obtained before making any chasing. Where conduits pass through expansion joints in the building, adequate expansion fitting or other approved devices shall be used to take care of the relative movement. Whenever the conduits terminate into Control Boxes, distribution boards etc. conduits shall be rigidly connected to the boxes/boards with check nuts on either side of the entry. After conduits, junction boxes, outlet boxes etc. are fixed in position, their outlets shall be properly plugged with PVC stoppers or any other suitable material so that water, mortar, vermin or any other foreign materials do not enter into the conduit system. All conduit ends terminating into an outlet shall be provided with bushes of PVC or rubber after the conduit ends are properly filed to remove burrs and sharp edges. Necessary G.I./Steel wire pull wires shall be inserted into the conduit for drawing wires before concreting. Insulated earth wires shall be run in each conduit originating from the panel board upto the Light, Socket and Switch boxes. If the Electrical Contractor forgets to install any conduit/ boxes etc., before the plastering/ painting work is done by other agencies, he may be permitted to install the same with prior permission of Construction manager /Consultant and he shall be liable to make good the wall, floor, ceiling etc. at his own cost.
- c) 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 box. Joints in junction or pull boxes are strictly not allowed.
- d) All conduits shall be installed so as to avoid touching of steam and hot water pipes. Conduits shall be installed in such a way that the junction 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 Construction manager/Consultant.

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

- e) No run of conduit shall exceed ten meters between adjacent draw in points nor shall it contain more than two right angle bends, or other deviation from the straight line.
- f) Caution shall be exercised in using the PVC conduits in location where ambient temperature is 50 degree Celsius or above. Use of PVC conduits in places where ambient temperature is more than 60 degree C 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.

All jointing method shall be subject to the approval of the Construction manager/Consultant.

- g) Separate conduits shall be provided for the following system.
 - Lighting wiring
 - 16 Amp power outlets.
 - Telephone/intercom system.
 - Fire Alarm system.
 - Cable TV/Music system.
 - Computer data cabling system.
 - Equipment wiring/Cabling.

h) **Conduit Joints :**

Conduits shall be joined by means of plain couplers. Where there are long runs of straight conduit, pull/inspection boxes shall be provided at intervals, as approved by the Construction manager/Consultant The conduits shall be thoroughly cleaned before making the joints. 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.

i) **Bends in Conduit :**

Wherever necessary, long 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 diameter of the conduit. Heat may be used to soften the PVC conduit for bending, but while applying heat to the conduit, the conduit shall be filled with sand to avoid any damage to the conduit. Kinks in the conduit bends shall not be acceptable.

j) **Bunching of Cables:**

Cables of AC supply of different phase shall be bunched in separate conduits. 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 20 mm diameter shall not be used.

MAXIMUM PERMISSIBLE NUMBER OF 1100 VOLT GRADE SINGLE CORE
CABLES
THAT MAY BE DRAWN IN TO RIGID PVC CONDUITS

CABLE SIZE IN SQ.MM	SIZE OF CONDUITS (MM) [MAX. NO. OF CABLES]				
	20	25	32	40	50
1.5	4	8	12	-	-
2.5	4	6	10	-	-
4.0	2	4	8	12	-
6.0	1	4	6	8	-
10.0	1	3	5	10	-
16.0	-	2	4	5	12

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.

1.13.2 **Open/Surface Conduit System with M.S. Conduits:**

- a) Wherever specifically called for, surface conduit system shall be adopted. All conduits shall be of rigid MS. pipe. All conduits and its accessories shall be of threaded type. Conduits shall run in square and Symmetrical lines. Before the conduits are installed, the exact route shall be marked at the site and approval of the Construction manager/ Consultant shall be obtained. Conduits shall be fixed by heavy gauge PVC saddles, secured by suitable rawl plugs, at an interval of not more than 1 meter. Wherever, couplers, bends, or similar fittings are used saddles shall be provided at either side at a distance of 300 mm from the centre of such fittings. Conduits shall be joined by means of screwed couplers and screwed accessories only. In long distance straight runs of conduit, inspection type couplers /junction boxes shall be provided. Threading shall be long enough to accommodate pipe to the full threaded portion of the couplers and accessories. Cut ends of conduits shall have no sharp edges nor any burrs left to avoid damage to insulation of wires.
- b) Bends in conduit runs shall be done by using pipe bending machine. Sharp bends shall be accomplished by introducing solid bends, inspection bends or PVC inspection boxes. Radius of solid bends shall not be less than 75mm. Not less than 90 degree bend shall be used in a conduit run from outlet to outlet.

- c) Wherever conduits terminate into control boxes, outlet boxes, distribution boards etc, they shall be rigidly connected to the box with checknuts on either side of the entry.
- d) Steel wire /fish wire shall be drawn in each conduit.
- e) Separate PVC insulated copper conductor earth wire shall be drawn in each conduit.
- f) Draw boxes shall be located at convenient location for easy drawing of wires.
- g) Every mains and submains shall run in an independent conduit with an independent earth wire of specified capacity along the entire length of conduit.
- h) The conduit 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 this specifications. But in no case it shall be less than 20 mm diameter.
- i) 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 Construction manager/Consultant. Conduit runs shall be planned so as not to conflict with any other services pipe, lines/duct.
- j) The conduit shall be painted with two coats of enamel paint, color as approved by the Construction manager/ Consultant after installation.
- k) If required, connection between PVC and steel conduits shall be through a junction box. Direct connection between PVC and steel conduits are not allowed.
- l) Where exposed conduits are suspended from the structure, they shall be clamped firmly and rigidly to hangers of design to be approved by the Construction manager/Consultant Where hanger supports 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. Where inserts are not provided, contractor shall use only anchor fasteners. In case, it is unavoidable, prior permission of the Construction manager /Consultant shall be obtained to make any openings in the concrete surface.
- m) **Conduit Joints:**

Conduit pipes shall be joined by means of screwed couplers and screwed accessories, as per IS : 2667. The threads shall be free from grease or oil. In long distanced straight runs of conduit, inspection type

couplers 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 or 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.

Brass female bushes shall be used in each conduit termination in a switch box, outlet box, electrical panel or any other box.

Conduit shall be secure in each outlet box, switch box, electrical panel or any other box by means of one G.I. hexagonal lock nut and bush, outside and inside the box.

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.

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.

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 to any cover or any removable parts of the equipment.

n) **Bends of Conduits:**

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 75mm. No length of conduit shall have more than the equivalent of four quarter bends from outlet, the bends at the outlets not being counted.

o) **Protection against Dampness:**

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.

p) **Protection of Conduit Against Rust:**

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.

All screwed and socketed connections shall be adequately made fully water tight by the use of proper joining material i.e. white lead for metal conduits.

q) **Bunching of Cables:**

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 in to the same conduit. Wires originating from two different phases shall not be run in the same conduit.

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

MAXIMUM PERMISSIBLE NUMBER OF 1100 VOLTS GRADE SINGLE

CORE CABLE THAT CAN BE DRAWN INTO M.S. CONDUITS

CABLE SIZE IN SQ. MM	SIZE OF CONDUITS (MM) [MAX.NO. OF CABLES]				
	20	25	32	40	50
1.5	5	10	14	-	-
2.5	5	8	12	-	-
4.0	3	6	10	-	-
6.0	2	5	8	-	-
10.0	-	4	7	10	-
16.0	-	3	5	6	-
25.0	-	-	3	4	6
35.0	-	-	2	3	5
50.0	-	-	-	-	4

1.14 **WIRING :**

1.14.1 All final branch circuits for lighting and appliances, shall be single conductor cables run inside conduits.

Branch circuit conductor sizes shall be as shown in the load analysis of drawing and conforming to the requirements of the I.E. Regulations & I.S. Code.

Home runs indicated on the drawings for the final branch circuits shall be kept in a separate conduit upto the panel board via switches wherever called for. No other wiring shall be bunched in the same conduit unless the other circuit main of same phase run in the conduit.

For each lot of wire supply, Contractor shall supply a certificate issued by the Manufacturer stating its origin, date of manufacture, constitution and standards to which it complies and the test certificates.

Looping system of wiring shall be used. Wires shall not be jointed inside the conduit or pull boxes. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of Construction manager / Consultant.

Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in galvanised steel boxes. Chromium plated screws shall be used.

Power wiring shall be distinctly separate from lighting wiring.

Each circuit phase wire from the distribution boards should be followed with a separate neutral wire of the same size as the circuit wire.

1.14.2 Drawing of Conductors :

- a) The drawing and jointing of PVC insulated copper wire and cables shall be executed with due regard to the following precautions. While drawing wires through conduits, care shall be taken to avoid scratches and kinks which causes breakage of conductors. There shall be no sharp bends.
- b) Insulation shall be shaved off like sharpening of a pencil and it shall not be removed by cutting it square.
- c) Strands of wires shall not be cut for connecting terminals. The terminals shall have sufficient cross sectional area to take all strands and shall be soldered. Connecting brass screws shall have flat ends. All looped joints shall be soldered and connected through block/connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. Conductors having nominal cross sectional areas exceeding 10 sq.mm. Shall always be provided with cable sockets. At all bolted terminals, brass flat washer of large area and approved steel spring shall be used. Brass nuts and bolts shall be used for all connections.
- d) Only certified wiremen and cable jointers shall be employed to do jointing work. All wires and cables shall bear the manufacturer's label and shall be brought to site in original packing. For all internal wiring, PVC insulated wires of 1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in loop system and no joints shall be allowed in the length of the conductors. If the use of joints connections

are unavoidable due to any specific reason, prior permission, in writing, shall be obtained from the Architect. No wire shall be drawn into 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 wire. Before the wires are drawn into the conduits, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction by forcing compressed air through the conduits. The minimum size of PVC insulated conductor wires for all sub-circuit wiring for light points shall be 2.5 sq.mm as indicated in the drawing.

1.14.3 **Joints** :

All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made in conduits and in junction boxes. Conductors shall be continuous from outlet to inlet.

1.15 **MAINS AND SUB-MAINS** :

Mains and sub-mains cable or wires where called for shall be of the rated capacity and approved make. Every main and sub-main wire shall be drawn into an independent adequate size conduit. An independent earth wire of the proper rating shall be provided for every single phase submain. For every 3-phase submain, 2 nos. earth wires of proper rating shall be provided alongwith the submain. The earth wires shall be fixed to conduits by means of clips at not more than 1000 mm distance. Where mains and sub- main cables are connected to switchgear, sufficient extra lengths of cable shall be provided to facilitate easy connections and maintenance.

1.16 **LOAD BALANCING** :

Load balancing of circuits in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

1.17 **COLOUR CODE OF CONDUCTORS** :

Colour code shall be maintained for the entire wiring installation: red, yellow, blue for three phases, black for neutral, green/yellow green for earthing.

The control wire from light control switches to the light/ fan points shall be the same colour as that of the phase/ circuit wires feeding that particular loop.

1.18 **EARTHING**:

All earthing system shall be in accordance with IS 3043 code of practice for earthing.

The type and size of earthing wire shall be as specified under the heading of cables.

Each conduit originating from the DB to various outlets shall have one earth wire (PVC insulated copper conductor green colour wire).

1.19 **TESTING OF INSTALLATION:**

Before a completed installation is put into service, the following tests shall be complied with.

1.19.1 **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 megohms 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 Neutral

1.19.2 **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.

1.19.3 **Polarity of Single Pole Switches:**

A test shall be made to verify that every non linked, single pole switch is connected to one of the phase of the supply system.

1.20 **COMPLETION CERTIFICATES:**

All the above tests shall be carried out in presence of Construction manager/Consultant and the results shall be recorded in a prescribed forms. Any default during the testing shall be immediately rectified and that section of the installation shall be re-tested. The completed test results forms shall be submitted to the Construction manager/Consultant 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.

SECTION-D

1.0 LIGHT FIXTURES:

1.1 SCOPE :

Scope of work under this section shall include supply inspection/testing at suppliers/manufacturer's premises at site, receiving at site, safe storage, transportation from point of storage to point of erection, erection and commissioning of light fittings, fixtures and accessories for back of the house area including all necessary supports, brackets, down rods and painting etc as required.

1.2 STANDARDS :

The lighting and their associated accessories such as lamps, reflectors, housings, ballasts etc., shall comply with the latest applicable standards, more specifically the following:

Electric light fittings General and safety requirements -	IS - 1913.
Industrial lighting fittings with metal reflectors -	IS - 1777
Decorative lighting outposts -	IS - 5077
Flood Lights -	IS - 10322 (Part-5, Section 5)
Luminaries for street lighting -	IS - 10322 (Part 3)
Bayonet lamp holders -	IS - 1258
Bi-pin lamp holders for tubular- fluorescent lamps -	IS - 3323
Ballasts for use in fluorescent light fittings -	IS - 1534
Starters for fluorescent lamp -	IS - 2215
Ballast for HP MV lamps -	IS - 6616
Capacitors for use in fluorescent, HPMV & LP sodium Vapour lamps circuits	IS-1569
Tubular Fluorescent lamps -	IS - 2418 (Part I)
High pressure mercury vapour lamps -	IS - 9900 (Part I)
Tungsten filament general electric lamps	IS - 418

1.3 LIGHT FITTINGS-GENERAL REQUIREMENTS :

- a) Fittings shall be designed for continuous trouble free operation under atmospheric conditions without reduction in lamp life or without deterioration of materials and internal wiring. Outdoor fittings shall be weather - proof and rain proof.
- b) Fittings shall be so designed as to facilitate easy maintenance including cleaning, replacement of lamps/ starters etc.
- c) All fittings shall be supplied complete with lamps. All mercury vapour and sodium vapour lamp fittings shall be complete with accessories like

ballasts, power factor improvement capacitors, starters, etc. Out door type fittings shall be provided with weather proof boxes.

- d) Fluorescent lamp fittings shall be complete with all accessories like ballasts, power factor improvement capacitors, starters capacitors for correction of stroboscopic effect.
- e) Each fitting shall have a terminal block suitable for loop-out connection by 1100 V PVC insulated copper conductor wires upto 4 sq.mm. the internal wiring should be completed by the manufacturer by means of standard copper wire and terminated on the terminal block.
- f) All hardware used in the fitting shall be suitably plated or anodised and passivated.
- g) Earthing Each lighting fitting shall be provided with an earthing terminal. All metal or metal enclosed parts of the housing shall be bonded and connected to the earthing terminal so as to ensure satisfactory earthing continuity throughout the fixture.
- h) Painting/Finish All surfaces of the fittings shall be thoroughly cleaned and degreased and the fittings shall be free from scale, rust, sharp-edges, and burrs.
- i) The housing shall be stove-enamelled or anodised as required. The surface shall be scratch resistant and shall show no sign of cracking or flaking when bent through 90 deg. over 12 mm dia mandrel.

1.3.1 **Decorative Type Fittings:**

Decorative fluorescent fittings shall be provided with mounting/housing channel cum reflectors of CRCA sheet steel. Stove enamelled diffusers or louvers shall be translucent white polystyrene.

1.3.2 **Accessories for Light Fittings Reflectors :**

The reflectors shall be made of CRCA sheet steel/aluminium /Silvered glass/Chromium plated sheet copper as required. The thickness of reflectors shall be as per relevant standards. Reflectors made of steel shall have stove enamelled/ vitreous enamelled/epoxy coating finish. Aluminium used for reflectors shall be anodised/epoxy stove enamelled /mirror polished. The finish for the reflector shall be as specified. The reflectors shall be free from scratches / blisters and shall have a smooth and glossy surface having optimum light reflecting coefficient. Reflectors shall be readily removable from the housing for cleaning and maintenance without use of tools.

1.3.3 **Lamp/Starters Holders :**

Lamp holders shall have low contact resistance and shall be resistant to wear. They shall hold lamps in position under normal conditions of shock and vibration prevalent in an industrial atmosphere.

Lamp holders for fluorescent lamps shall be of spring loaded bi-pin rotar type. Live parts of the lamp holder shall not be exposed during insertion or removal of the lamp or after the lamp has been taken out.

Lamp holders for incandescent and mercury vapour lamps shall be bayonet type upto 100 W and Edison screw type for higher wattages.

Starter holders for fluorescent lamps shall be so designed that they are mechanically robust and shall be capable of withstanding shocks during transit, installation and use.

1.3.4 **Ballasts** :

The ballasts shall be designed for long life and low power loss. They shall be mounted using self-locking, anti -vibration fixtures and shall be easy to remove without dismounting the fittings. The enclosures shall be dust tight and non-combustible.

Ballasts shall be inductive, heavy duty type, filled with thermosetting, insulating, moisture repellent polyester compound filled under pressure or vacuum. Ballasts shall be provided with taps to set the voltage. The ballast wiring shall be of copper and they shall be free from dust.

Separate ballast shall be provided in case of multi-lamp fittings, except in case of 2 x 20 W fittings.

1.3.5 **Starters** :

Starters shall have bi-metal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector of lamps and without use of any tool. Starters shall have brass contacts and radio interference capacitor.

1.3.6 **Capacitors** :

The Capacitors shall have a constant value of capacitance and shall be connected across the supply of individual lamp circuits.

The capacitor shall have a value of capacitance so as to correct the power factor of its corresponding lamps circuit to 0.95 lag or better. Capacitor shall be hermetically sealed preferably in a metal enclosure to prevent seepage of impregnant and ingress of moisture.

1.3.7 **Lamps** :

Incandescent lamps shall be clear type unless otherwise specified. Fluorescent lamps shall be "day-light colour" type unless otherwise specified and shall be provided with features to avoid blackening of lamp ends.

Mercury vapour lamps shall be of high pressure, colour corrected type.

Lamps shall be capable of withstanding vibrations prevalent in an industrial atmosphere and connections at bend in wires and filament/electrodes shall not break under such circumstances.

PL Lamps shall be energy effective compact single ended light sources in 9 to 11W ratings consisting of two narrow glass tubes welded together.

The lamp shall be complete with integral glow switch starter and capacitor and two pin electrical connection.

The lamp shall be colour rendered to give warm colour impression.

The comptalux lamp shall have a long life and shall be energy efficient.

1.4 **INSTALLATION :**

1.4.1 The light fixtures and fittings shall be assembled and installed in position complete and ready for service, in accordance with details, drawings, manufacturer's instructions and to the satisfaction of the Construction manager /Consultants. Pendant fixtures specified with overall stem lengths are subject to change and shall be checked with conditions on the job and installed as directed. All suspended fixtures shall be mounted rigid and fixed in position in accordance with drawings, instructions and to the approval of the Construction manager/Consultants. Fixtures shall be suspended true to alignment, plumb level and capable of resisting all lateral and vertical forces and shall be fixed as required.

1.4.2 All suspended light fixtures, fans etc, shall be provided with concealed suspension arrangement in the concrete slab/roof members. It is the duty of the Contractor to make these provisions at the appropriate stage of construction. Exhaust fans shall be fixed at location shown on drawings. They shall be wired to a plug socket outlet at a convenient location near the fan. All switch and outlet boxes, for fans and light fittings shall be bonded to earth. The recessed type fixtures shall not be supported into the false ceiling frame work. This shall have independent support from the socket of ceiling using conduit down rods/steel chain with provision for adjusting the level of fitting. Wires shall be connected to all fixtures through connector blocks. Wires brought out from junction boxes shall be encased in flexible pipes for connecting to fixtures concealed in suspended ceiling. The flexible pipes shall be check-nutted to the junction box with a brass bush. Double checknut at the fixture and flexible pipes, wherever used shall be of make and quality approved by the Construction manager/Consultants.

SECTION-E

1.0 EARTHING:

1.1 SCOPE:

All the non-current carrying metal parts of electrical installation shall be earthed as per IS:3043. All equipment, metal conduits, rising main cable armour, switch gear, distribution boards, meters, all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to earth electrodes. Earthing shall be in conformity with the provisions of Rules 32, 61, 62, 67 and 68 of IER 1956.

1.1.2 G.I.PIPE EARTH STATION :

G.I. pipe shall be of medium class, 40 mm dia and 4.5 m length. Galvanising shall conform to relevant Indian Standards. G.I. pipe electrode shall be cut tapered at the bottom and provided with holes of 12 mm dia drilled not less than 7.5 cm from each other up to 2 M of length from bottom. The pipe electrode shall be as far as practicable embedded below permanent moisture level. Except where rock is encountered, pipes shall be driven to a depth of at least 2.5 mtr. Where rock is encountered at a depth of less than 2.5mtr the electrode may be buried inclined to the vertical and the inclinations shall not be more than 30 deg from the vertical. The pipe electrode shall be made of one piece. Earth leads to the electrode shall be laid in a heavy duty GI pipe and connected to the pipe electrode with brass bolts, nuts and washers. GI pipe shall be terminated in a wire meshed funnel. The funnel shall be enclosed in a masonry chamber of 450 mm x 450 mm dimensions. The chamber shall be provided with C.I. frame and CI inspection cover. The earth station shall also be provided with a suitable permanent identification label tag. The earth electrode shall conform to IS:3043 latest edition. The soil around the earthing electrode shall be treated to reduce the resistivity of the soil by filling the complete depth of electrode with alternative layers of charcoal and salt.

1.1.3 PLATE EARTH STATION :

Plate electrodes shall be made of G.I./copper (CU) plate of 6mm/3mm thick and 600 x 600mm size. The plate shall be buried vertically in ground at a depth of not less than 2.5 meters to the top of the plate, the plate being encased in charcoal to a thickness of 300 mm all round. It is preferable to bury the electrode to a depth where subsoil water is present. Earth leads to the electrode shall be laid in a heavy duty GI pipe and connected to the plate electrode with brass bolts, nuts and washers. A GI pipe of not less than 20 mm dia shall be clamped with bolts vertically to the plate and terminated in a wire meshed funnel. The funnel shall be enclosed in a masonry chamber of 450 mm x 450 mm dimensions. The chamber shall be provided with GI frame and CI inspection cover. The earth station shall also be provided with a

suitable permanent identifications label tag. The earth electrode shall conform to IS:3043 latest edition.

1.1.4 **EARTHING CONDUCTORS** :

All earthing conductors shall be of high conductivity copper/or GI as specified and shall be protected against mechanical damage and corrosion. The connection of earth electrodes shall be strong secure and sound and shall be easily accessible. The earth conductors shall be rigidly fixed to the walls, cable trenches, cable tunnel, conduits and cables by using suitable clamps.

Main earth bus shall be taken from the main medium voltage panel to the earth electrodes. The number of electrodes required shall be arrived at taking into consideration the anticipated fault on the medium voltage net work.

Earthing conductors for equipment shall be run from the exposed metal surface of the equipment & connected to a suitable point on the sub main or main earthing bus. All switch boards, distribution boards and isolators disconnect switches shall be connected to the earth bus. Earthing conductors shall be terminated at the equipment using suit able lugs, bolts, washers and nuts.

All conduits cable armouring etc., shall be connected to the earth all along their run by earthing conductors of suitable cross sectional area. The electrical resistance of earthing conductors shall be low enough to permit the passage of fault current necessary to operate a fuse/ protective device or a circuit breaker and shall not exceed 2 Ohms.

1.1.5 **LOCATION FOR EARTH ELECTRODE**:

Normally an earth electrode shall not be situated less than 2 M from any building. Care shall be taken that excavation for earth electrode may not affect the column footings or foundation of the building. Further the location shall be such where the soil has reasonable chance of retaining moisture as far as possible. Entrances, pavements and roadways are definitely to be avoided for locating the earth electrode.

1.1.6 **EARTHING SYSTEM** :

Main earthing grid shall be of 50 x 6 GI strip laid in a grid formation. All other equipments shall be earthed to this strip. All panels, equipments and non current carrying conductor shall be earthed through the strip/wire of suitable size.

Main panels	- 50 x 6
Main panels to sub panels	- 25 x 6
Sub panel to DB	- 25 x 3
DBs to sub DBs	- 8 SWG G.I.

Earthing system shall be mechanically robust and the joints shall be capable of retaining low resistance even after subjection to fault currents.

Joints shall be tinned, soldered and/or double rivetted. All the joints shall be mechanically and electrically continuous and effective. Joints shall be protected against corrosion.

1.1.7 **TESTING** :

On the completion of the entire installation, the following tests shall be conducted :

- i) Earth resistance of electrodes.
- ii) Impedance of earth continuity conductors.
- iii) Effectiveness of earthing.

All meters, instruments and labour required for the tests shall be provided by the contractor. The test results shall be submitted in the prescribed tabulated form in triplicate to the consultants for approval.

1.2 **LIGHTNING PROTECTION SYSTEM:**

1.2.1 **SCOPE:**

The scope of work under this section covers the specifications for supply, installation, connection, testing and commissioning of lightning protection system consisting of the following :

- 1.2.1.1 Air termination network
- 1.2.1.2 Roof conductors
- 1.2.1.3 Down conductors
- 1.2.1.4 Testing joint
- 1.2.1.5 Earth termination network

1.2.2 **STANDARDS:**

The lightning protection system shall comply with IS: 2309/ 1989 and Indian Electricity Act and Rules.

1.2.3 **SYSTEM** :

- a) The lightning protection system shall be installed as indicated on the drawings or in case such is not available the contractor shall prepare one as per IS-2309/1989 and get the same approved by Construction manager/Consultant.

- b) As air terminals shall be installed on the highest roof of the building, the air terminals shall be joined to horizontal roof conductor by means of rivets/clamps.
- c) Roof conductor shall be laid horizontally on the roof as indicated on the drawing.
- d) Down conductor shall be installed on the vertical surface of the building. The down conductor shall be joined with roof conductors in the method as prescribed by the code. A test joint shall be provided in the down conductor 1000 mm above the ground level at a place which is easily accessible for testing.
- e) The down conductor shall be joined with earth termination network or to the earthing station as indicated on the drawing.
- f) The earthing station and the earthing conductor shall be as per section under heading "EARTHING".

1.2.4 **COMPONENT PART :**

1.2.4.1 **Air Terminals and Roof Conductors :**

- a) An air termination shall consist of vertical conductor or a system of horizontal conductors and shall be installed along the outer perimeter of the roof.
- b) No part of the roof shall be more than 9 m from the nearest horizontal protective conductor.
- c) All metallic projections, chimneys, ducts, vent pipe, railings, gutters etc., on or above the main surface of the roof of the structure shall be bonded to and form part of the air termination network. The method and nature of the fixing shall be simple, solid and permanent.
- d) The minimum dimension of the air termination network shall be as follows :

<u>Above Ground</u>	<u>Below Ground</u>	
Galvanised iron strip	20 x 3 mm	32 mm x 6 mm
- e) The Air terminal shall be installed vertical on the highest point of the roof and shall be clamped firmly with the structure. The roof conductor shall be laid horizontally above the finishing of the roof surface.

1.2.4.2 **Down Conductor :**

- a) The number of down conductors shall be as follows :
 - 1) A structure having a base area not exceeding 100 sq.m shall have only one down conductor.

- 2) For a structure having a base area exceeding 100 sq.m, the number of down conductors shall equal to smaller of the following :

One, for first 100 Sqmtr plus one more for every 300 sq.m or part thereof in excess of the first 100 sq.m or one for every 30 m of perimeter.

- b) The down conductor shall be distributed around the outside wall of the structure.
- c) Any external metal running vertically through the structure shall be bonded to the down conductor at the top and bottom.
- d) A down conductor shall follow the most direct path possible between the air terminals and the earth termination.
- e) The size of the down conductor shall be similar to roof conductor/air termination network.
- f) Each down conductor shall be provided with a testing joint in such a position that, it is convenient for testing (about 1000 mm above Ground level).

1.2.4.3 **Joints and Bonds :**

- a) The lightning protection system shall have as few joints as possible. Joints and bonds shall be mechanically and electrically effective eg. clamped, screwed, bolted, riveted or welded. With overlapping joint, the length of overlapping shall not be less than 25mm for all types of conductor. Contact surfaces shall be first cleaned, then inhibited from oxidation with a suitable non-corrosive compound. Joints of dissimilar metals shall be protected from moisture by an inert, tenacious material.
- b) The lightning conductor shall be secured at not more than 2m apart for horizontal run and 1.0 M for vertical run by fasteners resistive to corrosion.

1.2.4.4 **Earth Resistance :**

The resistance from any part of the lightning protection system to earth shall not exceed 10 Ohm before any bonding has been effected to metal in or on a structure or to services below ground. If the value obtained exceeds the specified 10 ohm it shall be reduced by adding to the number of earth electrode.

In addition the resistance from the earth electrode to the nearest test clamps shall not exceed 0.2 Ohm.

1.2.4.5 **Method of Measurement:**

The complete earth conductor shall be measured and paid per unit length, including air termination network, down conductor, test joints and earthing termination network.

TECHNICAL SPECIFICATIONS FOR AIR-CONDITIONING WORKS

Introduction

VRV / VRF Units

SCOPE :

The scope of this section comprises the supply, installation testing and commissioning of Variable Refrigerant Volume / flow System conforming to these specifications and in accordance with the requirements of Drawing and Schedule of Quantities.

TYPE :

Units shall be air cooled, variable refrigerant volume / flow DX type consisting of One / multiple outdoor units adding upto the indicated module capacity. Each outdoor module shall be connected to multiple indoor units.

It shall be possible to connect multiple nos and types of indoor units on one refrigerant circuit. The indoor units on any circuit can be of different type and also controlled individually. Following type of indoor units shall be connected to the system:

- Ceiling mounted cassette type
- Slim Ceiling mounted duct type (Fan Coil Unit)
- Ceiling mounted duct type.
- Wall mounted type
- Floor standing type
- Concealed floor standing type.
- Any other type specifically manufactured by the manufacturer.

Compressors shall be of scroll / rotary type installed in outdoor unit. Atleast one compressor shall be inverter driven / digital type in each module to match cooling capacity demand of the conditioned area precisely. More than one inverter / digital compressor is advantageous though not mandatory.

The refrigerant piping between indoor units and outdoor unit shall be extended up to 150m with maximum 50m level difference without any oil traps.

Both indoor units and outdoor unit shall be factory assembled, tested for performance and test certificates shall be furnished to this intent. The machines may be either pre charged / site charged. However former is preferable.

OUTDOOR UNIT :

The outdoor unit shall be of tropicalised design, factory assembled in a weather proof casing, constructed from heavy gauge steel panels and coated with baked on enamel / powder coated finish. The unit should be completely factory wired, tested with all necessary controls and switch gears:

- All outdoor units shall have minimum two compressors and be able to operate even in case one of compressor is out of order.
- It should be provided with duty cycling for automatically switching starting sequence of multiple outdoor units/compressors so that all compressors would have operated almost the same time.
- The noise level shall not be more than 60-65 dB(A) at normal operation measured horizontally 1m from the unit.
- The outdoor unit shall be modular in design and should allow for side by side installation.
- The unit shall be provided with its own microprocessor control panel.
- The microprocessor shall be compatible with 3rd party BMS on Modbus / Bacnet protocol when specified in BOQ.

The outdoor unit should be fitted with low noise, high air discharge fans suitably interlocked with the ambient temperature and compressors for optimum running. The outdoor unit fan should be able to get ducted to the extent of about 10-20 ft if site conditions so demand with out a drastic reduction in capacity / increase in power consumption.

The condensing unit shall be designed to operate safely when connected to multiple evaporator units, which have a combined operating nominal capacity of atleast 130 % of indoor units.

Compressor :

The compressor shall be highly efficient scroll type suitable for tropical climatic conditions, operating on R410a environmental friendly green refrigerant and capable of inverter control. It shall change the speed in accordance to the variation in cooling demand:

- The inverter shall be IGBT type for efficient and quiet operation.
- Digital compressors shall with PWM control valve for load / unload cycling
- All outdoor units shall be designed for automatic capacity control to meet load fluctuation and indoor unit for individual control. All parts of compressor shall be sufficiently lubricated even at extended hours of low load operation. Forced feed lubrication may also be employed.
- Oil sump heater shall be provided in the compressor casing.

Heat Exchangers :

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil.

- The aluminum fins shall be provided with hydrophilic coating for effective drainage of condensate and hydrophobic coating for longer life of condensers..
- The unit shall be provided with necessary number of direct driven low noise level propeller type fans with AC / DC motor arranged for vertical discharge.

Refrigerant Circuit :

The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valves at condenser end.

All necessary safety devices shall be provided to ensure the safely operation of the system.

Safety Devices :

All necessary safety devices shall be provided to ensure safe operation of the system.

Following safety devices shall be part of outdoor unit; high pressure switch, Relief valve, fuse, oil sump heater, fusible plug, over load relay, protection for inverter, and anti recycle timer.

Oil Recovery System :

Unit shall be equipped with an efficient oil recovery system to ensure stable operation with long refrigeration piping lengths and partial load operating conditions.

INDOOR UNIT :

This section deals with supply, installation, testing, commissioning of various type of indoor units confirming to general specification and suitable for the duty selected. The type, capacity and size of indoor units shall be as specified in detailed Bill Of Quantities.

General :

Indoor units shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. These units shall have electronic control valve to control refrigerant flow rate respond to load variations of the room.

a) The address of the indoor unit shall be set automatically in case of individual and group control

b) In case of centralized control, it shall be set by LCD remote controller

The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having support from housing.

The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/mechanically expanded for minimum thermal contact resistance with fins. Each coils shall be factory tested at 21kg/sqm of dry nitrogen pressure under water.

Unit shall have cleanable type filter fixed to an integrally moulded plastic frame. The filter shall be slide away type and neatly inserted for easy removal and refixing.

Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with electronic expansion valve & should have microprocessor based thermostat for precise control of room condition.

Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flat individually as per requirement.

Cordless remote controlled shall be supplied when specified in BOQ

Ceiling Mounted Cassette Type Unit :

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX-coil section. The housing of the unit shall be powder coated galvanized sheet steel. The body shall be light in weight and shall be able to suspend from four corners.

Unit shall have an external attractive panel for supply and return air. Unit shall have four way / two way / one way supply air grille/s on side/s and return air grille in center.

Each unit shall have high lift drain pump, fresh air intake provision Low gas detection system and very low operating sound.

All the indoor units regardless of their difference in capacity should have **same decorative panel size** for harmonious aesthetic point of view.

Ceiling Mounted Ductable Type Unit :

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & DX coil section .The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for ductable arrangement.

Ceiling Suspended Type :

Unit shall be suitable for ceiling suspended arrangement above false ceiling. The unit to include pre filter , fan section & DX coil section . The housing of unit shall be light weight powder coated galvanized steel.

High Wall Mounted Units :

The units shall be wall-mounted type. The unit includes pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel /moulded plastic.

Unit shall have an attractive external casing with sophisticated design and compact casing harmonized for any interior décor.

Ceiling Mounted Built-In Type :

Unit shall be suitable for Highly flexible for various arrangement with complete line-up of optional kits to satisfy various needs such as design concept ,interior decoration and so on . The unit include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

Each unit shall have optional high lift drain pump.

Centralized Type Remote (Touch Screen Type) Controller
(Option if specified in BOQ)

A multifunctional compact centralized controller shall be provided with the system.

The Graphic Controller must act as an advanced airconditioning management system to give complete control of VRV airconditioning Equipment, It should have ease of use for the user through its touch screen, icon display and LCD display.

It shall be able to control up to 64 groups of indoor units with the following functions :-

- Starting/stopping of Air Conditioners as a zone or group or individual unit.
- Temperature settling for each indoor unit or zone.
- Switching between temperature control modes, switching of fan speed and direction of airflow, enabling/disabling of individual remote controller operation.
- Monitoring of operation status such as operation mode & temperature setting of individual indoor units, maintenance information, trouble shooting information.
- Display of air conditioner operation history.
- Daily management automation through yearly schedule function with possibility of various schedules.

The controller shall have wide screen user friendly color LCD display and can be wired by a polarity independent 2 wire transmission cable to a distance of 500m. away from indoor unit.

UNIFIED ON/OFF CONTROLLER (OPTION IF SPECIFIED IN BOQ)

Unified ON/OFF controller shall be supplied as optional accessory.

The controller shall be able to control minimum 15 groups (each group containing maximum 16 indoor units) or 128 nos. of indoor units with the following functions:

- On/Off as a zone or individual unit.
- Indication of operation condition of each group.
- Select one of 4 operation modes.

SCHEDULE TIMER (OPTION IF SPECIFIED IN BOQ)

A schedule timer shall be supplied as an optional accessory.

- The timer shall be able to set operation schedule for all indoor units.
- The timer shall be able to set 8 pattern of schedule combined with centralized controller.

REFRIGERANT PIPING :

All refrigerant piping for the air conditioning system shall be constructed from hard drawn 18G copper refrigeration duty pipes with copper fittings and silver alloy soldered / brazed joints. The refrigerant piping arrangements shall be in accordance with good practice within the air conditioning industry, and are to include charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits.

Before jointing any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints through nitrogen bleeding to avoid oxidation and Subsequently, it shall be thoroughly blown out using nitrogen.

Refrigerant piping shall be carried out giving due consideration to the need ensure oil return and avoiding liquid slop over into the compressors. The piping shall include necessary Oil separators (if required) loops, traps, slopes, etc., to achieve these objectives. The system shall also include refrigerant controls like electronic expansion valves, pilot control solenoid valves, etc., and system components like liquid line strainers, liquid-moisture indicator, heat exchanger etc. Sufficient number of shut-off and service valves shall be provided to facilitate servicing of various items of equipment and components of the system. Adequate clearance between pipes should be provided for insulation, wherever insulation is called for.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 30Kg per sq.cm . Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum of 700mm eqv mercury column.

The air-conditioning system supplier shall design sizes and install proper interconnections of the complete refrigerant circuit in line with the design provided with the tender documents.

The thickness of copper piping shall not be less than 18gauge for pipes upto 19.1mm and 16 gauge for bigger sizes

The suction line pipe size and the liquid line pipe size shall be selected according to the manufacturers specified outside diameter. All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors,

brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

To protect nitrile rubber insulation of exposed copper piping from degrading due to ultra violet rays & atmospheric conditon, it shall be covered polyshield coating with atleast two coats of resin and hardner above nitrile rubber insulation. Alternatively the piping clusters may be covered with M.S / GI boxes.

PIPE INSULATION

Refrigerant Pipe Insulation :

The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm /13 mm thick elastomeric nitrile rubber as specified in BOQ.

PVC Drain / Pipe Insulation :

Drain pipes carrying condensate water shall be insulated with 6 mm thick elastomeric nitrile rubber insulation. Alternatively 4 KSC rated Blue PVC pipes may be used without insulation.

For proper drainage of condensate and avoiding foul smell / insects, U Trap shall be provided in the drain piping (wherever required). All pipe supports shall be of pre fabricated & pre painted slotted angle supports, properly installed with clamps etc.

Package Units with Remote Air cooled Condensers :

Casing: The package units should have sheet metal cabinet of heavy gauge / double skin construction. The body should be machine pressed and adequately stiffed. The body should be chemically treated for corrosion resistance and then painted over with at least two coats of paint on a primer. Powder coating is a preferred option. The coil and fan section shall be insulated both thermally and acoustically on the inside. All the components indicated below should be mounted within the cabinet. The unit capacity shall be as specified in the BOQ.

Compressor : The compressor shall be scroll type. The driving motor shall be suction gas cooled. The whole casing shall be suitably sealed against dirt and moisture. The compressor shall be mounted on suitable spring mounts to absorb vibrations. The compressor shall be provided with an oil sump heater to maintain the viscosity of the oil when the unit is not in operation.

Fan: The evaporator fans should be statically and dynamically balanced. They should be of the double inlet, double width, forward curved blade centrifugal type. The fan bearing should be "life lubricated" type ball bearings. The fan motor shall be TEFC and resilient mounted. The fan shall develop a minimum total pressure of 27 mm WC. Higher static shall be provided where specifically specified.

Fan Motor : The fan motor shall be totally enclosed and of sufficient capacity not to over load and operate for extended period on low Voltage (350 V/3 Ph.). The fan motor shall be mounted on a bracket that allows for adjustment of the belt tensions.

Cooling Coil: The cooling coil of the evaporator should be of copper tubes with aluminium fins. The fins should be bonded to the coil under hydraulic pressure or mechanical tube expansion. The cooling coil shall be provided with a thermostatic expansion valve of suitable capacity. An insulated drain pan shall be provided below the entire length of the cooling coil.

Outlet Damper : The fan outlet should be provided with a damper particularly for multi unit applications. The outlet damper shall be opposed blade type with zero noise bushes.

Filters: The unit filters should be of the dry synthetic non woven type / metallic type with a nylon material inside, cleanable. The unit shall be provided with a Return air grill in the front of the unit.

Piping: The refrigerant circuits should be factory piped and transported complete with initial charge of gas and oil. Topping up should be carried out in keeping with current practices. The circuit should include a thermostatic expansion valve, distributor, liquid strainer, filter drier, sight glass, shutoff valve.

Controls: The machine should run automatically on a built in thermostat. The switching circuit should be such as to permit the running of the fan, first, independently. The compressor can be cut in subsequently. Compressor motors and fan motors should be protected against overloads and under voltages. The above equipment will be interlocked with the condenser fan.

Minimum Protection: The protection should be from high/low pressure cutouts with manual reset only for high pressure. The compressor shall also be provided with over current protection and protection against high temperature. Single phasing preventor and Phase reversal protection shall also be incorporated. The unit shall have an auto restart feature in the event of a power interruption.

AIR COOLED CONDENSER :

Casing: Unit casing shall be steel, reinforced and braced with a suitable strong frame work. Casing shall be sectionalized with separate fan and coil section. Coils shall be removable through the top or bottom. Removable panels shall be provided in the casing for access to all internal parts. Casing and accessories shall be chemically cleaned, phosphatized and coated with a baked enamel primer finish before assembly. Finish coat of air dry enamel shall be applied to all exterior surfaced after final assembly.

Coils: Condensing coils shall be constructed of Al. fins mechanically bonded to copper tubes, tested at 425 psig air pressure, dehydrated, pressure tested with refrigerant and then sealed with holding charge of dry nitrogen. All cooling coils shall have an integral sub-cooling circuit for a minimum 15° F subcooling. An external receiver shall be provided wherever required.

Fans: The fans shall be direct drive propeller type. The fan shall have three to four blades and shall be suitably mounted on a steel mounting plate. The fan blades shall be of steel or Aluminium. The fan hub shall be of steel or semi-steel and the blades shall be rivetted on to the hub. Fan blades shall be quiet in operation and shall be statically and dynamically balanced in the factory.

The shaft shall be of steel, accurately ground and shall be of ample size for the loads transmitted and shall not pass through the critical speed through the critical speed through the entire range of speed for the fan.

The motor shall be of induction type that shall be easily replaceable and may be either sleeve or ball bearing type. Maximum speed of the motor shall be 1450 rpm.

The inlet of the fan shall be provided with a wire guard which completely surrounds the fan blades.

The condenser shall be provided with an isolator near the unit.

Noise: It shall be the unit manufacturer's responsibility to ensure that the unit operating noise level is within reasonable limits. Fan curves and sound power data may be put in as part of submittal data.

Air cooled split type units

Air cooled split units shall consist of the indoor evaporator unit and the outdoor condensing unit.

Evaporator Unit :

The indoor unit shall comprise of the cooling coil, fan assembly, refrigerant piping, refrigerant controls and safety devices.

All the components of the evaporator unit shall be housed in a sturdy GSS casing. The casing shall be powder coated to resist corrosion. The unit shall be provided with removable panels to enable access to the cooling coil, fan and fan casing, shaft and driving motor. The fan shall be of centrifugal type with forward curved blades for the impeller. The fan shaft and the fan impeller shall both be balanced, both statically and dynamically. The fan scroll shall be designed and shaped to optimize recovery of static pressure and maximize efficiency at rated delivery and static pressure. The fan shall be driven by a squirrel cage induction motor. The fan motor, drive etc. shall be designed and mounted so as to minimize noise and vibration. The cooling coil shall be with copper tubes and aluminium fins bonded to the copper tubes by mechanical pressure.

Condensing Unit :

The unit shall be factory fabricated and shall be suitable for outdoor installation. The casing and structure for the condensing unit shall be of robust construction and shall be machine pressed and folded. The panels shall be of GSS duly powder coated. The casing shall have removable panels to allow access to the condenser coil, the compressor and fan. If the starters for the compressor and the condenser fans are

housed in the condensing unit the design shall ensure that water/ moisture does not enter the switch gear chamber.

The compressor shall be direct driven scroll / reciprocating type. The compressor shall be suitable for operation with R22. The units shall be suitable for three phase 415Volts 50Hz four wire power supply. The tenderers shall indicate the permissible voltage variations for the units offered by them. The compressors shall be provided with a crankcase heater and safety controls like high / low pressure cutouts, Over current protection, oil safety switch, high temperature protection etc.

The condenser coil shall be of copper tubes and Aluminium fins bonded under mechanical pressure. During installation the unit shall be positioned so as to ensure that dust is not carried to the coil by the entering air.

Fans: The fans shall be direct drive propeller type. The fan shall have three to four blades and shall be suitably mounted on a steel mounting plate. The fan blades shall be of steel or Aluminium. The fan hub shall be of steel or semi-steel and the blades shall be rivetted on to the hub. Fan blades shall be quiet in operation and shall be statically and dynamically balanced in the factory.

The shaft shall be of steel, accurately ground and shall be of ample size for the loads transmitted and shall not pass through the critical speed through the critical speed through the entire range of speed for the fan.

The motor shall be of standard type that shall be easily replaceable and may be either sleeve or ball bearing type. Maximum speed of the motor shall be 1450 rpm.

The inlet/ outlet of the fan shall be provided with a wire guard which completely surrounds the fan blades.

Noise: It shall be the unit manufacturer's responsibility to ensure that the unit operating noise level is within reasonable limits. Fan curves and sound power data may be put in as part of submittal data.

The condensing unit shall be mounted on masonry pedestals or suitable supporting arrangement fabricated of MS channels and angles. The Supporting structure shall be supplied/Fabricated /Erected by the AC contractor. A drawing clearly showing the mounting arrangement / shall be submitted and the approval of the consultant obtained before the commencement of the work. Access to the unit and removal of the compressor shall be borne in mind while deciding the location of the condensing unit. The condensing unit shall be provided with a electrical isolator near the unit.

Refrigerant Piping

The Specifications that follow cover requirements of piping for refrigerant R 22 / R407c.

1. All piping used shall be hard copper pipes of minimum 18 G. The pipes shall be new, fresh and clean. Only brazed joints shall be used. The fittings shall be copper but brazed fittings shall be suitable for the pressure for which the piping is to be installed. Only long radius elbow shall be used, wherever there is sufficient room to permit their use.

2. For small lines such as gauge connections, equaliser lines of expansion valves, connections to pressure switches, oil safety switches, etc., piping shall be of soft copper tubing, flare type compression fittings being used.
4. Piping shall be installed with sufficient number of bends and turns to ensure sufficient flexibility and minimise vibration. Supports, clamps, saddles, hangers, etc., of adequate strength should be provided as required to support the piping adequately and to minimise vibration. Necessary isolating material like rubber, felt, spring, should also be provided as an additional measure to limit transmission of noise and vibration.
5. Refrigerant piping shall be carried out giving due consideration to the need ensure oil return and avoiding liquid slop over into the compressors. The piping shall include necessary Oil separators (if required) loops, traps, slopes, etc., to achieve these objectives. The system shall also include refrigerant controls like electronic expansion valves, pilot control solenoid valves, etc., and system components like liquid line strainers, liquid - moisture indicator, heat exchanger etc. Sufficient number of shut-off and service valves shall be provided to facilitate servicing of various items of equipment and components of the system. Adequate clearance between pipes should be provided for insulation, wherever insulation is called for.
6. All refrigerant piping & the entire circuit shall be pressure tested. The test pressures shall be as under :

High Pressure side - kg/sqcm (psi)	-	25 (365)
Low Pressure side 0 kg/sqcm (psi)	-	10 (150)
7. The system shall hold the pressure for a minimum period of 24 hours without revealing any leaks. The system shall also be vacuum tested for atleast 12 hours.
8. Hot gas lines running in the false ceiling or below false flooring within the air conditioned space shall be suitably insulated so that no heat is dissipated in the conditioned space or to the return air.
9. Insulation for refrigerant piping shall be only nitrile rubber tubing. No alternate insulations are acceptable.
10. Refrigerant pipe sizing shall be got approved by the consultants especially when the piping length is more.

SHEET METAL WORK :

1. All ducts shall be **machine fabricated** from either galvanized sheet steel conforming to IS: 277 or Aluminium conforming to IS: 737. The coating of zinc shall conform to class VIII. Flanges and stiffeners used in duct sections shall be rolled steel angles. All nuts, bolts and washers shall be of zinc plated steel and all rivets shall be galvanized or made of aluminium alloy. Self-tapping screws need not be used. For ducts used in clean rooms only aluminium shall be used and all nuts, bolts washers shall be of aluminium alloy. Gaskets shall be of 3mm-neoprene rubber and shall be leak proof.

Only new, clean and bright sheets without watermarks shall be used. The Consultants/owners reserve the right to reject the sheets not meeting the requirements.

Rectangular Ducting :

1. Duct construction shall follow IS:655. Thickness of sheets for rectangular duct shall be as follows:

Maximum Size of the Duct in mm	Minimum sheet thickness in mm	
	GSS	Aluminium
750mm and below	0.63	0.80
751mm to 1500mm	0.8	1.0
1501mm to 2250mm	1.0	1.5
2251 and above	1.25	1.8

2. The fabrication of the ducting including details of transverse joint connections, bracing, seams etc., For longitudinal joints etc., will be generally as per IS: 655. The ducts should be rigid and should have very minimum leakages.
3. Only angle iron flanges shall be used for all transverse joints and GS sheet flanges are not acceptable.
4. All ducts shall be supported on angle iron supports of 40mm x 40mm x 6mm at less than 2 metres centers in case of ceiling suspended ducts. Anchor grip bolts shall be used to fasten the duct supports to the ceiling. All civil work including drilling, chipping, grip bolting and other related works shall be within the scope of the air-conditioning contractor.
5. Stiffening angles shall be fixed to the sides of the duct by riveting. Flanged joints shall be used at intervals not exceeding 1800mm using angle iron of size not less than 40mm x 40mm x 3mm. Flanges shall be welded at corners first and then riveted to duct. All flanged joints must have 6mm felt lining between flanges.
6. All angles, rods and other MS members, materials, components etc. used for supports shall be provided with a coat of red oxide primer, both before and after being placed in position.
7. Suitable volume control dampers shall be provided in the branch ducts for balancing air quantities. Suitable links, levers and quadrants shall be provided for proper operation, control and setting of the dampers. Every damper shall have indicating device clearly showing the damper position at all times.
8. Fire dampers of louver type shall be complete with fusible linkages and shall be provided as shown in the drawing.
9. All joints shall be made air tight with proper packing gaskets and all interior surfaces shall be smooth. Bends shall be made with radius not less than one half the width of the duct or with properly designed inside curved vanes. Turning vanes shall be provided at branch take-off and collars wherever possible.

10. Where electrical finned heaters are mounted in the duct these shall be of low temperature / black heat operation and totally enclosed type fitted with radiation fins. A removal panel for access to the heaters shall be provided in the duct. Any holes in the duct for electrical wiring must be provided with suitable bushes to avoid leakage. 6mm thick asbestos board lining shall be provided all around inside the duct for a distance of 300mm on each side of the heaters. A manually reset thermostat shall be provided near the duct section having heaters. In addition, the heaters must be electrically interlocked with the corresponding fan motor.
11. Inspection doors shall be provided to permit access to heater boxes, filters etc., as required.
12. All sheet metal connections, partitions and plenums required to confine the flow of air to and through the filters and fans shall be constructed out of 18G GSS thoroughly stiffened with 40 x 40 x 3mm angles and fitted with necessary doors.
13. Duct connections to the air- handling unit shall be made by inserting a heavy fire resistant flexible double canvas of 100mm length. The sleeve shall be securely banded and bolted to the duct and equipment casing.
14. Rat proofing, consisting of 16 Gauge galvanised weld mesh, with 4 mesh per inch, shall be provided in all ducts at fan outlets, air terminals and return air slits, if indicated in the tender schedules.
15. Where sheet metal ducts or sleeves terminate in woodwork, tight joints shall be made by means of closely fitting heavy flanged collars.
16. All ducts shall be totally free from vibration under all conditions of operation.
17. Ducts erected for clean room jobs shall be sealed after fabrication. Inside of all ducts shall be cleaned thoroughly before being erected/ commissioned.
18. All air outlets and intakes and accessories shall be constructed from either steel or aluminium as indicated in the tender schedules. A sample of each type of air outlet or intake that will be used during the job shall have to be got approved from the Architects and consultants and shall be kept at the site.
19. Location of air outlets shall be as shown in the drawings and teakwood frames shall be used for fixing the grilles. Wooden frames shall be provided by the air conditioning contractor unless otherwise mentioned clearly in the tender specification.
20. All exposed ducting in air-conditioned areas shall be painted. The ducts shall be given first a suitable self-etch primer followed by 2 coats of synthetic enamel paint of approved colour.

ROUND DUCTING :

1. The thickness of sheet metal used for round ducting shall be as follows:

DIAMETER OF DUCT IN MM	THICKNESS OF SHEET IN MM	
	GI	ALUMINIUM
150 to 500	0.63	0.80
501 to 750	0.80	1.00
751 to 1000	0.80	1.00
1001 to 1250	1.00	1.25
1251 & above	1.25	1.25

2. All joints both circumferential and longitudinal shall be fabricated using grooved seam joints of appropriate type. Circumferential joints between the duct pieces shall incorporate flanges fabricated out of 3mm thick MS plate.
3. Bends shall be a minimum of 2 gauges heavier than ducts of straight length of equal diameter. They shall have a radius ratio of not less than 1.5, unless restricted by site conditions.
4. Bends of smooth construction are preferred. The bends shall have multiple sections of atleast 5 in numbers. In case of taper pieces, the taper shall not be sharper than 1 in 5.
5. After installation of the entire ducts, the ducts shall be tested for leaks. The entire distribution system shall be then balanced using a velometer. Measured air quantities shall be within 5% of the specified air quantities. Branch duct adjustments shall be made by volume or splitter dampers. Dampers shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any point of time.

INSULATION WORK :

This section covers the supply and application of insulation to sheet metal ducts, chilled water piping, condensate drain piping, refrigerant piping, air handling equipment, chillers, insulation of the walls and ceiling of plant rooms and insulation of roof.

The insulating material shall be expanded polystyrene having thermal conductivities not exceeding 0.029 Kcal/ hr/ sq.m / °C. /m at 20 °C. and densities not less than 20 kg/cum. Expanded polystyrene insulation shall be used for insulating chilled water piping, ducts exposed to atmosphere, chillers, air handling units and roofs.

Resin bonded fibre glass mat is used for insulating the ducts inside the conditioned areas and shall have a density not less than 24 kg/cum and a thermal conductivity not less than 0.029 k-cal hr/sq.m/°C at 20° C. Fibre glass used for the thermal insulation of ducts shall incorporate factory lamination with Al. foil on one side and fibre glass mat on the other side.

Expanded polystyrene / Fibreglass slabs in the form of panels for thermal insulation and acoustic insulation for walls ceiling etc. and for duct acoustic insulation having densities and thermal conductivities as mentioned above shall be used.

For pipe insulation pre- formed cylindrical sections shall be used.

All insulation for the piping and equipment shall be carried out only after satisfactory pressure testing for leaks.

The consultants/owners or their representatives reserve the right to peruse the weights, dimensions etc. of the materials supplied. The contractor if instructed shall furnish factory test certificates for the materials supplied by him. The contractor shall also, when instructed, get the materials tested by the labs specified by the consultant.

Thermal Insulation of ducting:

a. Using Fibre glass

Clean the duct surfaces and paint the surfaces with a thick coat of bituminous primer. When the primary is still tacky apply the blanket of factory laminated insulation material, so that it hugs the duct snugly. Seal all the joints using 75mm wide self Adhesive PVC/Al. tape.

b. Using Expanded Polystyrene:

Clean the surfaces and paint the same with bituminous primer. Apply hot bitumen at the rate of 1.5 Kg/sq.m on the TF quality expanded polystyrene slabs and stick the same to the ducts. Seal all the joints with bitumen. Wrap the insulated surface with 19mm chicken

wire mesh 26G and tie the joints with tie wires. Apply Sand cement plaster 12mm in two layers of 6mm thick (sand cement ratio 1: 3)

Exposed ducting: - The Insulation shall be with 50mm thick expanded polystyrene as in 2 above. The plaster shall be 12mm thick with water proofing compound. Paint the plastered surface with one layer of primer & apply hot bitumen to the surface. Wrap the duct with tarfelt/R.P tissue and seal all the joints with hot bitumen. Tie the tarfelt/ R.P tissue to the duct surface with PVC straps.

Acoustic Insulation

Ducts and Plenums: Clean the surface of the duct. Fiberglass crown 150/25mm shall be used for the insulation. The insulation shall be covered with R.P tissue and 26G Al. perforated sheet .The perforated sheet shall be held in place with GI fasteners and washers at not greater than 600 centers.

AHU rooms: Clean the surface of the walls/ ceiling of all dirt/ cement dust. Paint the surface with two coats of bituminous primer. Fix 50x50x25mm deep TW plugs at intervals of 1m. Using 50x50x50mm GI channels make a grid work of 600 x 600 mm. Fix the channels to the wall using GI screws. Insert 50mm Fibreglass mats into the frame work and cover the same with RP tissue. Finally fix 24G Perforated sheet

on top of the RP tissue using Gi screws and washers making sure the surface of the Al. sheet is taut and free of waviness.

Roof Insulation :

Overdeck Insulation : Clean the surface of the roof and apply bituminous primer. Hot bitumen should be applied to the roof and heavy-duty TF quality expanded polystyrene not less than 20Kg/CUM stuck to the roof. All joints shall be sealed with bitumen. Stick tarfelt over the polystyrene and seal all joints. Concrete screening of minimum 75mm should be carried out over this to prevent damage to the insulation. (Concrete screening to be carried out by the civil contractor).

Underdeck Insulation: Clean the surface of the slab and paint the surface with bituminous primer. Mark a grid work of 500x500mm. Drill at these centers and fix TW plugs and draw GI wires. Stick the TF quality 50mm thick EPS slabs to the slab using hot bitumen @ 1.5Kg/Sq.m. To hold the EPS slabs firm, at the joints fix GI washers and fasten using the GI wires.

MEASUREMENTS :

This section lays down the procedures to be followed for the measurement of variable items of work.

Ducting and Duct Insulation:

1. Ducting shall be measured on the external surface. The rate per Sq.m of the external surface shall include angle iron flanges, gaskets, fasteners, duct supports, hangers, Vanes, Splitters, flexible connections, access doors and painting of the flanges and ducts wherever necessary.

The external area shall be calculated by measuring the finished dimensions of overall width and depth (corner joints not to be added) in the centre of the duct section and the over-all length of the duct section from flange face to flange face in case of ducts with uniform sections. Total area will be arrived at by adding up the areas of all the duct sections.

In case of taper pieces average width and length shall be calculated as follows:

A1 = width of small cross section

A2 = width of large cross section

B1 = Depth of the small cross section

B2 = Depth of the larger cross section

$$\text{Average width} = \frac{A1 + A2}{2}$$

$$\text{Average Depth} = \frac{B1 + B2}{2}$$

Width and depth in the case of taper pieces shall be measured at the edge of the collar of the flange for duct / sections fitted with angle flanges; Otherwise at the bottom of the flange where the flanges are of GSS. Face to face length for taper piece shall be the mean of the lengths measured face to face from the centre of width and depth flanges.

For special pieces like bends, branches and tees, etc. the same principle of area measurement as for linear lengths shall be adopted, except for bends and elbows, the lengths of which shall be the average of the lengths of inner and outer periphery along the curvature of angle of the piece.

Duct measurement for calculation of area shall be taken before the application of Insulation.

Duct Insulation:

The area of ducts to be insulated shall be measured before the application of insulation. Payment will be made for the areas calculated directly from such measurements.

Grills and Diffusers:

Grills and dampers shall be measured on cross sectional area basis excluding flanges.

Cables:

Payment of LT armoured cables shall be on the basis of linear measurements measured from gland to gland. The rate shall include extra cables left in the panel. Measurement will be taken as straight runs along the route. No claims for balance cable remaining after the completion of work will be entertained. No joints in straight runs will be permitted. The contractor has to take the actual measurements based on approved route before procuring the cables.

The rates quoted for the cables laid in underground trenches shall include excavation, sand cushioning, standard burnt brick protection, refilling consolidating, etc. as per specifications.

Cable termination:

The rate quoted for the termination shall include copper/ Al. lugs as applicable, brass compressed glands, copper earth clamps for glands, taping, crimping etc.

Cable trays are measured on the basis of linear measurements which include supports, clamps, grouting, painting etc.

Accepted makes of Equipment and materials

- | | | | |
|----|--|---|---|
| 1. | VRV / VRF Units of Interter / Digital Type | : | Daikin / Toshiba / Media / General / LG / Bluestar / Mitsubishi / Trane / York/ Samsung |
| 2. | Fresh air AHU | : | Blue Star / Caryaire / Saveair / Zeco / edgetech / Vayhan / Starkair / Nutech |
| 3. | Grills & Diffusers | : | Airmaster |
| 4. | GI Sheets | : | Jindal / SAIL |
| 5. | Expanded Polystyrene | : | Beardsell / KK Nag |
| 6. | Fibre Glass | : | Kimko / UP Twiga / Owens Corning |
| 7. | Propeller Fans | : | Crompton / GEC |
| 8. | Fresh air Cabinet fans | : | Kruger / Nicotra / systemaire / greenheck / Osteberg |
| 9. | Cables | : | CCI / Gloster / universal |

- 10 GI VCD with PVC Gear : Caryaire / Air master
11. Flexible ducts : Atco / caryaire / seven star
12. Nitrile rubber insulation : Thermo break / Vidoflex / Armacell / Superlon

TECHNICAL DATA TO BE SUBMITTED WITH OFFERS

Following data shall be submitted with the tender for each rating of the machine

Variable Refrigerant Volume / Flow Air cooled units

1. Make and model ;
2. Country of Origin
3. Nom. capacity of Outdoor Unit ;
4. Capacity at 36C ambient and 45F suction temperature
5. Max no. of connectible indoor units;
6. Type ;
7. Permissible length of refrigerant piping from ODU to farthest IDU
8. Max permissible vertical piping length
9. Type of compressor ;
- 10.No. of compressor (each Outdoor unit)
- 11.No. Of inverter / Digital compressor (Each Outdoor unit)
- 12.Operating Voltage and frequency.
- 13.Air temp. entering and leaving condenser
- 14.Clearance required from adjacent machines
- 15.Clearance required from adjacent structures
- 16.Dimension of Machine W x D x H
- 17.Confirm type of inverter scroll compressor DC /AC
- 18.External static pressure available in ODU?
- 19.Is anticorrosion treatment available on fins of outdoor unit ?
- 20.Set up available for Night time quiet operation :

21. Confirm feature available for reduction of fan noise and pressure loss on outdoor unit :

22. Is it possible to have automatic address setting of each indoor on Outdoor unit ? Otherwise what alternate function available ?

Indoor Units

1. Manufacturer and origin --
2. Type --
3. Capacity Nominal TR
4. Capacity at 23C room temperature TR
5. Airflow Min/Max. Cfm
6. Sound level Hi / Med / Lo
7. Overall Dimensions l x w x h
8. Unit Operating weight kg
9. Is remote controller(corded) provided for each indoor unit Yes/No.
10. Any thing additional vendor wants to highlight.

Format of readings for each split unit

1. Unit serial No :
2. Model :
3. Name plate Capacity Rating :

Compressor (for each compressor in multi ckt unit)

- 1 Saturated suction temperature :
- 2 Saturated discharge temperature :
- 3 Saturated suction Pressure :
- 4 Saturated discharge temperature :
- 5 Voltage RY/ YB / BR :
- 6 Current Drawn R / Y / B :
- 7 Starting Current :
- 8 Power consumed at the operating conditions. :
- 9 Noise level - dB :

Condenser

1. Coil face area - SFT :
2. Air Quantity - CFM :
3. Ambient Temperature DB - °F :
4. Temperature at outlet of coil DB - °F :
5. Motor Amps (for each fan) :
6. Power drawn W :

Evaporating Unit(DX)

- | | |
|--|---|
| 7. Cooling coil area - SFT | : |
| 8. Return air velocity - FPM | : |
| 9. Return air Qty CFM | : |
| 10.Fresh air qty CFM | : |
| 11.Return air temperature DB / WB - °C | : |
| 12.Supply Air temperature DB / WB - °C | : |
| 13.Current Drawn Blower R / Y / B | : |
| 14.Power Consumed | : |

Conditioned Space

- | | |
|---|---|
| 15.Temperature in the office area | |
| 16.RH in the office area | |
| 17.Temperature in the cabins (as many) | |
| 18.RH in the Cabins (as many) | |
| 19.First grill temperature DB/ WB - °C | : |
| 20.Last grill temperature DB / WB - °C | : |

Test Readings to be furnished during performance testing

Following readings shall be furnished for each equipment supplied and installed.

VRV / VRF

- | | |
|---------------------|---|
| 1. Unit serial No | : |
| 2. Model | : |
| 3. Nominal Capacity | : |

Compressor (for each compressor in multi ckt unit)

- | | |
|------------------------------------|---|
| 1. Saturated suction temperature | : |
| 2. Saturated discharge temperature | : |
| 3. Saturated suction Pressure | : |
| 4. Saturated discharge temperature | : |
| 5. Oil Pressure | : |
| 6. Voltage | : |
| 7. Current Drawn | : |
| 8. Starting Current | : |
| 9. Noise level - dBA | : |

Condenser

- | | |
|---|---|
| 1. Coil face area - Sq.m | : |
| 2. Air Quantity - cfm | : |
| 3. Temperature at outlet of coil DB / WB - °C | : |
| 4. Fan speed - rpm | : |
| 5. Motor Amps (for each fan) | : |

Evaporating Unit

- | | |
|---|---|
| 1. Cooling coil area - Sq.m | : |
| 2. Return air velocity - m/sec | : |
| 3. Return air temperature DB / WB - °C | : |
| 4. Ambient Dry / Wet bulb temperatures - °C | : |
| 5. Fresh air - cfm | : |
| 6. Canvas temperature DB / WB - °C | : |
| 7. Fan speed - rpm | : |
| 8. Motor Amps | : |

Conditioned Space :

- 1 Average temperature in the conditioned space :
(readings should be taken at various points in the conditioned space and marked on the drawing)
- 2 First grill temperature DB/ WB - °C :
- 3 Last grill temperature DB / WB - °C :

1. GENERAL INSTRUCTIONS FOR QUOTATION :

The contractor is hereby advised to read the following instructions carefully before quoting the rates.

a) All items to be supplied and fixed in position. The quantities are probable and to be insured at the work spot and paid accordingly.

b) As soon as the work is completed in all respects, the entire area shall be kept clean and neat. All debris, surplus materials etc shall be removed immediately from the site.

c) Only superior and highest quality of joinery / hardware fittings shall be used as per samples approved by the UIDAI.

d) Make sure the designs sizes etc shown in the drawings wherever not specified in the schedule of probable quantities.

e) Any substandard material used during execution will be rejected and be replaced with quality one.

f) The contractor has to carry out the work in coordination with the other appointed agencies. The contractor should study the situation at site and organise the work accordingly. Whenever work needs to be done in coordination with other agencies, the contractor should work out the actual time required to complete his part of the job in all respects and inform the UIDAI for approval.

g) The contractor must to carry out the sound oriented works without disturbing the neighbourers in working hours and hence, the contractor should make arrangements to carry out such works during holidays and probably during nights and complete the work in all manner within stipulated time.

h) Revision of rates is not allowed and revised rates will not be paid for any reason such as unexpected increase in the cost of the materials or delay in completing the work etc.

1. Technical Bid will be opened by the UIDAI, Bangalore or his duly authorised Officers at **1530 hrs on 02/06/2011** at UIDAI office, in the presence of any tenderer or any agent authorised by the tenderer present at that time.

2. Earnest money Deposit of **Rs.3,80,000/- (Rupees Three lakh eighty thousand only)** shall be paid by DEMAND DRAFT drawn in favour of DDO, UIDAI, Bangalore in the receipt thereof attached to the Tender. No other form of payment will be accepted and non-compliance with these conditions would entail for rejection to the tender summarily.
3. Failure on the part of the successful tenderer to execute the contract or agreement would entail forfeiture of the Earnest Money Deposit in addition to that, the contractor would also be responsible for making good the extra expenditure incurred by the UIDAI due to recalling of fresh tender.
4. The copies of the abstract of estimate quantities, contract, documents, schedule, drawings and details of condition of contract etc. will be available for inspection in the office of UIDAI, Bangalore during working hours and the tenderer should sign in the register kept in the UIDAI office in token of having seen them. The tenderer should note that the quantities mentioned in the estimate are approximate.
5. Final acceptance of the tender rests with UIDAI, Bangalore who reserve the right to accept or reject any or all tenders without assigning any reasons thereof.
6. The submission of tender by contractor implies that he has read all these terms and conditions of contract and made himself aware of the scope and specification of the work to be done and the availability of materials required etc.
7. Tenderer shall pay compensations to workmen working under him for any injury caused during the execution of the work as per Workmen Compensation Act in force failing which the amount will be deducted from his bills and paid to the injured workman.
8. The Contractor shall pay the sales and other usual taxes levied by Government or Municipalities and the royalty due to Government.

2. REFUND OF SECURITY DEPOSIT:

Security deposit of the contractor shall be refunded after the completion of the defect liability period and as recommended by the Architect.

During the defect liability and maintenance period, if the Contractor fails to attend to the rectifications, repairs and maintenance works, the same will be got done by other agencies and the expenditure incurred towards such works will be deducted from the security deposit and EMD.

**GOVERNMENT OF INDIA
PLANNING COMMISSION**

UNIQUE IDENTIFICATION AUTHORITY OF INDIA



CONFORMITY OF TECHNICAL SPECIFICATION

(THIS CONFIRMATION OF TECHNICAL SPECIFICATION SHOULD BE A PART OF TECHNICAL BID. TECHNICAL SPECIFICATIONS ARE DEFINED IN "TECHNICAL SPECFN CONFIRM.PDF" DOCUMENT WHICH CAN BE DOWNLOADED)

for

**Providing interior works including partitions, flooring, false ceiling
& Civil works, furniture and electrical/AC works, etc.
at UIDAI, Regional Office - Bangalore**

TENDER No: UIDAI/RO/BLR/INTERIORS/RE-TENDER/01

dtd:12/05/2011

**Regional Office : 3rd Floor, Khanija Bhavan, South Wing, #49, Race Course Road,
Bangalore – 560 001**

Ph: 080-22340863/22340864 Fax : 080-22340310 Email :leninashok@uidai.gov.in

**GOVERNMENT OF INDIA
PLANNING COMMISSION**

UNIQUE IDENTIFICATION AUTHORITY OF INDIA



COMMERCIAL BID

(THIS IS COMMERCIAL BID. THIS SHOULD BE SUBMITTED IN SEPARATE SEALED ENVELOPE. COMMERCIAL BID REQUIREMENTS ARE DEFINED IN "COMMERCIAL BID PART I & PART II.PDF" DOCUMENT WHICH CAN BE DOWNLOADED)

for

**Providing interior works including partitions, flooring, false ceiling
& Civil works, furniture and electrical/AC works, etc.
at UIDAI, Regional Office - Bangalore**

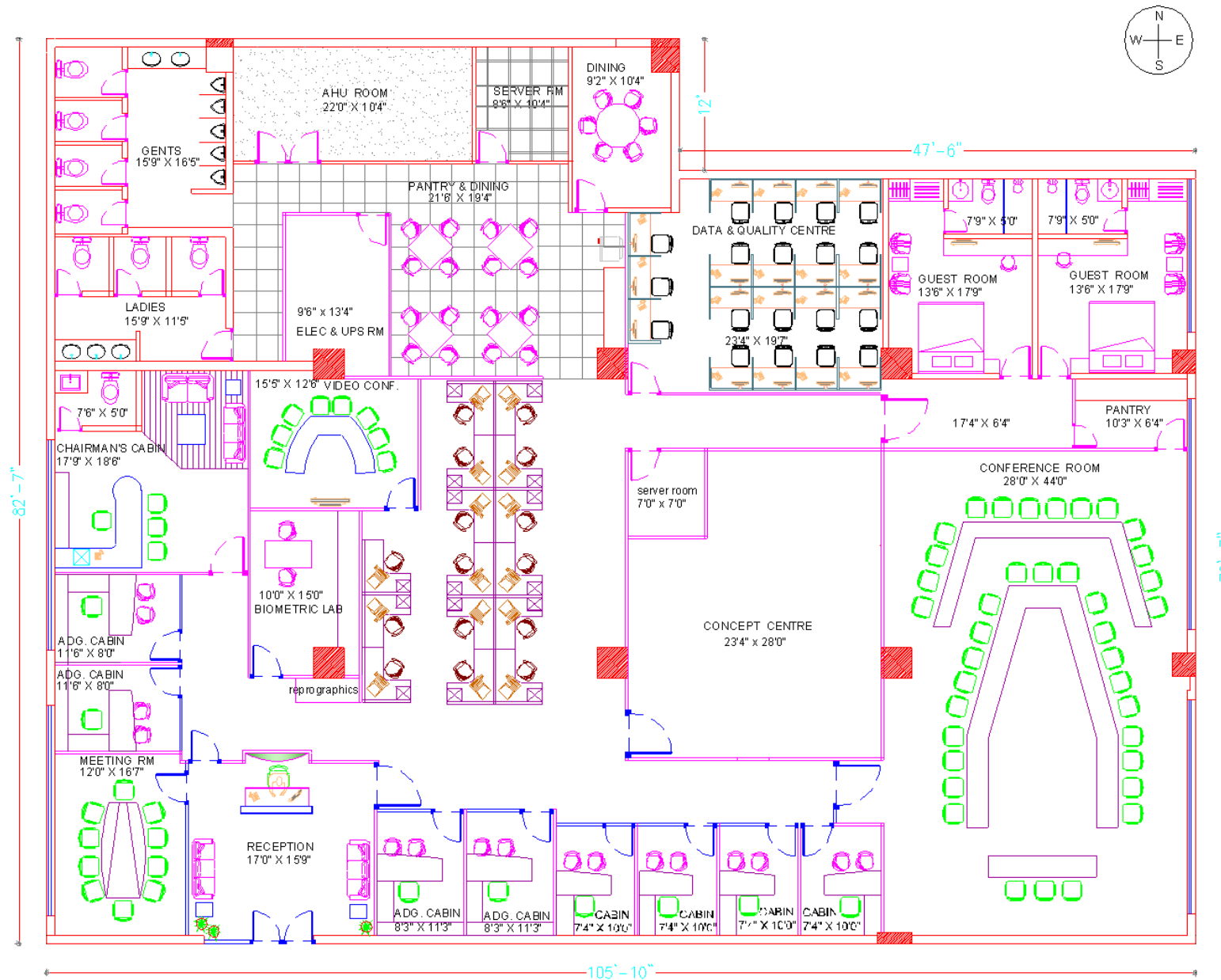
TENDER No: UIDAI/RO/BLR/INTERIORS/RE-TENDER/01

dtd:12/05/2011

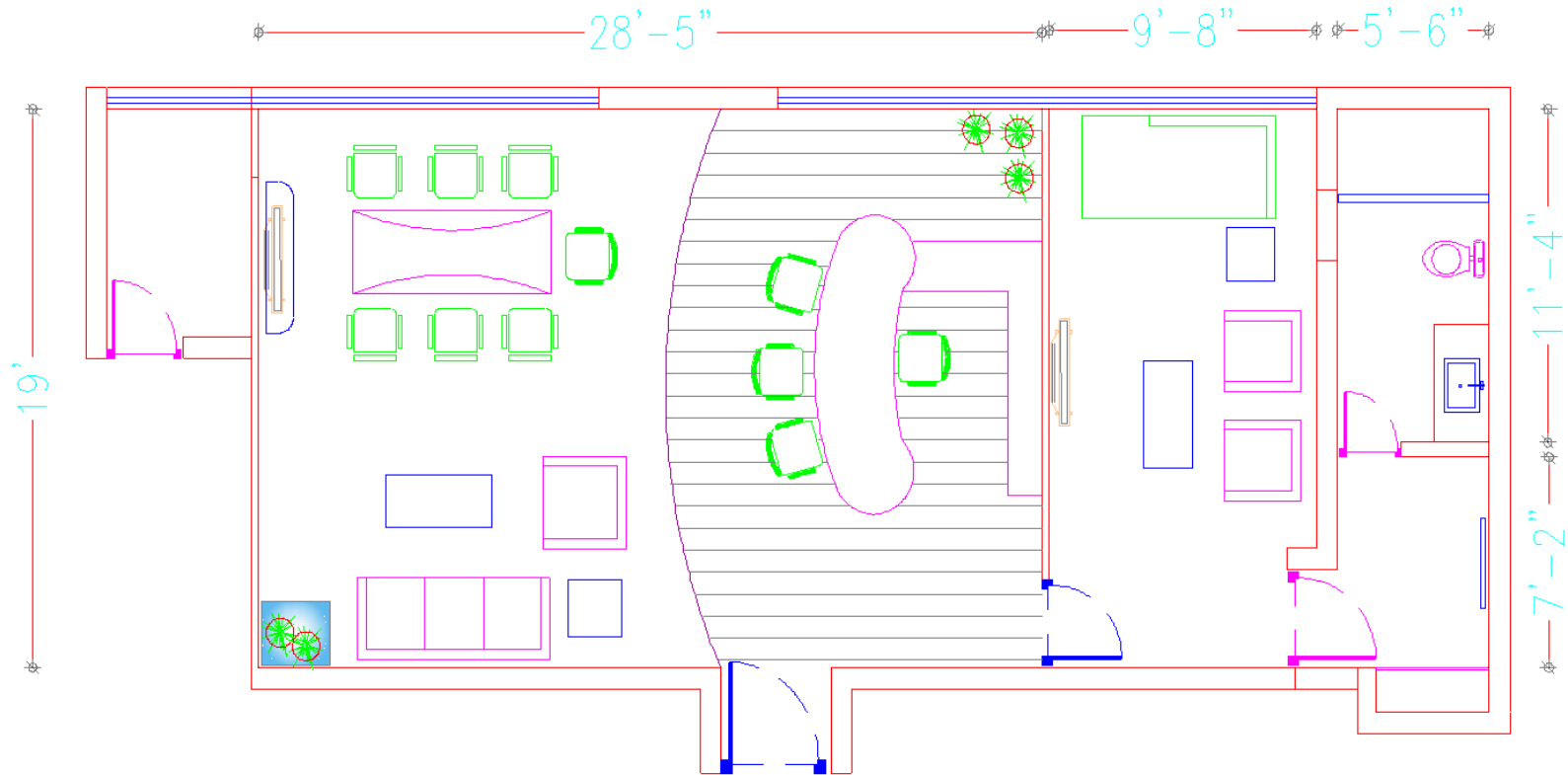
**Regional Office : 3rd Floor, Khanija Bhavan, South Wing, #49, Race Course Road,
Bangalore – 560 001**

Ph: 080-22340863/22340864 Fax : 080-22340310 Email :leninashok@uidai.gov.in

LAYOUT FOR MAIN BLOCK :



LAYOUT FOR EXECUTIVE BLOCK :



Auto CAD drawings for the following are included in “DrawingsForInteriors.zip” file which can be downloaded:

1. Furniture Layout
2. Ceiling Layout
3. Furniture Details
4. Lighting Layout
5. Electrical Layout
6. UPS and Networking Layouts