I N D I A N B A N K

TENDER DOCUMENT

FOR

INTERIOR, FURNISHING, ELECTRICAL

AIR CONDITIONING & ATM WORK FOR

BRANCH AT

NAGAUR,RAJASTHAN

Date of Issue :- 18 / 04 / 2016

Date of Submission :- 28 / 04 / 2016

ISSUED TO:-……

ARCHITECT

VASTU SADAN PVT. LTD.

122 A/12, G.F., GAUTAM NAGAR,

NEAR POST OFFICE, NEW DELHI - 110049

TEL. NO. 41643426, 41643626

SECTION – I

INVITATION TO TENDERS

1.0 Sealed tenders on item rate bases are invited in the prescribed form by the **Chief Manager, Indian Bank**, for Interior, Furnishing, Electrical, A.C & ATM Work at **NAGAUR, BRANCH, RAJASTHAN**.

Tender No.	Name of Work	Earnest Money	Time of Completion
IB / NG / FUR / 05 /2016-17	**Interior Furnishing, Elect. AC & ATM work at Nagaur, Branch,Rajasthan**.	**12, 000 /-** in the form of DD	**21 Days**

1.1 The work as detailed in this tender shall be executed and completed in all respect with in a period of **21 Days** from the date of written order to commence the work in accordance with the tender documents, Instruction to tenderers, Technical specification, Schedule of Quantities, Condition of contract, Schedules and drawings, to the satisfaction of Architect / Employer.

1.2 The Tenderer(s) are required to deposit **Rs. 12, 000/-** as Earnest Money along with the tender document in the form of crossed Demand Draft only payable at Jaipur in favour of Chief Manager, Indian Bank, Jaipur.

1.3 The Earnest Money will be refunded without any interest to the unsuccessful tenderers after a decision is taken regarding award of contract.

1.4 Tenders, filled in the prescribed form in sealed covers and super scribed with the name of work, Tender No. **IB/NG/FUR/05/2016-17** must be submitted to the **Zonal Manager**, **Indian Bank**, **Zonal Office, SF 63, JTM Mall, Near Jagatpura Flyover, Model Town, Malviya Nagar, Jaipur - 302017, Rajasthan** not later than **1.00 P.M.** on **28/04/2016.** Tenders will be opened on the same day at **2.30 P.M**. in the presence of tenderers or their representatives. **Any correction/alteration made using "Correcting Fluid" will not be accepted and tender will be liable to be rejected.**

1.5 Tender documents can be obtained on working day from **M/S Vastu Sadan Pvt Ltd.,122 A /12 Ground Floor, Gautam Nagar, New Delhi- 110049 Phone : 41643426** on payment of tender cost (non-refundable) of **Rs. 1000/-** in cash/ by pay order / DD in favour of Vastu Sadan Pvt. Ltd. The drawings are enclosed along with set of specifications.

1.6 Rate must be quoted for complete work at site inclusive of all costs, taxes and charges, etc. All taxes and duties including sales Tax or works contract, E.S.I. charges etc. as applicable at **RAJASTHAN** central or state sales Tax, Octroi, Royalties etc. on works and materials required for use in the execution of this project shall be entirely borne and payable by the contractor and the Employer will not entertain any claim whatsoever in this respect.

1.7 The tenders shall remain valid for acceptance by the Employer, for a period of 3 month from the date of opening of tender.

1.8 Total Security Deposit shall comprise of :

a) Earnest Money Deposit

b) Initial Security Deposit

c) Retention Money

1.9 Initial Security Deposit

1.9.1 The amount of Initial Security Deposit shall be 2 % of the accepted value including earnest money. Initial Security Deposit shall be refunded without any interest to the contractor after the issue of certificate of virtual completion.

1.9.2 The balance amount of Initial Security Deposit is to be paid by the contractor to the Employer within 14 (Fourteen) days of intimation to him or the acceptance of the tender in the form of Demand Draft.

1.9 Retention Money

1.9.1 The retention percentage (i.e. deduction from interim bill) shall be 8 % of the gross value of each interim bill.

1.9.2 The maximum amount of retention money shall be the balance amount of the total security deposit.

1.9.3 50% of the retention amount is refunded to the contractor subject to the following :-

(1) Issue of virtual completion certificate by the Architect / Premises department.

(2) Contractor should remove his material, equipments, labour force, temporary sheds / stores etc. from the site.

The remaining 50% of the retention money may be refunded 14 (Fourteen) days after the end of defects liability period provided he has satisfactorily carried out all the work and attended to all defects in accordance with the conditions of the contract.

1.11. Earnest money of the successful tender will be liable to be forfeited in the event of refusal or delay on his part in deposit initial security deposit and signing the agreement within 7 (seven) days, of the issue of letter of award of the work.

1.12. Tender documents duly filled and signed by the tenderer shall be submitted for the work.

1.13. The Indian Bank and their approved architect, do not bind itself to accept the lowest or any tender, or to assign any reason thereof and also reserves the right of accepting the whole or part of the tender and the tender shall in such an event be bound to perform the contract at the same rates quoted in the tender for the various items of the work.

1.14. Canvassing in any form in connection with the tender is strictly prohibited and the tenders submitted by the contractors who resort to canvassing from shall be liable for rejection.

1.15. The tendering firms, in case the tender is a partnership firms, shall submit the tender signed by all the partners. In the event of absence of any partner, it must be signed on his behalf by a person holding power of attorney authorizing him to do so and such power of attorney be attached along with the tender.

APENDIX SHOWING IMPORTANT SCHEDULES

1.	NAME OF WORK	:	Interior Furnishing, Electrical Air Conditioning & ATM work of Branch at **NAGAUR , RAJASTHAN.**
2.	SIGNING THE AGREEMENT	:	Within 3rd Days of the issue of letter of intend / order.
3.	DATE OF COMMENCEMENT OF WORK	:	Within 3rd Days of issue of letter of intend / order or the day on which the contractor is given the site whichever is latter.
4.	PERIOD OF COMPLECTION	:	**21 Days** from the tender date of commencement of work.
5.	LIQUIDATED DAMAGES	:	1% of contract amount per week of delay subject to the max. of 10% of the accepted contracted sum .
6.	PERIOD AND VALUE OF RUNNING / ON ACCOUNT BILL.	:	75% of amount within 7th days after date of receipt of architect certificate and balance within 21days.
7.	INITIAL SECURITY DEPOSIT	:	2 % of the accepted value of the Tender including of the Earnest Money.
8.	REFUND OF INITIAL SECURITY DEPOSIT AND RETENTION MONEY	:	(a) <u>INITIAL SECURITY DEPOSIT</u> To be released with 14 days after the issue of certificate of virtual completion.
		:	(b) <u>RETENTION MONEY</u> As clause 1.9.3
9.	TOTAL SECURITY DEPOSIT	:	As per clause No. 1.7
10.	INCOME TAX DEDUCTION	:	As prevailing rate from each bill.
11.	DEFECTS LIABLITY PERIOD	:	12 Months after completion of work.
12.	PERIOD OF FINAL MEASUREMENT	:	2 Weeks after virtual completion of work

SECTION – 2

INSTRUCTION TO TENDERERS

INSTRUCTION TO TENDERERS.

2.1 The tenderer shall examine carefully all the tender documents consisting of:–

- Invitation to Tenderers.
- Instruction to Tenderers.
- Form of Agreement.
- General Conditions of Contract.
- Schedule of Quantities.

These shall form part of the Agreement.

The tender is advised to visit and inspect the site at his on cost and responsibility and to secure all necessary information which may be required for completing the tender. Ignorance of site conditions cant be an excuse for non- performance of the contract. All costs, charges and expenses that may be incurred by the tenderer in connections with the preparation of his tender shall bear by him and the employer / architect does not accept any liability whatsoever in this regard.

2.2 Time is the essence of the contract and the tenderers are required to complete the work in all respect within the stipulated time of completion and handover the same, complete in all respects to the satisfaction of the architect.

2.3 The tender should contain not only the rates but also the value of each item of work entered in the prescribed column of the B.O.Q. and all the item should be totaled up in order to show the aggregate value of the entire tender. The rates quoted by the tenderers should be expressed accurately both in words and figures so that there is no discrepancy. All corrections in the tender shall be duly attested by initials of the tenderer, corrections, if not attested may entail rejection of tender. The rates quoted by the tenderers in word in item rate tender will be the basis (and not the amounts in case of discrepancies) in finalising the tender.

2.4 It shall be clearly under stood that the rates quoted in the tender are to be, for complete work at site, as per instructions to Tenderers, conditions of contract, specifications and drawings, addenda referred to therein and also for all such works as are necessary for the proper completion of the contract, although specifications thereof may not have been made in the specifications or drawings or tender documents. The rates shall be firm and shall not be subject to cost escalation on account of labour, material and labour conditions or any other reason whatsoever.

2.5 The tenderers shall used only the form issued with this tender to fill up the rates.

2.6 Every page of the tender shall be signed on the left hand side bottom corner and any tender not so complied with is liable to be treated as defective & liable to be rejected.

2.7 In the event of a tender being a selected for acceptance. The Indian Bank will inform the tenderer for the specification and other documents for the acceptance with tender. The successful tenderer shall also deposit the required amount of the security money within the prescribed time and if the tenderer fails to deposit the required amount of the security money within the prescribed period, Indian Bank may reject the tender.

2.8 The successful tenderer will be notified about the acceptance of his tender by the Employer and he will have to deposit balance amount initial security and executed agreement within 7 (Seven) days thereof, failing which his tender would be liable to rejection with forfeiture of the Earnest Money.

2.9 The tender shall fill up the complete form of article of agreement before submission of tender. Failure to comply may entail rejection of the tender.

2.10 The contractor will be governed by the Indian contract act, Indian sale of good act and all other relevant laws. All payments due to the contractor under the contract will be made in Indian rupee currency.

2.11 The rate quoted shall be for complete work at site and should be inclusive of incidentals necessary for carrying out the work. The rates shall be inclusive of sales tax if applicable at **RAJASTHAN** for work contract, central or state sales tax, octroi duty, royalty, ESI or any other tax or duty levied by any government or public bodies. The rate shall be firm and shall not be subject to cost escalation of labour, material and exchange variations, labour conditions and other conditions whatsoever.

2.12 A schedule of approximate quantities for various items accompanies this tender. It shall be clearly understood that neither the architect nor the employer will accept any responsibility for the correctness or completeness of this schedule in respect of item and quantities and this schedule is liable to alternations by omission, deduction or addition at the discretion of the employer in consultation with the architect without violating the items of the contract.

2.13 The contractor must produce latest income tax clearance certificate along with this tender.

2.14 Form of 'Tender of works' contained in section –3 shall be completed along with submission of tender. In case of failure to do so the tender is liable to rejection.

2.15 The employer does not bind itself to accept the lowest or any tender or to assign any reason thereof and also reserves the right of accepting the whole or part of the tender. The part acceptance will not violate the terms and conditions of the contract and will execute the work at the specified rates without any extra charges or compensation.

2.16 Income tax deductions will be made as per the prevailing rates from the contractor's on account bills.

2.17 No mobilisation advance or secured advance is to be allowed to the contractor.

2.18 Power and water connection if required is to be arranged by the contractor. Cost shall be paid by the employer as per actual billing.

SECTION - 3

FORWARDING LETTER

FROM: _____

_____

_____

_____

To: _____

_____

_____

_____

Ref.: _____

Dear sir,

1. With reference to the tender invited by you, I/ we hereby offer to perform, provide, execute and complete the works in conformity with conditions of contract, drawings and specifications for the respective items of schedule of quantities attached hereto.

2. I/ we have satisfied myself / ourselves as to the location and prevailing conditionings of the site, and have red carefully the articles of agreement, condition of contract, specification, general and special conditions, technical specifications etc, and I/We understand that the works are to be completed within **21 Days** from the date of commencement and fully under stand that the time will be the essence of the contract.

3. I/We enclosed a demand draft for **Rs. 12, 000/-** drawn on Indian Bank payable at Jaipur in favour of the Chief Manager, Indian Bank as earnest money and fully understand that this amount will not bear any interest.

4. I/We agree to keep the offer for **3 months** from the date of opening the tender.

5. Should this tender be accepted in whole or in part, I/We hereby agree to abide by and fulfill and the terms and conditions annexed hereto. I/We fail to commence the work specified in tender documents , I/We agree that my / our earnest money shall stand forfeited absolutely to the Employer otherwise the said Earnest money shall be retained by the Employer towards security deposit (retention money).

6. All the terms and conditions contained in the notice Inviting Tenders, Conditions of Tenders, General conditions of contract, specifications for execution of the work, additional conditions and the agreement etc. constituting the tender documents have been fully read by me/us and explained to me/us and I/We hereby accept the same and sign hereunder in token of their acceptance.

7. We are further enclosing herewith the following documents :-

   i) Partnership Deed. Article of Association and power of Attorney. We agree that no change will be made in these documents without prior approval of the Indian Bank

   ii) Tender documents duly signed along with detailed program and targets of completion of each items work.

   iii) Detail of deployment of manpower, machinery, plant and equipment.

   iv) Latest I.T.C.C

v) Demand Draft No. _____ Date _____ Drawn _____

Name of the partners / Directors

Of the firm 1)

2)

Date: _____ Yours faithfully,

Witness: _____ Name & Sign. of Tenders (s) office

stamp and seal of the Tenders (s) .

Address : _____

_____

_____

Occupation :- _____

SECTION – 4

AGREEMENT

AGREEMENT

This agreement made at _____ day of _____ , between the **Indian Bank,** Jaipur having its registered office at Indian Bank, Zonal Office, SF 63, JTM Mall, Near Jagatpura Flyover, Model Town, Malviya Nagar, Jaipur - 302017, Rajasthan (herein after called the Employer which expression shall include their heirs, executors, administrators and assignees) of the one part and M/S _____ _____ (herein after called the 'Contractor') of the other part. Whereas the employer is desirous that work should be executed as per drawings and specifications describing the work to be done, to be prepared by their approved Architects and WHEREAS the said drawings, the specifications and the price schedule of quantities have signed by or on behalf of the parties hereto and WHEREAS the contractor has agreed to execute upon and subject to the conditions set forth herein and the said priced schedule of quantities at the respective rates mentioned in the priced schedule of quantities , which as part of the tender document.

And WHEREAS the contractor has deposited **Rs. 12, 000/-** as the Earnest Money with the Employer, which shall become part of security deposit to be until the expiry of the Defect liability period for the due observance of the contract .

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In consideration of the said contract, payments to be made to the said conditions execute and complete the works shown upon the said Drawings and such further detailed drawings as may be furnished to him by the said Architects and described in the specifications and the said priced schedule of quantities.
2. The employer shall pay the contractor such sums as shall become payable hereunder at the times and in the manner specified in the said conditions.
3. The said contract comprised the building above mentioned and all subsidiary works connect there within the same site as may be ordered to be done from time to time by the said Architects even , through such works may not be shown on the Drawings or described in the said specification or the priced schedule of quantities .
4. The Employer through Architect reserves to himself the right of altering the drawing and nature of the work and adding to or omitting any items of works , check of measurement , payment certificate, variation arising in view of change of scope of work and approval of rates of extra substituted items. The decision of the Employer shall be final and binding in this regard.
5. The Employer in consultation with the Architect reserves the right to exercise control on quality of work, check of measurement, payment certificate, variation arising, in view of change of scope of work and approval of rates of extra submitted items. The decision of the Employer shall be final and binding this regard balance retention money being deducted from my /our bills in accordance with the conditions of contract.
6. The following documents shall be deemed to form and constructed as part of this agreement along with the amendments, negotiated and confirmed in various subsequent latter exchanged as mentioned hereinafter and parties hereto will respectively abide by and submit themselves to the conditions and stipulations and perform the agreement on their parts respectively in such conditions contained.
   - i) Invitation to Tender.
   - ii) Instruction to Tenderers.
   - iii) General Conditions of the contract.
   - iv) Technical Specifications.
   - v) Schedule of Quantities.
   - vi) Employer letter date _____/_____/_____ to the contractors awarding the contract.
   - vii) Contractors letter date _____/_____/_____ to the Employer in acceptance of the award of contract.
7. All disputes arising out of or in any way connected with the agreement shall be deemed to have arisen at Jaipur only, the court in Jaipur shall have jurisdiction to determine the same.
8. The several parts of this contract have been read to us and fully understood by us.

Witness our hand this…… day of ……2016

SIGNED BY THE SAID (EMPLOYED) ……

IN THE PRESENCE OF ……

ADDRESS ……

……

SIGNED BY THE SAID (CONTRACTOR) ……

IN THE PRESENCE OF ……

ADDRESS ……

……

SECTION – 5

GENERAL CONDITION OF CONTRACT

Except where provided for in the description of the individual items in the schedule of quantities and in the specifications and conditions laid down herein after and in the drawing. The work shall be carried out as per standard specifications and under the direction of employer / Architect.

1. INTERPRETATION

In construing these conditions, the specifications, the schedule of quantities, tender and agreement, the following words shall have meaning herein assigned to them except when the subject or context otherwise required.

i) Employer: The term employer shall mean Indian Bank having their head office at 66, Rajaji Salai, Chennai and any of its employees representative authorized on their behalf.

ii) Architect: The term architect shall mean the approved architects of Indian Bank or in the event of his / their ceasing to be the architect for the purpose of this contract such other person/s as the employer shall nominate for the purpose.

iii) Contractor: The term contractor shall mean Company, firm or the party to whom the Contract is awarded and shall include his / their legal representative(s) or successor(s).

iv) Site: Shall mean the places or buildings envisaged by the employer where the work is to be executed or carried out.

v) Site Engineer: The bank may appoint the site engineer. The bank may also determine the number of site engineer and the supporting staff at site office to assist them and also whether the site engineer shall be temporary or permanent. As far as possible, the site engineer should assume charge of his post before the contractor reports on site of work. Where more than one site engineer is appointed, one of them shall be designated as senior site engineer by the premises department and the other site engineer shall be reporting to the senior site engineer.

vi) Drawings: The work is to be carried out in accordance with drawings, specifications, the schedule of quantities and any further drawings which may be supplied or any other instruction, which may be given by the employer during the execution of work.

All drawings relating to work given to the contractor together with a copy of schedule of quantities are to be kept at site and the employer / Architect shall be given access to such drawings or schedule of quantities whenever necessary.

In case any detailed drawings and necessary contractor shall prepare such detailed drawing and / or dimensional sketches therefore and have it confirmed by the employer / Architect prior to taking up such works.

The contractor shall ask in writing for any clarification on matters occurring anywhere in drawings, specifications and schedule of quantities or to additional instructions at least 10 days ahead from the time when it is required for implementation so that the employer may be able to decision thereon.

vii) "The Works" shall mean the work or works to be executed or done under this contract.

viii) "Act of Insolvency" shall mean any act as such as defined by the presidency town's insolvency act or provisional insolvency act or any amending statues.

ix) "The schedule of quantities" shall mean the schedule of quantities as specified and forming part of this tender.

x) "Priced schedule of quantities" shall mean the schedule of quantities duly priced with the accepted quoted rates of the contractor.

2. SCOPE

The work consists of **INTERIOR , FURNISHING, ELECTRICAL, AIR CONDITIONING AND ATM WORK Branch at NAGAUR, RAJASTHAN** in accordance with the "drawings" and "Schedule of quantities". It includes furnishing all material, labour, tools and equipments and management necessary for the incidental to the construction and completion of the work. All works, during its progress and upon completion, shall confirm to the lines, elevations and grades as show on the drawings furnished by the employer / architects. Should any detail essential for the efficient completion of the work to be omitted from the drawings and specifications, it shall be responsibility of the contractor to inform the employer / architects and to furnish and install such detail with employer's / architect's concurrence, so that ,upon completion of the proposed work , the same will be acceptable and ready for use.

Employer/ Architect may in their absolute discretion issue further drawings and / or written instructions, details, directions and explanations, which are hereafter collectively referred to as "The Employer's / Architect's instructions in regard to:

a) The variation and modification of the design quality or quantity of works or the addition or omission or substitution of any work.

b) Any discrepancy in the drawings or between the schedule of quantities and / or drawings and / or specification.

c) The removal from the site of any defective material brought thereon by the contractor and the substitution of any other material thereof.

d) The demolition removal and / or re-execution of any work executed by the contractor/s.

e) The dismissal from the work of any persons employed thereupon

f) The opening up for inspection of any work covered up.

g) The rectification and making good of any defects under clauses hereinafter mentioned and those arising during maintenance period (retention period)

The Contractor shall forthwith comply and duly execute any work comprised in such employer / Architect's Instructions provided always that verbal instructions, directions and explanations given to the contractor or his representative upon the works by the employer / Architects shall, if involving a variation, be confirmed in writing to the Contractor within seven days. No work, for which rates are not specifically mentioned in the priced schedule of quantities, shall be taken up without written permission of the employer / architect. Rates of items not mentioned in the priced schedule of quantities shall be fixed by the employer in consultation with the architects as provided in clause 'variation'.

Regarding all factory made products for which ISI marked products are available, only products bearing ISI marking shall be used in the work.

3. TENDERER SHALL VISIT THE SITE

Intending tenderer shall visit the site and make him thoroughly acquainted with the local site condition. Nature and requirement of the works, facilities of transport condition effective labour and materials, access and storage for material and removal of rubbish. The tender shall provide in their tender for cost of carriage, height and other charges as also for any special difficulties and including police restriction for transport etc. for proper execution of work as indicated in the drawings. The successful tenderer will not be entitled to any claim of compensation for difficulties faced or losses incurred on account of any site condition which existed before the commencement of the work or which in the opinion of the employer / architects might be deemed to have reasonably been inferred to be existing before commencement of work.

4. TENDERS

The entire set of tender paper issued to the tenderer should be submitted fully priced also signed on the last page together with initials on every page. Initial / signature will indicate the acceptance of the tender paper by the tenderer.

The schedule of quantities shall be filled in as follows:-

i) The rate column to be legibly filled in ink in both English figures and words.
ii) Amount column to be filled in for each item and the amount for each subhead as detailed in the "Schedule of Quantities".
iii) All corrections to be initialed.
iv) The rate column for alternative items shall be filled up.
v) The "Amount" column for alternative items of which the quantities are not mentioned shall not be filled up.
vi) In case of any error / omissions in the quoted rates, the rates given in the tender marked "Original" shall be taken as correct rates.

No modifications, writing or corrections can be made in the tender papers by the tenderer but may at his option offer his comments or modifications in a separate sheet of paper attached to the original tender papers.

The employer reserved the right to reject the lowest or any tender and also to discharge any or all of the tenders for each section or to split up and distribute any item of work to any specialist firm or firms, without assigning any reason.

The tenderers should not that tender is strictly on the item rate basis and their attention is drawn to the fact that the rates for each and every item should be correct, workable and self-

supporting. It called upon by the employer / architects detailed analysis of any or all the rates shall be submitted. The employer / architect shall not be bound to recognize the contractor's analysis.

The work will be paid for as "measured work" on the base of actual work done and not as "lump sum" contract.

All items of work described in schedule of quantities are to be deemed and paid as complete work in all respects and details including preparatory and finishing work involved, directly related to and reasonably detectable from the drawings, specifications and schedule of quantities and no further extra charge will be allowed in this connection. In the case of lump sum charge in the tender in respect of any item of works the payments of such items of work will be made for the actual work done on the basis of lump sum charges as assessed by the employer / architect.

The employer has power to add to, omit from any work as shown in drawings, or described in specifications or included in schedule of quantities and intimate the same in writing, but no addition, omission or variation shall be made by the contractor without authorization from the employer. No variation shall vitiate the contract.

The tenderer shall note that his tender shall remain open for consideration for a period of 3 months from the date of opening of the tender.

5. AGREEMENT

The successful contractor required to sign agreement as may be drawn up to suit local conditions and shall pay for all stamp and legal expenses, incidental thereto.

6. GOVERNMENT AND LOCAL RULES

The contractor shall confirm to the provisions of all local bye-laws and acts relating to work and to the regulations etc. of the govt. and the local authorities and of any company with whose system the structure is proposed to be connected. The contractor shall give all notices required by said act, rules, regulations and bye-laws etc. and pay all fees payable to such authority/ authorities for execution of work involved. The cost if any, shall be deemed to have been included in his quoted rates, taking into account all liabilities for licenses, fees for footpath encroachment and restoration etc. and shall indemnify the employer against such liabilities and shall defend all actions arising from such claim or liabilities.

7. TAXES AND DUTIES

The tenderer must include in their tender prices quoted for all duties royalties, excise and sales tax or any other taxes or local charges if applicable. No extra claim on this account will in any case be entertained.

8. PROVISIONAL SUM (P.S.)

All provisional sums described in the schedule of quantities as P.S. shall be exclusively allotted to the purchase of material and not for any handling and fixing to be done by the contractor. Such cost of handling and fixing with profit (including transport charges if required) shall be separately included in the contract price as described in the schedule of quantities. The disposal of the amount cover under this head will be absolutely at the discretion of the employer. Contractor is to make payments for these materials to the supplier on certificate or order issued by the employer / architect and release them through his bills from the employer.

9. QUANTITIES OR WORK TO BE EXECUTED

The quantities shown in the schedule of quantities are intended to cover the entire new structure indicated in the drawings but the employers reserves the right to execute only a part or the whole or any excess thereof without assigning any reason therefore.

10. OTHER PERSONS ENGAGED BY THE EMPLOYER

The employers reserves the right to execute any part of the work in this contract or any work which is not included in this contract, by other agency or persons and contractor shall allow all reasonable facilities and use of his scaffolding for the execution of such work. The main contractor shall extend all co-operations in this regard.

11. EARNEST MONEY AND SECURITY DEPOSIT

The tenderer will have to deposit an amount of **Rs. 12, 000/-** in the form of bank draft drawn in favour of **INDIAN BANK** at the time of submission of tender as an earnest money. The employer is not liable to pay any interest on the earnest money. The earnest money of the unsuccessful

tenderers will be refunded without any interest soon after the decision to award the work is taken or after the expiry of the validity period of the tender.

The successful tenderer to whom the contract is awarded will have to deposit an initial security deposit a further sum to make up 2 % of the value of the accepted tender including the earnest money. The initial security deposit will have to made within 14 days from the date of acceptance of tender failing which the employer at his discretion may revoke the letter of acceptance and forfeit the earnest money deposit furnished along with the tender. The initial security deposit will be invested by the employer in a fixed deposit account for the duration of the contract period. It shall be refunded to the contractor along with accrued interest within fourteen days after the issue of certificate of virtual completion.

Apart from the initial security deposit made as above, retention money shall be deducted from progressive running bill @ 8% of the gross value of each running bill until the total security deposit i.e. the initial security deposit plus the retention money equals:

a) 10% on the first one lakh rupees of the estimated cost of work.

b) 7.5% on the next one lakh rupees of the estimated cost of work.

c) 6% on the remaining amount of the estimated cost of work, subject to a ceiling on total security deposit rupees ten lakhs (Rs. 10, 00, 000)

The retention amount will be refunded to the contractor 14 days after the end of defect liability period provided he has satisfactorily carried out all the work and attended to all defects in accordance with the condition of the contract. No interest is allowed on retention money.

12. CONTRACTOR TO PROVIDE EVERYTHING NECESSARY:

The contractor shall provide everything necessary for the proper execution of works according to the intent and meaning of the drawings, specifications and Schedule of Quantities taken together whether the same may or may not be particularly shown or described therein, provided that the same can reasonably be inferred there from and if the Contractor finds any discrepancy in the drawings or between the drawings, general conditions, specifications and Schedule of Quantities, he shall immediately refer the same in writing to the employer / Architect, whose decisions shall be final and binding. The contractor shall provide himself for ground and fresh water for carrying out of the works at his own cost. The employer shall on no account be responsible for the expenses incurred by the contractor for hired ground or fresh water obtained from elsewhere.

The rates quoted against individual items will be inclusive of everything necessary to complete the said items of work within the contemplation of the contract, and beyond the unit price no extra payment will be allowed for incidental or contingent work, labour and / or material inclusive of all taxes and duties whatsoever except for specific items. If any, stipulated in the tender documents.

The Contractor shall supply, fix and maintain at his own cost, during the execution of any works, all necessary centering, scaffolding, staging, planking, strutting, hoarding, watching and lighting by bights as well as by day required not only for the proper executions and protection of the said works, but also for the protection of the public and the safety of any adjacent roads, streets, walls, houses, building and all other erections, matters or things. The Contractors shall take down and remove any or all such centering, scaffolding, staging, planking, strutting, etc., as occasion shall required or when ordered so to do and shall fully reinstate and make good all the matters and things disturbed during the execution of the works to the satisfaction of the Employer / Architects.

The contractor shall also provide such temporary roads on the site as may be necessary for the proper performance of the contract and for his own convenience but not otherwise. Upon completion, such roads shall be broken up and leveled where so requited by the drawings unless the Employer shall otherwise direct.

The contractor shall at all times , give access to workers engaged by the Employer or any men employed on the buildings , and to provide such parties , sufficient and if required , special scaffolding hoists and ladders and provide them with water and lighting and level or make any holes , groves etc. , in any work . Where directed by the employer or as may be required to enable such workmen to lay or fix pipes, electrical wiring, special fittings etc. The quoted rates of the tenders shall accordingly include all these above-mentioned contingent works.

13. TIME OF COMPLETION EXTENSION OF THE PROGRESS CHART

1. Time of completion: The entire work is to be completed in all respects within the stipulated period. The work shall deemed to be commence ed within the fourteen days from the date of acceptance letter or date of handing over of site , whichever is earlier. Time is the essence of the contract and shall be strictly observed by the contractor.

   The work shall not be considered as complete until the employer / architects have certified in writing that his has been completed and the defect liability period shall commence from the date of such certificates.

2. Extension of time: If in the opinion of the employer / Architects the work be delayed (a) by any exceptionally inclement weather or (b) by reason of instructions from the employer in consequence of proceedings taken or threatened by or disputes, with adjoining or neighboring owner or (c) by the workers, or delay of other contractors or tradesmen engaged or nominated by the employer and not referred to in the specification or (d) by reason of authorized extra or addition or (e0 by reason of any combination of workmen or strikes or lock out affecting any of the building trades or (g) from other causes which the employer may consider are beyond the control of the contractor, the employer at the completion of the time allowed for the contract, shall make fair and reasonable extension of time for completion in respect therefore. In the event of the employer failing to give possession of the site upon the day specified above the time completion shall be extended suitably.

3. In case of such strikes or lock-outs, as referred to above, the contractor shall immediately give the employer, written notice thereof. Nevertheless, the contractor shall use his best endeavors all that to prevent delay, and shall do all that may be reasonably required , to the satisfaction of the employer, to proceed with the works and on his doing so that it will be ground of consideration by the employer for an extension of time as above provided. The decision of the employer as to the period to be allowed for an extension of time for completion hereunder (which decision shall be final and binding on the contractor) shall be promulgated at the conclusion of such strike or lock-out and the employer shall then, in the event of an extension being granted, determined and declare the final completion date. The provision in clause 15 with respect to payment of liquidated damages shall, in such case, be made an construed as if the extended date fixed by the employer were substituted for and the damage shall be deducted accordingly.

4. Progress of Work: During the period of construction the contractor shall maintain proportionate progress on the basis of a program chart submitted by the contractor immediately before commencement of work and agreed to by the employer / architects. Contractor should also include planning for procurement of scarce material well in advance and reflect the same in the program chart so that there is no delay in completion of the project.

14. LIQUIDATED DAMAGES

Should the work not be completed to the satisfaction of the employer / architect within the stipulated period, the contractor shall be bound to pay to the employer a sum calculated as given below by way of liquidated damages and not as penalty during which the wok remains uncommented or unfurnished after the expiry of the completion date.

a)	For contracts having time for month or less	1% of the estimated amount shown in Completion 4 the tender per week subject to a ceiling of 10% of the accepted contracted sum
b)	For contracts having time for exceeding 6 month but not exceeding 2 years (24 months)	0.5% of the estimated amount shown in Completion the tender per week subject to a ceiling of 7.5%of the accepted contracted sum.
c)	For contracts having time for Completion in excess of 2 years	0.25 % of the estimated amount shown in the tender per week subject to a ceiling of 5% of the accepted contracted sum.

15. NOTICE AND PATENT OF APPRORIATE AUTHORITY AND OWNERS

The contractor shall confirm to the provision of any acts of legislature relating to the work and to the regulations and bye-laws of any authorities and / or any water, lighting and other companies, and / or authorities with whose systems the structures were proposed to have connection and shall before making any variations from the drawings or specification that may be associated to so confirm, give the employer / architect written notices for making them and apply for instruction thereon. The employer / architect on receipt of such intimation shall give a decision within the reasonable time.

The contractor shall arrange to give notice required for by the said acts, regulations or bye-laws to be given to any authority and to pay to such authority or to any public officer fees that may be properly chargeable in respect of the work and lodge the receipt with the employer.

The contractor shall indemnify the employer against the claims in respect of patent rights, royalties, damages to the buildings, roads or member of public in course of execution of work and shall defend actions arising from such claims and shall keep the employer saved harmless and indemnified in all respects from such actions costs and expenses.

16. CLEARING SITE AND SETTING OUT WORKS

The site shown on the plan shall be cleared of obstructions, loose stone and materials, rubbish of all kinds. All holes and hollows whether originally existing or produced by removal or loose stone or material shall be carefully filled up with earth well rammed and leveled off as directed at his own cost.

The Contractor shall set out the works and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions, and alignment of all parts thereof. If at any time any error shall appear during the progress or on completion of any part of the work, the Contractor shall at his own expenses rectify such error, if called upon to do so the satisfaction of the Architect and the Employer. The contractor shall further set out the works to the alternative positions at the site until one is finally approved and the rates quoted in his tender should include for this and no extra on this account will be entertained.

17. DATUM

The average ground level will be considered as the crown of the nearest road which should be taken as "Datum" which is however subject to final confirmation by the employer / architect. All levels shown in the drawings are to be strictly adhered to.

18. CONTRACTOR IMMEDIATELY TO REMOVE ALL OFFENSES

All soil filth or other material of offensive nature taken out of any trench, sewer, drain, cesspool or other places shall not be deposited on the surface but shall be at once carted away by the contractor to place provided by him.

The contractor shall keep the foundation and works free from water and shall provide and maintain at his own expenses electrically or other power driven pumps and other plant to the satisfaction of the employer for the purpose unit the building is handed over to the employer. The contractor shall arrange for the disposal of the water so accumulated to the satisfaction of the employer and local includes in his rates for the purpose.

19. ACCESS

Any authorised representative of the employer shall at all reasonable times have free access to the works and/or to the workshops, factories or other places where item/items of work are being prepared or manufactured for the contract and also to any place where the materials are lying or from which they are being obtained. The Contractor shall give every facility to the Architect, Owner and their representative for the inspection and examination and test of the materials and workmanship. Except the representative of employer no person, shall be allowed at any time without permission of the employer.

20. MATERIAL, WORKMANSHIP, SAMPLES, TESTING OF MATERIALS

All the works specified and provided for in the specification or which may be required to be done in order to perform and complete any part thereof shall be executed in the best and most workman like manner with materials of best and approved quality of the respective kinds in accordance with the particular contained in the implied by the specifications and as represented by the drawings or accordance to such other additional particulars and instruction as from time to time be given by the employer / architect during the execution of the work , and to his entire satisfaction.

If required by the employer / architect the contractor shall have to carry out test on materials and workmanship in approved material testing laboratories or as prescribed by the employer / architect at his own cost to rove that the materials etc. under test confirm to the relevant IS standards or as specified in the specifications. The necessary charges for preparation of mould (in case of concrete cube) transporting, testing etc. shall have to be done by the contractor. No extra payment on this account should in any case be entertained.
All the material (except where otherwise described) store and equipment required for the full performance of the work under the contract must be provided through normal channel and must include charge for import duties, sales tax, octroi and other charges and must be the best of their

kind available and the contractor/s must be entirely responsible for the proper and efficient carrying out of the work. The work must be done in the best workman like manner. Samples of all materials to be used must be submitted to the employer / architect when so directed by the engineer / architect.

21. REMOVAL OF IMPROPER WORK:

The employer shall, during the progress of the works, have power to order in writing from time to time the removal from the works, within such reasonable time/times, as may be specified in the order, of any materials which in the opinion of the employer /architect are not in accordance, with the specifications or instructions, and the substitution of proper materials and proper re-execution of any work, executed with materials or workmanship, not in accordance with the drawings and specifications or instructions. In case contractor refuse to comply with the orders, the employer shall have the power to employ and pay other agencies to carry out the work and all expenses consequent thereon or incidental thereto as certified by the employer / architect shall be borne by the Contractor, or may be deducted from any money due to or may become due to the Contractor. No certificate which may be given by the architect shall relieve the contractor from his liability in respect of unsound work or bad material.

22. SITE ENGINEER

The term "Site Engineer" shall mean the person appointed and paid by the Employer superintend the work . The contractor shall afford the Site Engineer every facility and assistance for examining the works and materials and foe checking and measuring work and materials. The Site Engineer shall have no power to revoke , alter , enlarge or relax any requirements of the contractor or to sanction any day work , additions , alterations , deviations or omissions or any extra work whatever, except in so far as such authority may be specially conferred by a written order of the employer .

The Site Engineer shall have power to give notice to the contractor or to his foreman , of non-approval of any work or materials and such work shall be suspended of the use of such materials shall be discontinued until the decision of the Employer is obtained . The Architects, from time to time, will examine the work . Engineer from the premises Department of the Employer and the Site Engineer. But such examination shall not in any way exonerate the contractor from the obligation to remedy any defects, which may be found to exist at any stage of the work or after the same is complete. Subject to the limitation of this clause the contractor shall taken instructions only from the Architects / Employer.

23. CONTRACTOR'S EMPLOYERS

The contractor shall employ technically qualified and competent supervisors for the work who shall be availably (by turn) throughout the working hours to received and comply with instructions of the Employer / Architects. The contractor shall engage at least one experienced Engineer as site-in-charge for execution of the work. The contractor shall employ in connection with the work arsons having the appropriate skill or perform their job efficiently.

The contractor shall employ local labourers on the work as far as possible . No labourer below the age of sixteen years and who is not an Indian National shall be employed on the work.

Any labourer supplied by the contractor to be engaged on the work on day-work basis either wholly on partly under the direct order or control of the employer or his representative shall be deemed to be a person employed by the contractor.

The contractor shall comply with the provisions of all labour legislation including the requirements of.

a) Employer's Liability Act.

b) Workman's Compensation Act.

c) Contract Labour (Regulation & Abolition) Act, 1970 and Central Rules 1971

d) Apprentices Act 1961

e) Any other Act or enactment relating thereto and rules framed hereunder from time to time.

The contractor shall keep the Employer saved harmless and indemnified against claims if any of the workmen and an costs and expenses as may be incurred by the Employer in connection with any claim that may be made by any workmen.

The contractor shall comply at MS own cost the order of requirement of any Health Officer of the State or any local authority or of the Employer regarding the maintenance of proper

environmental sanitation of the area where the contractor's labourers are housed or accommodated, for the prevention of small pox. Cholera, plague, typhoid, maintain and keep in good sanitary conditions adequate sanitary accommodation and provide facilities for pure drinking water at all times for the use of men engaged on the works and shall remove and clear away the same in completion of the works. Adequate precautions shall be taken by the contractor to prevent nuisance of and kind on the works or the lands adjoining the same.

The contractor shall arrange to provide first aid treatment to the labourers engaged on the works He shall within 24 hours of the occurrence of any accident at or about the site or in connection with execution of the works, report such accident to the Employer and to the competent authority where such report is required by law.

24. DISMISSAL OF WORKMEN :

The contractor shall on the request of the employer immediately dismiss from the works any person employed thereon who may, in the opinion of the employer, is unsuitable or incompetent or who may misconduct himself, and such person shall not again be employed or allowed on the works without the permission of the employer. The employer shall not enter into correspondence for stating the reasons for dismissal of such workmen. Such discharge shall not be the basis of any claim for compensation or damages against the employer or any of their officer or employee.

25. ASSIGNMENT

The whole 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 share thereof or interest therein, nor shall take a new partner, without the written consent of the employer and no subletting shall relieve the contractor from the full and entire responsibility of the contract or from active superintendence of the works during their progress.

26. DAMAGE TO PERSONS AND PROPERTY INSURANCE ETC.

The contractor shall be responsible for all injury to persons, property or things and for all structural and decorative damage to property which may arise from operation or neglect or default of himself or of any Sub--Contractor or of any of his or a Sub-Contractor's employees, whether such injury or damage may arise from carelessness, accident or any other cause whatever in any way connected with the carrying out of this contract. This clause shall be held to include, interlace any damage to buildings, whether immediately adjacent or otherwise, any damage to roads, streets, footpaths, bridges, or ways as well as damages caused to the buildings and works forming the subject of this contract by rain, wind or other inclemency of the weather. The Contractor shall indemnify the Employer and hold him harmless in respect of all, and any expenses arising from any such injury or damage to persons or property as aforesaid and also in respect of any claim made in respect of injury or damage under any acts of Governments or otherwise, and also in respect of any award of compensation or damages consequent upon such claim.

The Contractor shall reinstate all damages of every sort mentioned in this clause, so as to deliver up the whole of the Contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property or third parties.

The contractor shall effect the insurance necessary and indemnify the employer entirely from all responsibility in this respect. The insurance must be placed with a company approved by the employer and must be effected jointly in the names of the contractor and the employer and the policy lodged with the latter. The scope of insurance is to include damage or loss to the contract itself till this is made over in a complete state. Insurance is compulsory and must be effected from initial stage. The contractor shall be responsible for anything, which may be excluded from the Insurance Policies above referred to, and also for all other damages to any property arising out of and incidental to the negligent or defective carrying out of this contract.

The employer shall be at liberty and is hereby empowered to deduct the amount of any damages, compensations, costs charges and expenses arising or occurring from or in respect of any such claims or damages from any sums due or to become due to the Contractor.

27. INSURANCE

Unless otherwise instructed the contractor shall insure the work and keep them insured until the virtual completion of the contract against loose or damage by fire and / or earthquake, flood. The insurance must be placed with a company approved by the employer, in the joint names of the employer and the contractor for such amount and for any further sum if called to do so by the employer, the premium of such further sum being allowed to the contractor as an authorized extra.

The contractor shall deposit the policy and receipts for the premiums with the employer within 10 days from the date of signing the Contract. In default of the Contractor insuring as provided above, the employer on his behalf may so insure and may deduct the premiums paid from any money due or which may become due to the contractor. The Contractor shall as soon as the claim under the policy is settled, or the work reinstated by the In Insurance office, should they elect to do so proceed with all due diligence with the completion of the works in the same manner as though the fire had not occurred and in all respects under the same conditions of contract. The contractor in case, of rebuilding or reinstatement after fire, shall be entitled to such extension of time for completion as the employer may deem fit.

28. ACCOUNTS RECIEPTS AND VOUCHERS

The contractor shall, upon the request of the employer furnish them with invoices, accounts, receipts and other vouchers that they may required in connection with the work under this contract. If the contractor shall use materials less than what he is required under the contract the value of the difference in the quantity of the material he was required to use and that he actually used shall be deducted from his dues. The decision of the employer shall be final and binding on the contractor as to the amount of the material is required to use for any work in this contract.

29. MEASUREMENT

Before taking any measurement of any work the site engineer or a subordinate deputed by him shall give reasonable notice to the contractor. If the contractor fails to attend at the measurement after such notice or fails to countersign or to record the difference within a week from the date of measurement in the manner required by the site engineer then in any such event the measurement taken by the site engineer or by the subordinate deputed by him as the case may be is final and binding on the contractor and the contractor shall have no right to dispute the same.

30. PAYMENTS

The bills of the Contractor's shall be submitted to the Architects which in turn shall duly forward the same certifying the correctness thereof along with all the relevant records to the employer with in a week of the receipt of bills and other records from the Architects subject to deduction of applicable taxes, advances, security deposits etc. or such other sums as may be agreed or provided for under the Contract

All the interim payments shall be regarded as payments by way of advance against the final payments for work actually done and completed , and shall not preclude the requiring of bad , unsound , and imperfect or unskilled work to be removed and taken any and reconstructed , or recreated or be considered as an admission of the performance of the contract , or may part thereof in any respect or the accruing of any claim , nor shall it conclude determine or affect in any way the power of the Employer under these conditions or any of them as to the final settlement and adjustment of the accounts or otherwise or in any other way vary or affect the contract .

Final payment: - The final bill shall be accompanied by a certificate of completion from that employer/ Architect. Payments of final bill shall be made after deduction of retention money as specified in clause 11 of these conditions, which same shall be refunded after the completion of the defect liability period after receiving the employer's / architects certificates that the contractor has rectified all defect to the satisfaction of the employer / architect. The acceptance of payment of the final bill the contractor would indicate that he will have no further claim in respect of the work executed.

31. VARIATION / DEVIATION

The price of all such additional items/ non tendered items will be worked out on the basis of rates quoted for similar items in the contract wherever existing or on engineering rate analysis based on prevalent fair price of labour, material and other components as required. The tender rates shall hold good for any increase or decrease in the tendered quantities up to variations of 25%. For variation beyond ± 25% the rate for the respective items may be reviewed on mutually agreed terms.

32. SUBSTITUTION

Should the contractor desire to substitute any material and workmanship, he / they must obtain the approval of the employer / architect in writing for any such substitution well in advance. Material designated in this specification indefinitely by such terms as "Equal" or other approved etc. specific approval of the employer / architect has been obtained in writing.

33. PREPARATION OF BUILDING WORKS FOR OCCUPATION & USE ON COMPLETION

The whole of the work will be thoroughly inspected by the contractor and deficiencies and defects put right on completion of such inspection the contractor shall inform the Employer that he has completed the work and it is ready for inspection .

On completion the contractor shall clean windows, and doors including oiling if necessary , of all hardware., inside and outside , stair – case , and every part of the building . He will leave the entire building neat and clean and ready for immediate occupation and total satisfaction of the Bank.

34. CLEARING SITE ON COMPLETION

On completion of the works the contractor shall clear away and remove from the site construction plant, surplus material, rubbish and temporary works of every kind and leave the whole of the site and the works clean and in a workmanlike condition to the satisfaction of the employer / architect.

35. DEFECTED AFTER COMPLETION

The contractor shall make good at his own cost and to the satisfaction of the Employer all defects, shrinkage, settlements or other faults which may appear within 13 months after completion of the work . In default the Employer may employ and pay other persons to amend and make good such damages , losses and expenses consequent thereon or incidental there to shall be made good and borne by the contractor and such damages , loss and expenses shall recoverable from him by the employer or may be deducted by the employer , in lieu of such amending and making good by the contractor deduct from any money die to the contractor a sum equivalent to the cost of amending such work and in the event of the amount retained being insufficient , recover that balance from the contractor from the amount retained under clause No. 12 together with any expenses the Employer any have incurred in connection therewith .

36. CONCEALED WORK

The contractor shall give due notice to the employer / architects whenever any work is to be buried in the earth, concrete or in the bodies of walls or otherwise becoming inaccessible later on , in order that the work may be inspected and correct dimensions taken before such burial , in default whereof the same shall at ht opinion of the employer / architect be either opened up for measurement at the contractor's expanses or no payment may be made for such materials . Should any dispute or differences arise after the execution of any work as to measurements etc. or other matters which cannot be conveniently tested or checked , the notes of the Employer / Architects shall be a accepted as correct and binding on the contractor .

37. ESCALATION

The rate quoted shall be firm throughout the tenure of the contract (including extension of time, if any, granted) and will not be subject to any fluctuation due to increase in cost of material, labour, sales tax, octroi etc. unless specially provided in these documents.

The price variation clause being adopted by the RBI may be followed, if such a situation arises on a case basis.

38. IDLE LABOUR

Whatever the mesons may be, no claim for idle labour, additional establishment cost of hire and labour charges of tools and plants would be entertained under any circumstances.

39. SUSPENSION

If the Contractor, except on account of any legal restraint upon the employer preventing the continuance of the works, or in the opinion of the employer, shall neglect or fail to proceed with due diligence in the performance of his part of the Contract or if he shall more than once make default, the employer shall have the power to give notice in writing to the Contractor requiring that the works be proceeded within a reasonable manner, and with reasonable dispatch, such notice shall not be unreasonably given and must signify that it purports to be a notice under the provisions of this clause and must specify the acts or defaults on the part of the Contractor upon which it is based.

After such notice shall have been given to the contractor shall not be at liberty to remove the site of works or from any ground continuous thereto any plant and materials to subset from date of such notice being given until the notice shall have been complied with. If the contractor shall fail for 7 (seven) days after such notice has been given to proceed with the works as therein

prescribed, the employer may proceed as provided in clause 40 (Termination of contract by employer).

40. TERMINATION OF CONTRACT BY EMPLOYER

If the contractor being a company going in to liquidation whether voluntary or compulsory or being a firm shall be dissolved or being an individual shall be adjudicated insolvent or shall make an assignment or a composition for the benefit of the greater part, in number of amount of his creditors or shall enter in to a deed or arrangement with his creditors, or if the Official Assignee in insolvency, or the receiver of the contractor in insolvency, shall repudiate the contract or if a Receiver of the contractor's firm appointed by the court shall be unable, within the fourteen days after notice to him requiring him to do so, to show to the reasonable satisfaction of the employer that be is able to carry out and fulfill the contractor and if so required by the contractor to give reasonable security therefore, or if the contractor shall suffer execution to be issued, or shall suffer any payment under this contract to be attached by or on behalf of and of the creditors of the contractor, or shall assign, charge or encumber this contract or any payment due or which may become due to the contractor, there under, or shall neglect or fail to observe and perform an or any of the acts matters of things by this contract to be observed and performed by the contractor within three clear days after the notice shall have been given to the contractor in manner hereinafter mentioned requiring the contractor to observe or perform the same or shall use improper materials or workmanship in carrying on to the works, or shall in the opinion of the employer not exercise such due diligence and make such due progress as would enable the work to be completed within due time agreed upon, and shall fail to proceed to the satisfaction of the of the employer after three clear days notice requiring the contractor so to do shall have been given to the contractor as hereinafter mentioned, or shall abandon the contract then and in any of the said cases, the employer may not with standing previous waiver determine the contract by notice in writing to the effect as hereinafter mentioned, but without thereby effecting the powers of the employer of the obligations and liabilities of the contractor the whole which shall continue in force as fully as if the contract had not been so determined and as if the works subsequently executed had been executed by or on behalf of the contractor (without thereby creating trust in favour of contractor) further the employer or his agent or servants, may enter upon and take possession of the work and all plants, tools, scaffolding, shed , machinery, steam and other power, utensils and material lying upon premises or the adjoining lands or roads of sell the same as MS own property or may employ the same by mesa of his own servants and workman in carrying on and completing the work or by employing any other contractor or other persons or person to complete the work, the contractor shall not in any way interrupt or do any act matter of thing to prevent or hinder such other contractors or other persons or person employed from completing and finishing or using the material or plants for the works when the works shall be completed, or as soon thereafter as conveniently may be the employer shall give notice in writing to the contractor to remove MS surplus material and plants, and should the contractor fail to do so within 14 days after receipt by him the employer may sell the same by public auction and shall give credit to the contractor for the amount to so released. Any expenses or losses incurred by the employer in getting the works carried out by the other contractor shall be adjusted against the amount payable to the contractor by way of selling his tools or plants or due on account of work carried out by the contractor prier to engaging other contractor or against the security deposit.

41. ARBITRATION

In the event of any dispute or difference whatsoever arising between the parties out of or pertaining to any Clause of this Contract including any question relating to meaning and interpretation of this contract or any alleged breach thereof, except those the decisions whereof have been specifically provided in the Contract, the same shall be settled as far as possible by mutual discussions and consultations between the parties.

In case of failure to resolve the difference/dispute in the above manner, the same shall be referred to the sole arbitration of any person appointed by mutual consultation of employer and contractor, who shall be presently unconnected with the organization for which the work is executed.

The Arbitrator shall give a separate award in respect of each dispute or difference referred to him. The Arbitrator shall decide each dispute I accordance with the terms of the contract and give a reasoned award. The venue of the Arbitrator shall be such place as may be fixed by the arbitrator in the sole discretion.

The fees, if any of the arbitrator shall if required to be paid before the award is made and publishing, be paid half by each of the parties. The cost of the reference and of the award

including the fees if any, of the arbitrator who may direct to and by whom and in what manner, such code or any part thereof shall be paid and may fix or settle and amount of costs to be so paid.

The award pf the Arbitrator shall be final and binding on both the parties.

Subject to aforesaid the provision of the arbitration act 1940 or any statutory modification or re-enactment thereof and the rules made there under, and for the time being in force, shall apply to the arbitrator proceeding under this clause.

The employer and the contractor hereby also agree that arbitration under clause shall be a condition precedent to any right and action under the contract with regard to the matters hereby expressly agreed to be so referred to arbitration.

GENERAL SPECIFICATIONS FOR INTERIOR FURNISHING WORK

1. **GENERAL :**

1. These specifications are for work to be done, item to be supplied and materials to be used in the works as shown and defined on the drawings and described herein, to the satisfaction of the banks/architects.
2. The workmanship is to be the best possible and of a high standard. The contractor shall take all steps immediately to make up deficiency if any by the banks / architects. Use must be made of special tradesman in all aspects of the work and allowance must be made in the rates for the same.
3. The materials to be provided by the contractor shall be in accordance with the samples already got approved from the banks/architects by the contractor and in conformity with specifications and approved list called upon to do so by the banks / architects.
4. Samples of all materials are to be submitted to the banks / architects for their approval before the contractor orders of deliver the material to the site. Samples together with their packing are to be provided free of charge by the contractor and should any materials be rejected they will be removed from the site at the contractor's expense. All samples will be required to submit specimen finishes of colors, fabrics etc. for the approval of the banks / architects before proceeding with the work.
5. The contractor shall be responsible for providing and maintaining temporary overages required for the protection of finished work. He is also to clean out all wood shavings, cut ends and other waste from all parts of the works before coverings or infillings are constructed.
6. The contractor shall maintain uniform quality and consistency in workmanship throughout the execution of the work.

2. **Joinery in woodwork**

1. The contract surfaces between internal frame and the cover material shall be glued with approved adhesive in addition to fixing with necessary screws etc.
2. After preparing proper surface of the cover material by sand-papering etc. the laminates or veneers shall be fixed on it with the help of approved adhesive
3. Framework for full height partition shall be rigidly fixed to the floor, walls and ceiling soffit. The partition height shall be measured up to bottom of false ceiling and framing members / ply going above shall not be measured, except hwre specifically mentioned.
4. Any portions that are warped or found with other defects are to be placed. The whole of the work is to be framed and finished in a workman like manner in accordance with the detailed drawings and the direction of banks/architects and
5. whenever required, fitted with all necessary metal ties, straps, screws, adhesives, etc. joinery work generally to be finished with fine sand / glass paper.
6. All joints shall be standard mortise and tenon, dowel, dovetail, or cross halved. Screws, nails etc. will be of standard iron or wire. Tenon should fit the mortises exactly.
7. Nailed or glued butt joined will not be permitted.
8. Where screw heads are on a finished surface, those will be sunk and hole plugged with a wood plug of the same wood and grain to match the color.

3. **TIMBER**

1. All wood for internal framework shall be strictly as specified in the tender document under approved list of material. The wood shall be of natural growth and free from worm holes, loose or dead knots or other defects, sawn square and shall not suffer warping, splitting or other defects.

   All other exposed wood shall be properly seasoned of natural growth and shall be free from worm holes, loose or dead knots or other defects, sawn square and shall not suffer warping, splitting or other defects.
2. The moisture content shall not exceed 12%
3. All Internal framework shall be treated with approved wood preservatives.
4. All wood brought to site shall be clean, it shall not have any preservative or other coating / covering.
5. All rejected, decayed, bad quality wood shall be immediately removed from site, as may be directed.
6. All the dimensions mentioned for T.W. members are finished size.

4. **PLYWOOD**

All plywood shall be strictly as per approved list of material and approved by bank/architect. The plywood shall have ISI mark and relevant registration no. on the product.

5. **Hardware and Metals:**

1. All the screws / bolts with nuts to be used shall have oxidized finish (unless required otherwise). Of approved shape, size and quality.
2. Fittings shall be brass oxidized unless specified otherwise.
3. Samples of all hardware are required to be got approved in advance.
4. The agency should cover up and protect the brass surface by suitable material as necessary and subsequently clean it away at the time of handling over.
5. All hardware shall be fitted with good workmanship without the surrounding edges being damaged.

6. **Laminate :**

1. **All laminates on table tops, shall be as specified in tender of approved shade and make.**
2. The contractor shall get the sample showing the surface texture, pattern and color approved by Banks/Architects.
3. All edges, beadings, etc. shall also be finished in laminate.

7. **Fabrication in Metal**

1. All brazing and welds are to be executed in a clean and smooth manner, rubbed down and finished in flat and tidiest way, particularly where exposed.

8. **Glazier**

1. All glass is to be of approved manufacture, and as per approved quality and sample to be of the qualities specified and free from bubbles, air holes, waviness and other defects.
2. In cutting glass, proper allowance shall be made for expansion.
3. Glass for mirror shall be approved manufacture and quality.
4. On completion, all glasses surfaces shall be cleaned inside and all cracked, scratched glass/mirror shall be replaced.
5. Sun control film shall be non-reflective type pf approved make and shade. The fixing shall be without any defects such as air bubbles/creases/adhesive marks etc.

9. **Paint and polishes**

1. All material required for the work shall be of approved manufacture, delivered to the site in the manufacturer's containers with the seals etc. unbroken and after use empty containers shall be stored till finally cleared by the banks.
2. All iron or steel/metal surfaces shall be thoroughly scraped and rubbed down with wire brushes and shall be entirely free from rust, mill scale etc. Before applying the primary cost.
3. Melamine polish/French polish/polyurethene finishes shall be properly finished without any flaw marks, spots, roughness etc.

10. **Metal frame suspended gyp board ceiling:**

1. Unless otherwise specified the suspended false ceiling shall have following specifications i.e. providing and fixing G.I. perimeter channels of size 0.55 mm size thick having one flange of 20 mm and another flange of 30 mm and a web of 27 mm along with perimeter of ceiling, screw fixed to brick wall/partition with the help of nylon sleeves and screws, at 610 mm centers. Then suspending G.I. intermediate channels of size 45 mm, 0.9 mm, thick with two flanges of 15 mm each from the soffit at 1220 mm centers with ceiling angle of width 25mmx10mmx0.55mm thick fixed to soffit with G.I. cleat and steel fasteners. Ceiling section of 0.55 mm thickness having knurled web of 51.5 mm and two flanges of 26mm each with lips of 10.5mm are then fixed to the intermediate channel at 457mm centers. 12.5mm tapered edge Gyp board (conforming to IS-2095-1982) is then screw fixed to ceiling section with 25mm drywall screws at 230mm centers. Screw fixing is done mechanically either with screw-driver and drilling machine with suitable attachment. Finally the boards are to be joined and finished so as to have a flush lock which includes filling and finishing the tapered and square edges of the boards with joining compound, paper tape and two coats of primer suitable for Gyp board (as per recommended practices of India Gypsum or equivalent)
2. For light fittings, grids diffusers and cutouts etc. have to be made with the frame of perimeter channels of size 20mmx27mmx30mmx0.55mm thick, supported and shall not be considered for extra changes.

12.0 Metal frame suspended aluminium perforated plank's ceiling:

1. Suspended false ceiling, which includes planks in width dimension 254mm and length 1264mm manufactured out of 0.7mm aluminium alloy. The planks should have square edges, short sides of each plank should be raised and piped. Perforated planks shall be with a standard perforation 2.5mm dia, holes at 5.5mm centers giving 16% open area.
2. Planks would be suspended by means of suspension system comprising 0.5mm galvanized steel clip-in-profiles installed at correct spacing to support the planks. Suspension profiles would be suspended from roof structure by G.I. ceiling bracket G.I. suspension angle and aluminium hold on clamp at maximum 1200mm center along clip-in-profiles.
3. Planks to be trimmed along the wall perimeter by means of 25mmx25mmx1.6mm extruded aluminium perimeter angle powder coated.
4. Aluminium planks would be finished with 50 microns epoxy polyester powder paint in approved shade on exposed surface. Aluminium wall trim would also be finished with 50 microns epoxy polyester powder paint in broken white space.
5. The ceiling shall be erected in a continuous sequence. Spans would not exceed those recommended.

MODE OF MEASUREMENTS FOR INTERIOR FURNISHING WORKS :

DOORS, WINDOWS AND GRILLS.

1. Clear area over one face inclusive of frame shall be measured. Hold fasts and portion embedded in masonary or flooring shall not be measured.
2. PARTITIONS IN WOOD WORK

   The partition height shall be measured up to bottom of false ceiling and framing members / ply going above shall not be measured
3. DECORATIVE PANELLING OVERWALL OR OVER PARTITIONS

   The actual area of cladding shall be measured in square meter.
4. CARPETS

   The actual area covered by the carpet shall be measured. No extra shall be allowed for wastage. No deduction shall mad e for columns up to 0.5 sq. meter.
5. PAVING AND TILE WORK

   The work mentioned in this section shall be measured in square meter and shall be priced per unit of square meter. In all paving work, the slabs shall be touching the walls and go well under the plaster, but the measurements shall be the clear measurements of the rooms or areas finished. No allowance shall be made for portions going under the plaster.
6. ALUMINIUM SLIDING WINDOWS

   The measurement of aluminium sliding windows shall be taken only after the frame going with shutter is fixed in its final finished position in line level and plumb. Width and height shall be measured net between the out to out portion of the aluminium window frames.
7. FALSE CEILING

   For false ceiling work, the measurement shall be for the actual area covered. No deductions shall be made for the cutouts, for light fittings, speakers, AC grills and column up to 0.5 sq. meter.
8. WOODWORK

   For conversion of centimeters to meter the resultant figure shall be taken upto two digits after decimal point. Third digit shall not be taken into account.

TECHNICAL SPECIFICATION for ELECTRICAL

1 POINT WIRING :-

1.1. Definition :-

A point (other than socket outlet point) shall include all work necessary in complete wiring to the following outlets from the controlling switch or MCB. The scope of wiring for a point shall, however, include the wiring work necessary in tapping from another point in the same distribution circuit.

i. Ceiling rose or connector (in the case of points for ceiling/exhaust fan points, pre wired light fittings and call bells).

ii. Ceiling rose (in the case of pendants except stiff pendants)

iii. Back plate (in the case of stiff pendants).

iv. Lamp holder (in the case of goose neck type wall brackets, batten holders and fittings which are not pre wired).

1.2. Scope :-

Following shall be deemed to included in point wiring.

i. Conduit/casing and capping as the case may be, accessories for the same and wiring cables between the switch box and the point outlet.

ii. All fixing accessories such as clips, nails, screws, Phil plug, raw plug etc as required.

iii. Metal switch boxes for control switches, regulators, sockets etc, recessed or surface type, and phenolic laminated sheet covers over the same.

iv. Outlet boxes, junction boxes, pull-through boxes etc, but excluding metal boxes if any, provided with switchboards for loose wires/conduit terminations.

v. Any special block required for neatly housing the connector.

vi. Control switch or MCB, as specified.

vii. 3 pin or 6-pin socket, ceiling rose or connector as required.

viii. Connections to ceiling rose, connector, socket outlet, lamp holder, switch etc.

ix. Interconnecting wiring between points on the same circuit, in the same switch box or from another.

x. Protective (loop earthing) conductor from one metallic switch box to another in the distribution circuits, and for socket outlets. (The length of protective conductor run along with the circuits/sub mains is excluded from scope of points)

xi Bushes conduit or porcelain tubing where wiring cables pass through wall etc.

1.3 Material :-

The system of wiring shall consist of ISI marked single core PVC insulated flexible copper conductor wires as per IS: 694 amended up to date.

2. MEASUREMENT :-

i. Contractor shall measure the work jointly with the site engineer and prepare measurement sheets in triplicate. Three copies of measurement sheets shall be submitted along with running account bills. Bills received without proper measurements of work shall not be considered submitted.

ii. Should the contractor neglect to measure the work, then the measurement taken by Engineer/Architect or a person approved by the Bank shall be final and binding to him. Such measurements shall be taken in accordance with the mode of measurements wherever specified or as per actual executed quantities.

iii. All authorized extra works, omissions and all variations made without the Engineer/Architect/Bank's knowledge, or subsequently sanctioned by him in writing (with the prior approval of the contractor in writing) shall be included in such measurement.

iv. All bills for the work shall be submitted in the tender price bid format.

2.1. Point wiring (other than socket outlet points) :-

i. Unless and otherwise specified, there shall be no linear measurement for point wiring for light points, fan points, exhaust fan points and call bell points. These shall be measured on unit basis by counting.

ii. No separate measurement will be made for interconnections between points in the same distribution circuit and for the circuit protective (loop earthing) conductors between metallic switch boxes.

2.2 Point wiring for socket outlet points :-

i. The light plug (5A/6A) point and power (15A/16A) point wiring shall be measured on linear basis, from the respective tapping point of live cable, namely switch box, another socket outlet point, or the sub distribution board as the case may be, up to the socket outlet.

ii. The metal box with cover, switch/MCB socket outlet and other accessories shall be measured and paid as a separate item.

iii. The power point outlet will be 15A/5A or 16A/6A six-pin socket outlet.

2.3 Group control Points wiring :-

i. In the case of points with more than one point controlled by the same switch, such point shall be measured in parts i.e.(a) from the switch to the first point outlet as one point, and (b) for the subsequent points each shall be treated as separate point.

ii. No recovery shall be made for non-provision of more than one switch in such cases.

2.4 Twin control light Point WIRING: -

i. A light point controlled by two numbers of two way switches shall be measured as two points from the fitting to the switches on either side.

ii. No recovery shall be made for non-provision of more than one ceiling rose or connector in such cases.

2.5 Multiple controlled call bell Points wiring :-

i. In the case of call bell points with a single call bell outlet, controlled from more than one place, the point shall be measured in parts i.e. (a) from the call bell outlet to one of the nearest ceiling roses meant for connection to bell push, treated as one point and (b) from that ceiling rose to the next one and so on, shall be treated as separate point(s).

ii. No recovery shall be made for non-provision of more than one ceiling rose or connector for connection to call bell in such cases.

3. CIRCUIT AND SUBMAIN WIRING :-

3.1. Circuit wiring :-

Circuit wiring shall mean the wiring from the distribution board up to the tapping point for the nearest first point of that distribution circuit, viz. up to the nearest first switch box.

3.2. Sub main wiring :-

Sub main wiring shall mean the wiring from one main/distribution switchboard to another and from Distribution Board to Power Outlet / AC Outlet.

4. MEASUREMENT OF CIRCUIT AND SUBMAIN WIRING :-

i. Circuit and sub main wiring shall be measured on linear basis along the run of the wiring. The measurement shall include all length from end to end of conduit or casing and capping as the case may be, exclusive of interconnections inside the switchboard etc. The increase on account of diversion or slackness shall not be included in the measurement.

ii. The length of circuit wiring with two wires shall be measured from the distribution board to the first nearest switch box in the circuit irrespective of whether the neutral conductor is taken to switch box or not.

iii. When wires of different circuits are grouped in a single conduit/casing and capping, the same shall be measured on linear basis depending on the actual number and sizes of wires run.

iv. When circuit wires and wires of point wiring are run in the same conduit/casing and capping, circuit wiring shall be measured on linear basis depending on the actual number and sizes of wires run in the existing conduit/casing capping.

v. Protective (loop earthing) conductors, which are run along the circuit wiring and the sub main wiring, shall be measured on linear basis and paid for separately, if not included in item.

vi. Except as specified above for point wiring, circuit wiring and sub main wiring, other types of wiring shall be measured separately on linear basis along the run of wiring depending on the actual number and sizes of wires run.

5. SYSTEM OF DISTRIBUTION AND WIRINGS :-

i. Main distribution board shall be controlled by the circuit breaker. Each outgoing circuit shall be controlled by a circuit breaker on the phase or live conductor.

ii. The branch distribution board shall be controlled by a circuit breaker. Each outgoing circuit shall be provided with a MCB of specified rating on the phase or live conductor.

iii. The load of the circuits shall be divided, as far as possible, evenly between the number of ways of the distribution boards, leaving at least one spare circuit for future extension.

iv. The neutral conductors (incoming and outgoing) shall be connected to a common link (multi way connector) in the distribution board and be capable of being disconnected individually for testing purposes.

v. Wiring shall be separate for essential loads (i.e those fed through stand by supply) and non-essential loads throughout.

6. BALANCING OF CIRCUITS :-

The balancing of circuits in three wire or poly phase installations shall be arranged up to the satisfaction of the Engineer-in-charge.

7. **WIRING SYSTEM :-**

h. Unless and otherwise specified the wiring shall be done only by the "Looping system". Phase or live conductors shall be looped at the switch boxes and neutral conductors at the point outlets.

ii. Lights, fans and call bells shall be wired in the 'lighting' circuits. 15A/16A socket outlets and other power outlets shall be wired in the 'Power' circuits. 5A/6A socket outlets shall also be wired in the "Lighting" circuit both in residential as well as non-residential buildings.

iii. The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of linked switchgear.

iv. Surface wiring shall run, as far as possible, along the walls and ceiling so as to be easily accessible for inspection.

v. In no case, the open wiring shall be run above the false ceiling without the approval of Engineer-in-charge.

vi. In all types of wiring, due consideration shall be given for neatness, good appearance and safety.

8. **PASSING THROUGH WALLS OR FLOORS :-**

i. When wiring cables are to pass through a wall, these shall be taken through a protection (steel/PVC) pipe or porcelain tube of suitable size such that they pass through in a straight line without twist or cross in them on either end of such holes. The ends of metallic pipe shall be neatly bushed with porcelain, PVC or other approved material.

ii. Where a wall pipe passes outside a building so as to be exposed to weather, the outer end shall be bell mouthed and turned downwards and properly bushed on the open end.

9. JOINTS IN WIRING :-

i. No bare conductor in phase and/or neutral or twisted joints in phase, neutral, and/or protective conductors in wiring shall be permitted.

ii. There shall be no joints in the through-runs of cables. If the length of final circuit or sub main is more than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.

iii. Termination of multi-stranded conductors shall be done using suitable crimping type thimbles.

10. CONFORMITY TO I.E. ACT, I.E. RULES AND STANDARDS :-

i. All electrical works shall be carried out in accordance with the provisions of the Indian Electricity Act, 1910 and Indian Electricity Rules 1956 amended up to date.

ii. The work shall also conform to relevant Indian Standard codes of practice for the type of work involved.

iii. In all electrical installation works, relevant safety codes of practice shall be followed.

Iv. The complete wiring installation shall confirm to IS: 732 amended up to date.

11. GENERAL REQUIREMENTS OF COMPONENTS :-

1. **Quality of Materials :-**

All materials and equipment supplied by the contractor shall be new. They shall be of such design, size and material as to satisfactorily function under the rated conditions of operation and to with stand the environmental conditions at site.

11.2 Rating of Components :-

i. All components in a wiring installation shall be of appropriate ratings of voltage, current and frequency, as required at the respective sections of the electrical installation in which they are used.

ii. All conductors, switches and accessories shall be of such size as to be capable of carrying the maximum current, which will normally flow through them, without their respective ratings being exceeded.

11.3 Conformity of standards :-

All components shall conform to relevant Indian Standard specification, wherever existing. Materials with ISI certification mark shall be preferred. However for conduits, wiring cables, piano/tumbler switches and socket outlets, ISI marked materials shall only be permitted.

11.4 INTERCHANGEABILITY: -

Similar parts of all switches, lamp holders, distribution fuse boards, switch gears, ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be interchangeable in each installation.

SWITCHES & RECEPTACLES (Piano Type)

1. CONTROL SWITCHES FOR POINTS :-

i. The switch box or regulator box shall be made of metal on all sides, except on the front. In the case of cast boxes, the wall thickness shall be at least 3 mm and in case of welded mild steel sheet boxes, the wall thickness shall not be less than 1.2 mm (18 gauge) for boxes up to a size of 20 cm x 30 cm, and above this size 1.6 mm (16 gauge) thick MS boxes shall be used. The metallic boxes shall be duly painted with anticorrosive paint before erection.

ii. Where a large number of control switches and/or fan regulators are required to be installed at one place, these shall be installed in more than one outlet box adjacent to each other for ease of maintenance.

iii. An earth terminal with stud & 2 metal washers shall be provided in each MS box for termination of protective conductors and for connection to socket outlet/metallic body of fan regulator etc.

iv. Clear depth of the box shall not be less than 50 mm, and this shall be increased suitably to accommodate mounting of fan regulators in flush pattern.

v. The fan regulators can also be mounted on the switch box covers, if so directed by the Engineer-in-charge.

vi. Control switches (single pole switches) carrying not more than 16 A shall be of piano type, as specified, and the switch shall be "ON" when the nob is down.

vii. Only MCB' s shall be used for controlling industrial type socket outlets.

viii. Control switch shall be placed only in the live conductor of the circuit. No single pole switch or fuse shall be inserted in the protective (earth) conductor, or earthed neutral conductor of the circuit.

ix. All switches, regulators, outlets & other accessories shall be white colour with matching white cover plate. In no case ivory or off-white switches shall be accepted.

2. **SOCKET OUTLETS: -**

i. Socket outlet shall be of the same type, white piano type as their control switches. These shall be rated either for 5A/6A or 15A/16A. Combined 5A/15A or 6A/16A six pin socket outlet shall be provided in `power' circuits.

ii. In an earthed system of supply, socket outlets and plugs shall only be of 3 pin type, the third pin shall be connected to earth through protective (loop earthing) conductor. 2 pin or 5 pin sockets shall not be permitted to be used.

iii. Every socket outlets shall be controlled by a switch or MCB, as specified. The control switch/MCB shall be connected on the `live' side of the line.

iv. Outlet boxes for socket outlets (both15A/16A and 5A/6A) points shall be of size 175 mm x 100mm.

v. Unless and otherwise specified, the control switches for the 5A/6A and 15A/16A socket outlets shall be kept along with the socket outlets.

3. SWITCH BOX COVERS :-

Phenolic laminated sheets of approved white shade shall be used for switch box covers. These shall be of white 3 mm thick synthetic phenolic resin bonded laminated sheet as base material and conforming to grade P-I of IS:2036-1974, Secured to the box with counter sunk C.P. Brass Screws. The corners of cover plates shall be at right angle.

SWITCHES & BOXES (Modular Type)

i. The switch box or regulator box shall be made of metal on all sides, except on the front. Since Modular type switches are to be used in the project, hence the boxes shall also be used of the same make and model. The size of box shall be governed by the number of switches/outlets/regulators on the respective board. The boxes shall be with zinc plating and yellow passivation to complies with the rust test as per IS 3854. The boxes should have slotted holes for level adjustments. The boxes shall be fitted with riveted brass earth terminals for earth connections.

ii. Clear depth of the box shall not in a range of 50 mm to 65 mm depending upon the size of board and manufacturer.

iii Control switch shall be placed only in the live conductor of the circuit. No single pole switch or fuse shall be inserted in the protective (earth) conductor, or earthed neutral conductor of the circuit. The switches shall be provided with silver contacts. The neutral should make first and breaks last.

iv. Socket outlet shall be rated either for 5A/6A or 15A/16A. 5/6 Amp sockets shall be of 5 pin type with shutters. Combined 5A/15A or 6A/16A six pin shuttered socket outlet shall be provided in `power' circuits. The earth pin shall be connected to earth through protective (loop earthing) conductor. All sockets shall be provided with safety shutters to allow easy entry of two pin plugs without the need to force the earth terminal by unsafe means. All sockets shall confirm to IS: 1293.

v. Every socket outlet shall be controlled by a switch, as specified. The control switch shall be connected on the `live' side of the line.

vi The switches and sockets shall be manufactured using engineering plastic to make it fire retardant and highly resistant to impact.

vii. The fan speed regulators shall be of electronic and stepped type

viii. The RJ-45 data socket shall be suitable for cat5/cat 6 data cables.

ix. Gold plated contacts shall be provided in all communication jacks to enhance data and voice transmission.

SWITCHGEAR AND CONTROLGEAR

1. GENERAL ASPECTS :-

i. All items of switchgear and distribution boards (DB's) shall be metal clad type.

ii. The types, rating and/or categories of switchgear and protective gear shall be as specified in the tender schedule of work.

iii. RCCB's, ELCB's and RCBO's where specified, shall conform to the requirements of current rating, fault rating, single phase or three phase configuration and sensitivity laid down in the tender documents.

iv. While each outgoing way of distribution board (D.B.) shall be of miniature circuit breaker (MCB) as specified, and of suitable rating on the phase conductor, the corresponding earthed neutral conductor shall be connected to a common neutral terminal block and shall be capable of being disconnected individually for testing purpose.

v. **Independent earth terminal block.**

Every distribution board (single phase as well as three phase) shall have an earth terminal block identical to, but independent from neutral terminal block, to enable termination of protective (loop earthing) conductors (incoming as well as out goings) individually by screwed connection and without twisting.

vi. Earthing terminal (1 for single phase and 2 for three phase) shall be provided on the metal cladding of switches and D.B.' s for body earthing. These shall be suitably marked.

vii. Knock out holes, with or without end plates as per standard design of manufacturers, shall be provided in the metal cladding of switches and D.B.' s for termination of conduits/cables.

viii. Each distribution board shall be provided with a circuit list giving details of each circuit, which it controls, and the current rating of the circuit, and the size of the fuse element.

2. MCB TYPE DISTRIBUTION BOARDS (MCB DB) :-

i. MCB DB' s may be of single phase, three phase (horizontal type) suitable for feeding single phase loads or 3 phase (vertical type) suitable for feeding single phase as well as three phase loads, each phase isolation type three phase DB in which each phase can be isolated by a separate circuit breaker or RCCB, as specified. These shall be complete with accessories, but without MCB' s, which shall be specified as a separate item in the tender documents. ii. The current ratings and the number of ways shall be as specified. Blanking plates shall be provided to close unused ways. These shall be indicated as a separate item in the Schedule of work.

iii. MCB DB' s shall be of surface/flush mounting pattern according to the requirement of their location, and shall be suitable to accommodate MCB' s and MCB type isolators and RCCB (ELCB) at incoming in single pole or multi pole configuration, as required.

iv. MCB DB's shall be double door type; dust and vermin proof conforming to IP 42, and shall be fabricated out of CRCA sheet steel, 1.6 mm thick, with stove enameled paint finish.

v. In case of Concealed / Recessed D.B.'s, cutting of brick work, providing suitable lintel, making good the wall including plastering etc. with necessary civil work including all Civil material shall be included in contractor's scope for proper completion of work.

vi. MCB DB' s shall have removal type end plates with knockouts at the bottom and top, and shall have hinged covers with locking arrangement.

vii. Only the knobs of the MCB' s shall protrude out of the front covers through openings neatly machine made for the purpose.

viii. The bus bars used shall be solid electrolytic copper of appropriate sections.

ix. Din bar(s) shall be provided for mounting the MCB' s.

x. The complete board shall be factory fabricated and shall be duly pre-wired in the works, ready for installation at site.

xi. The board shall be fully pre wired with single core PVC insulated copper conductors/insulated solid copper links, and terminated on to extended type terminal connectors, suitable for connections to the sizes of the respective conductors.

xii. All incoming and outgoing wiring to the pre wired MCBDB' s shall be terminated only in the extended terminal connectors to be provided within the DB. The terminal connectors shall therefore be so provided as to facilitate easy cable connections and subsequent maintenance.

3. MCCB TYPE DISTRIBUTION BOARDS (MCCB DB) :-

i. All MCCB DB' s shall be of three phase suitable for feeding single phase loads or 3 phase loads through SP/TP MCB's, IP 42 enclosure, sheet steel, double door with tinned copper bus bar, neutral bar, earth bar, knock outs etc. The DB's shall be original factory fabricated of approved make.

ii. The current ratings of Incomer MCCB shall be upto 250 amp and the number of ways shall be as specified. Blanking plates shall be provided to close unused ways.

iii. MCCB DB shall be of surface/flush mounting pattern according to the requirement of their location, and shall be suitable to accommodate Four pole MCCB at incomer and SP/TP MCB's at outgoings, as required.

iv MCCB DB's shall be dust and vermin proof conforming to IP 42, and shall be fabricated out of CRCA sheet steel, 1.6 mm thick, with stove enameled paint finish.

v. In case of Concealed / Recessed D.B.'s, cutting of brick work, providing suitable lintel, making good the wall including plastering etc. with necessary civil work including all Civil material shall be included in contractor's scope for proper completion of work.

vi. MCCB DB' s shall have removal type end plates with knock-outs at the bottom and top, and shall have hinged covers with locking arrangement.

viii. The bus bars used shall be solid electrolytic copper of appropriate sections.

ix. Din bar(s) shall be provided for mounting the MCB' s.

4. WORKMANSHIP :-

i. Good workmanship is an essential requirement to be complied with. The entire work of manufacture/fabrication, assembly and installation shall conform to sound engineering practice.

ii. The work shall be carried out under the direct supervision of a first class licensed foreman, or of a person holding a certificate of competency issued by the state Government for the type of work involved, employed by the contractor, who shall rectify then and there the defects pointed out by the Engineer-in-charge during the progress of work.

5. COMMISSIONING ON COMPLETION: -

Before the workman leaves the work finally, he must make sure that the installation is in commission, after due testing.

6. COMPLETION PLAN AND COMPLETION CERTIFICATE :-

i. For all works completion certificate after completion of work shall be submitted to the Engineer-in-charge.

ii. Completion plan drawn to a suitable scale in tracing cloth with ink indicating the following, along with three blue print copies of the same shall also be submitted.

a) General layout of the building.

b) Locations of main switch board and distribution boards, indicating the circuit numbers controlled by them.

c) Position of all points and their controls.

d) Types of fittings, viz. fluorescent, pendants, brackets, bulkhead, fans and exhaust fans etc.

e) Name of work, job number, accepted tender reference, actual date of completion, names of Division/Sub-Division and name of the firm who executed the work with their signature.

7. ADDITION TO AN INSTALLATION :-

An addition, temporary or permanent, shall not be made to the authorised load of an existing installation until it has been definitely ascertained that the current carrying capacity and the condition of the existing accessories, conductors, switches etc affected, including those of the supply Authorities, are adequate for the increased load.

CIRCUIT BREAKERS

A. MINIATURE CIRCUIT BREAKERS (MCB) :-

Miniature Circuit Breaker shall comply with IS-8828-1996/ IEC898-1995 amended upto date.

Miniature circuit breakers shall be quick make and break type for 240/415 V AC, 50 Hz application with magnetic thermal release for over current and short circuit protection.

The breaking capacity shall not be less than 10kA at 415V AC.

MCBs shall be DIN mounted.

MCBs shall be current limiting type (class-3).

MCBs shall be C-curve.

MCBs shall have minimum power loss (watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values.

MCBs shall be of self-extinguishing ULV0 grade thermoset plastic material. The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection.

All DP, TP, TPN and 4pole MCBs shall have a common trip bar independent to external operating handle.

Mechanical Life shall be 20000 operations and Service life at rated load for In below 32A shall be 20000 and for In above 32A shall be 10000 operations.

B. Earth Leakage Circuit Breaker / Residual Current Circuit Breaker - Current Operated Type (ELCB / RCCB / RCBO)

- **System of operation**

ELCB/ RCCB/RCBO shall work on the principle of core balance transformer. The incoming shall pass through torroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding; this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a pre-determined critical value. ELCB/RCCB/RCBO shall be current operated independent of line voltage. Current sensitivity shall be of 30mA at 240/415V AC or as specified in BOQ / drawings and shall have a minimum of 10000 electrical operations. The RCBO shall also provide over load and short circuit protection in addition to the earth leakage protection.

- **Mechanical Operation**

The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing/opening of all three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

- **Neutral Advance Feature**

The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact. First before the phases; and at the time of opening, the neutral shall break last after allowing the phases to open first. This is an important safety feature which is also required by regulations.

- **Testing Provision**

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

C. MOULDED CASE CIRCUIT BREAKER (MCCB's)

The rated normal current should be specified at 40°C

1. General

Moulded case circuit breakers shall be incorporated in the switchboard wherever specified. MCCB shall conform to IS:13947 (Part-2): 1993 or IEC-60947-2 in all respects. MCCB shall be suitable either for single phase AC 230 Volts or three phase 415 volts ± 10%. The rated insulation voltage shall be 600 volts. Suitable discrimination shall be provided between upstream and down stream breakers in the range of 10-20 milli seconds. The MCCBs will have earth fault module (if specifically asked) and front operated.

MCCB shall indicate its suitability for isolation and this should appear clearly on the MCCB with the symbol as specified in standard IS: 13947/IEC 60947

2. Construction

The MCCB cover and case shall be made of high strength heat-resistant and flame retardant thermosetting insulating material; operating handle shall be quick make/quick break. The operating handle shall have suitable `ON' `OFF' and `TRIPPED' mechanical indicators notable from outside. Three phase MCCBS shall have a common operating handle for simultaneous operation and tripping of all the three phases.
Suitable arc extinguishing device shall be provided for each contact. **Tripping unit shall be thermal-magnetic type up to 250A and Microprocessor based above 250A (or as specified specifically in Bill of Quantities and drawings)** provided on each pole and connected by a common trip bar such that tripping of any one pole operates all three poles to open simultaneously. Tripping device shall have IDMT characteristics for sustained over load and short circuits.

3. Contact tips shall be made of suitable arc resistant, sintered alloy for long electrical life. Terminals shall be of liberal design with adequate clearances.

4. Accessories

All the accessories shall be mounted from the front and shall be adjustment free. MCCBs shall have the electrical accessories fitted even without removing the circuit breaker from the switchboard so that site changes, if any, can be carried out easily. MCCB shall be provided with the following accessories, if specified in schedule of quantities, such as Under voltage trip, Shunt

trip, Alarm switch, auxiliary switches, Rotary and motorized operating mechanism, Plug in and with draw able mechanism etc.

5. Interlocking

Moulded case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switchboard.

a) Handle interlock to prevent unnecessary manipulations of the breaker.

b) Door interlock to prevent the door being opened when the breaker is in ON position.

c) Defeat-interlocking device to open the door even if the breaker is in ON position.

6. Rupturing capacity

The moulded case circuit breaker shall have a rupturing capacity as mentioned against each in Schedule of Quantity at 415 volts. Wherever required, higher rupturing capacity breakers to meet the system short circuit fault shall be used. In absence of any capacity specifically mentioned in the bill of quantities and drawings, following rupturing capacities shall be used –

100 / 125 Amp : 25 KA

160/200/250 Amp : 35 KA

300/400/630/800 Amp : 50 KA

7. The MCCB shall be **current limiting type** and comprise of quick make – break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. For thermal magnetic protection the O/L adjustment should be 75%-100% and for microprocessor-based release the adjustment should be 40%- 100% and S/c for 2 to 12 times .All MCCBs rated 200 Amps and above shall have adjustable magnetic short circuit pick-up.

8. Electrical Features

All MCCB's & shall be selected on the basis of rated current. Four poles MCCBs shall be always supplied with neutral protection. The MCCBs having 400A & should have category B as per the IEC standards to ensure the selectivity. Minimum Electrical & Mechanical Endurance of MCCB Shall be as follows

Rating of MCCB	Electrical Endurance	Mechanical Endurance
Upto 160 A	7000 Opns	25000 Opns
Above 160 A	4000 Opns	15000 Opns

9. The trip command shall override all other commands. The manufacturer shall provide both the discrimination tables (with test certificates) and let-through energy curves. Line and Load connections shall be interchangeable.

10. Installation

. .It should be possible to terminate Aluminium cable of required size for the defined current carrying capacity. The requisite size should be made available by means of extended terminals (as a standard offer) in case the direct terminals are not of adequate size. Adequate phase to phase clearance has to be ensured in case of extended terminations.

The circuit breaker should provide the flexibility of terminating line and load from any direction. Manufacturers should test the circuit breaker for this condition and requisite test certificate should be available.

Phase barrier should be provided as a standard feature.

11. Testing

a. Original test certificate of the MCCB as per BS 3871 or JS-C-8370 shall be furnished.

b. Pre-commissioning tests on the switchboard panel incorporating the MCCB shall be done as per standard specifications.

D. <u>AIR CIRCUIT BREAKER</u>

1. General

Air circuit breakers shall be incorporated in power control center and motor control centers wherever specified. ACB shall conform to **IEC60947 / IS: 13947** Part-2 1993 in all respects. ACBS shall be suitable for operation on 660 volts, 3 phase, 50/60 Hz, AC supply. The rated insulation voltage shall be equal to or greater than 1000V.The rated impulse withstand voltage

shall be equal to 12kV, so that the device can be used for every installation category, in compliance with the international standards CEI IEC 664-1.

2. Type and construction

Air circuit breakers shall be of enclosed pattern, dead front type with trip free operating mechanism. Air Circuit breakers shall be **withdrawable type with horizontal drawout carriage.** The mechanism shall be mechanical if not specifically mentioned for electrical. The ACBs shall be strong and robust in construction with suitable arrangement for anchoring when in fully engaged or fully drawn out positions. The carriage or cradle on which the breaker is mounted shall be of robust design made of fabricated steel, supported on rollers. Cradle shall also comprise of main and secondary separable contacts and all drawout mechanisms in a completely fig welded assembly short circuit on top. There shall be no dependence upon the panel board frame for any critical alignment. The withdrawal arrangement shall be such as to allow smooth and easy movement.

The drawout operation shall be possible through a closed door. Three positions of the moving part shall be possible :

1 - connected / service position - all auxiliary and main circuits engaged

2 - test position - all auxiliary circuits engaged all main circuits disconnected

3 - isolated position - all circuits disconnected.

All three positions should be indicated discreetly on the cradle. Safety shutter to be provided as standard
All the current carrying parts of the circuit breakers shall be silver-plated. Suitable arcing contacts shall be provided to protect the main contacts. The contacts shall be of spring-loaded design. The sequence of operation of the contacts shall be such that arcing contacts `make' before and `break' after the main contacts. Arcing contacts shall be provided with efficient arc chutes on each pole. The arc chutes shall be suitable for ready replacement. Self-aligning isolating contacts with automatic shutters to screen the live parts shall be provided. The design of the breaker shall be such that all the components are easily accessible to inspection, maintenance and replacement. The ACB at its rated current shall be suitable for operation in extremely tropical humid climate at 50°C ambient temp. The manufacturer shall declare ideal de-rating charts.

There should be total segregation between the power circuit and control circuit, thus making double insulation and ensuring fitting of accessories while the circuit breaker is in the ON position. It shall be possible to inspect the arcing chamber and main contacts. The ACB shall have metal load bearing structures. The main contacts shall be separate from the arc-breaking contacts. It shall be possible to check the wear of the main contacts with the ACB in its racked-out position, removing the arcing chambers. No mechanical junctions in the main contact shall be there so that losses are minimal.

3. Operating Mechanism

Air circuit breaker shall be provided with a **quick-make, trip-free** operating mechanism. The operating mechanism shall be strain-free spring operated. The operating shall be "handle front of the panel" type. The design shall be such that the circuit breaker compartment door need not be opened while moving the breaker from completely connected, through test, in to the disconnected position. The spring shall be charged automatically during the closing operation. Mechanical Indication of the position of the spring charge shall be provided.

4. Interlocking and safety arrangement

Air circuit breakers shall be provided with the following safety and interlocking arrangements:

i. It shall not be possible for breaker to be withdrawn when in `ON" position.

ii. It shall not be possible for the breaker to be switched on until it is either in fully inserted position or for testing purposes it is in fully isolated position.

iii. The breaker shall be capable of being raked in to `testing' isolated and maintenance positions and kept locked in any of these positions.

iv. A safety latch to ensure that the movement of the breaker, as it is withdrawn is checked before it is completely out of the cubicle.

v. If under voltage release is provided then circuit breaker will close only if it is energized. Under voltage release should have time delay to avoid nuisance tripping for transient voltage failure.

vi. The operating mechanism shall provide for raking the breaker in to connect, test and disconnected positions without opening the compartment door.

vii. Mechanical interlocks shall be provided between the operation of different breakers (if specified in Bill of Quantities).

The circuit breaker shall provide as a standard feature, the following mechanical indicator in the front Panel

1 Contact portion indicator (on/off)

2. Stored energy status indicator

3. Trip indicator on fault

5. Rating

The CTs range from 250A to 6300A: all the CTs shall have a structure made of self-extinguishing thermoplastic material. The breaking capacity of the ACB shall be greater than or equivalent to 50kA. The Breaking Capacity of the circuit breaker shall be as indicated in the BOQ with minimum of 50kA for upto 1250A, 65kA for 1600 to 2000A and 80kA for 2500 to 3200A. **Icu=Ics for all ACBs**. Icw rating at 1 sec/3sec should be declared. The minimum Electrical & Mechanical Life of ACB at 415/440V shall be as follows:

Rating of ACB	Electrical Endurance	Mechanical Endurance
Upto 1600 A	10000 Opns	20000Opns
2000-4000 A	5000 Opns	15000 Opns
Above 4000 A	1500 Opns	10000 Opns

6. Accessories

All the accessories like U/V, shunt opening, shunt closing shall be accessible from the front.

Circuit breakers shall be provided with the following Accessories: -

i) Under-voltage relay for the incoming ACB.

ii) Microprocessor based Overload releases with IDMT characteristics.

iii) Microprocessor based Instantaneous earth fault release.

iv) Alarm switches (if specifically asked for)

v) Auxiliary switches

viii. NO and NC auxiliary contacts rated for 10 Amps at 415 V AC and 6 Amp at 48V DC, in addition to ones already in use for the operation of the breaker and will be used in subsequent interlocks to be incorporated in future.

8. <u>Mechanical indicators</u>

Mechanical indication on the front of the air circuit breaker shall be provided to indicate the following :

- main contacts closed "ON"
- main contacts open "OFF"
- springs charged
- springs discharged
- circuit breaker in "service" position (drawout only)
- circuit breaker in "test" position (drawout only)
- circuit breaker in "isolated" position (drawout only)

9. Mounting

Circuit breakers shall be mounted as per the standard specification of power control centers.

10. Testing

Testing of each circuit breaker shall be carried out at the works as per IEC:60947 and the original test certificate shall be furnished in triplicate. The tests shall incorporate atleast the following:

i) Impulse withstand test

ii. Insulation test

iii. Di-electric rigidity /Insulation test

iv. Mechanical operation checking

v. Thermal protection with a current of 3ith starting from cold conditions.

11. Protection

The ACB shall be with an integral self-powered **microprocessor based current release** for Overload, Short-Circuit and Earth Fault protection which works on true rms values for ensuring accurate protection, if specifically asked for. The protection unit should meet the EMI/EMC requirement as per latest standard. Online Test Fault shall be provided to test healthiness of release and ACB.

12. Setting range of protection release

a) Overload protection shall have adjustable setting from 40% to 100% of the ACBs rated current in steps of 10% and adjustable time setting from 3-18m sec.

b) Short circuit protection shall have adjustable current setting from 100% to 1000% of the overload setting and adjustable time delay setting for fault discrimination from 50-500 m sec.

c) E/F protection if specified will have adjustable current setting from 40% to 100% of ACB rated current and adjustable time setting from 100-800m sec. It shall be possible to charge the release setting on load.

METALLIC CONDUIT WIRING SYSTEM

1. SCOPE :-

This chapter covers the detailed requirements for wiring work in metallic conduits. This chapter covers both surface and recessed types of works.

2. APPLICATION :-

i. Recessed conduit is suitable generally for all applications. Surface conduit work may be adopted in places like workshops, plant rooms, pump rooms, wiring above false ceiling/below false flooring, and at locations where recessed work may not be possible to be done. The type of work, viz. surface or recessed, shall be as specified in the respective works.

ii. Flexible conduits may only be permitted for interconnections between switch gear, DB' s and conduit terminations in wall.

3. MATERIALS :-

3.1 Conduits :-

i. All rigid conduit pipes shall be of steel and be ISI marked. The wall thickness shall be not less than 1.6 mm (16 SWG) for conduit up to 32 mm dia. and not less than 2 mm (14 SWG) for conduits above 32 mm. These shall be solid drawn or reamed by welding, and finished with galvanized or stove enameled surface.

ii. The maximum number of PVC insulated cables conforming to IS : 694-1990 that can be drawn in one conduit is given size wise in **table 1**, and the number of cables per conduit shall not be exceeded. Conduit sizes shall be selected accordingly in each run.

iii. No steel conduit less than 20 mm in diameter shall be used.

3.2 Conduit accessories :-

i. The conduit wiring system shall be complete in all respects, including their accessories.

ii. All conduit accessories shall be of threaded type, and under no circumstances pin grip type or clamp grip type accessories shall be used.

iii. Bends, couplers etc. shall be solid type in recessed type of works and may be solid or inspection type as required, in surface type of works.

iv. a) Saddles for surface conduit work on wall shall not be less than 0.55 mm (24 gauge) for conduits up to 25 mm dia. and not less than 0.9 mm (20 gauge) for larger diameter. The corresponding widths shall be 19mm & 25mm.
b) The minimum width and the thickness of girder clips used for fixing conduits to steel joists, and clamps shall be as per **table 2.**

TABLE - 1
Maximum number of PVC insulated 650/ 1100 Volt grade copper conductor cable

that can be drawn into rigid steel conduit.

Nominal cross sectional area of conductor in Sq. mm.	20 mm	25 mm	32 mm	40 mm
1.50	5	10	14	-
2.50	5	8	12	-
4.00	3	8	10	-
6.00	2	5	8	-
10.00	-	3	5	6
16.00	-	-	3	6
25.00	-	-	2	4

Note :-

The above table shows the maximum capacity of conduits for a simultaneous drawing of cables.

TABLE – 2

Girder clips or clamps

S.No.	Size of conduit	Width	Thickness
i.	20 mm	19 mm	0.9 mm (20 SWG)
ii.	25 mm	19 mm	0.9 mm (20 SWG)
iii.	32 mm & above	25 mm	1.2 mm (18 SWG)

4. INSTALLATION :-

4.1 Common aspects for recessed and surface conduit works :-

i. Conduit joints :-

a. The conduit works of each circuit or section shall be completed before the cables are drawn in.

b. Conduit pipes shall be jointed by means of screwed couplers and screwed accessories only. Threads on conduit pipes in all cases shall be between 13 mm to 19 mm long, sufficient to accommodate pipes to full threaded portion of couplers or accessories.

c. Cut ends of conduit pipes shall have no sharp edges, nor any burrs left to avoid damage to the insulation of the conductors while pulling them through such pipes.

d) The Engineer-in-charge, with a view to ensuring that the above provision has been carried out, may require that the separate lengths of conduit etc., after they have been prepared, shall be submitted for inspection before being fixed.

e) No bare threaded portion of conduit pipe shall be allowed, unless such bare threaded portion is treated with anticorrosive preservative or covered with approved plastic compound.

ii. Bends in conduits :-

a. All necessary bends in the system, shall be done either by neatly bending the pipes without cracking with a bending radius of not less than 7.5 cm, or alternatively, by inserting suitable solid or inspection type normal bends, elbows or similar fittings, or by fixing cast iron inspection boxes, whichever is most suitable.

b) Conduit fittings shall be avoided as far as possible on conduit system exposed to weather. Where necessary, solid type fittings shall be used.

iii. Outlets :-

a) All outlets such as switches, wall sockets etc. may be either flush mounting type, or of surface mounting type, as specified and as required on site.

b) All switches and accessories shall be fixed in flush pattern.

iv. Painting after erection :-

After installation, all accessible surface of conduit pipes, fittings, switch and regulator boxes etc shall be painted.

5. ADDITIONAL REQUIREMENTS FOR SURFACE CONDUIT WORKS :-

i. Painting before erection :-

The outer surface of conduit including all bends, unions, tees, junction boxes, etc. forming part of the conduit system , shall be adequately protected against rust when such system is exposed to weather by being painted with 2 coats of red oxide paint applied before they are fixed.

ii. Fixing conduit on surface :-

a) Conduit pipes shall be fixed by saddles, screwed to suitable approved plugs with screws in an approved manner at an interval of not more than one meter, on either side of the couplers or bends or similar fittings.

b) Where conduit pipes are to be laid along the trusses, steel joists etc. the same shall be secured by means of saddles or girder clips or clamps as required by the Engineer-in-charge.

c) In long distance straight run of conduit, inspection type couplers at reasonable intervals shall be provided, or running threads with couplers and jam nuts shall be provided.

iii. Fixing outlet boxes :-

Only a portion of the switch box may be sunk in the wall, the other portion being projected out for suitable entry of conduit pipes into the box.

6. ADDITIONAL REQUIREMENTS FOR RECESSED CONDUIT WORK :-

i. Making chase :-

a) chase in the wall shall be neatly made, and of ample dimensions to permit the conduit to be fixed in the manner desired.

b) In the case of buildings under construction, the conduits shall be buried in the wall before plastering, and shall be finished neatly after erection of conduit.

c) In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

ii. Fixing conduit in chase :-

a. The conduit pipe shall be fixed by means of staples, J-hooks, or by means of saddles, not more than 40 cm apart or by any other approved means of fixing.

b) All threaded joints of conduit pipes shall be treated with some approved preservative compound to secure protection against rust.

iii. Fixing conduit in R.C.C. work :-

a) The conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel

reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.

b) Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing of conductors.

c) Location of inspection/junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

iv. Fixing inspection boxes :-

a. Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.

b. These shall be mounted flush with the wall or ceiling concrete. Minimum 65 mm depth junction boxes shall be used in roof slabs.

c. Suitable ventilating holes shall be provided in the inspection box covers.

v. Fixing switch boxes and accessories :-

Switch boxes shall be mounted flush with the wall. All outlets such as switches, socket outlets etc. shall be flush mounting type, unless otherwise specified in the Additional Specification.

vi. Fish wire :-

To facilitate subsequent drawing of wires in the conduit, GI fish wire of 1.2 mm (18 SWG) shall be provided along with the laying of the recessed conduit.

7. BUNCHING OF CABLES :-

a) Cable carrying alternating current, installed in metal conduit, shall always be bunched so that the outgoing and return cables are drawn into the same conduit.

b) Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.

c) I n case of three phase loads, separate conduits shall be run from the distribution boards to the load points, or outlets as the case may be.

8. EARTHING REQUIREMENTS :

i. The entire system of metallic conduit work, including the outlet boxes and other metallic accessories, shall be mechanically and electrically continuous by proper screwed joints, or by double chuck nuts at terminations. The conduit shall be continuous when passing through walls or floors.

ii. Protective (loop earthing) conductor(s) shall be laid along the runs of the conduit between the metallic switch boxes and the distribution boards/switch boards, terminated thereto. These conductors shall be of such size and material, the protective earth conductors shall be either drawn inside the conduits along with the cables, or shall be laid external to the conduits. When laid external to the conduits, this shall be properly clamped with the conduit at regular intervals.

v. The protective conductors shall be terminated properly using earth studs, earth terminal block etc. as the case may be.

iv. Gas or water pipe shall not be used as protective conductor (earth medium).

PVC CONDUIT WIRING SYSTEM

1. SCOPE :-

This chapter covers the detailed requirements for wiring work in non-metallic conduits. This chapter covers both surface and recessed types of wiring work.

2. APPLICATION :-

1. Recessed conduit work is generally suitable for all applications. Surface conduit work may be adopted in places like workshops etc. and where recessed work may not be possible to be done. The type of work shall be as specified in individual works.

2. Flexible non-metallic conduits shall be used only at terminations, wherever specified.

3. Special precautions :-

i. If the pipes are liable to mechanical damages, they should be adequately protected.

ii. Non-metallic conduit shall not be used for the following applications :-

a) In concealed/ inaccessible places of combustible construction where ambient temperature exceeds 60°C.

b) In places where ambient temperature is less than 5°C.

c) For suspension of fluorescent fittings and other fixtures.

d) In areas exposed to sunlight.

3. MATERIAL :-

3.1 Conduits :-

i. All non-metallic conduit pipes and accessories shall be of suitable material complying with IS : 2509-1973 and IS : 3419-1988. for rigid conduits and IS : 9537(V)-2000 for flexible conduits. The interior of the conduits shall be free from obstructions. The rigid conduit pipes shall be ISI marked.

ii. The conduit shall be circular in cross-section. The conduit shall be designated by their nominal outside diameter. The dimensional details of rigid non-metallic conduits are given in **Table-3.**

iii. No non-metallic conduit less than 20 mm in diameter shall be used.

iv. **Wiring capacity :-**

The maximum number of PVC insulated aluminium/copper conductor cables of 650/1100 V grade conforming to IS : 694-1990 that can be drawn in one conduit of various sizes is given in **table-4**. Conduit sizes shall be selected accordingly.

3.2 Conduit accessories :-

i. The conduit wiring system shall be complete in all respect including accessories.

ii. Rigid conduit accessories shall be normally of grip type.

iii. Flexible conduit accessories shall be of threaded type.

iv. Bends, couplers etc. shall be solid type in recessed type of works, and may be solid or inspection type as required, in surface type of works.

v. Saddles for fixing conduits shall be heavy gauge non-metallic type with base.

vi. The minimum width and the thickness of the ordinary clips or girder clips shall be as per **Table-5.**

vii. For all sizes of conduit, the size of clamping rod shall be 4.5mm (7 SWG) diameter.

4. INSTALLATION :-

1. Common aspects for both recessed and surface conduit works.

i. The erection of conduits of each circuit shall be completed before the cables are drawn in.

ii. **Conduit joints :-**

a. All joints shall be sealed/cemented with an approved cement. Damaged conduit pipes / fittings shall not be used in the work. 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.

b. The Engineer-in-charge, with a view to ensuring that the above provision has been Carried out, may require that the separate lengths of conduit etc. after they have been prepared, shall be submitted for inspection before being fixed.

iii. **Bends in conduits :-**

a. All bends in the system may be formed either by bending the pipes by an approved method of heating, or by inserting suitable accessories such as bends, elbows or similar fittings, or by fixing non-metallic inspection boxes, whichever is most suitable. Where necessary, solid type fittings shall be used.

b. Radius of bends in conduit pipes shall not be less than 7.5 cm.

c. Care shall be taken while bending the pipes to ensure that the conduit pipe is not injured, and that the internal diameter is not effectively reduced.

iv. **Painting :-**

After installation, all accessible surface of metallic accessories shall be painted.

5. ADDITIONAL REQUIREMENTS FOR SURFACE CONDUIT WORK :-

i. Conduit pipe shall be fixed by heavy gauge non-metallic saddles with base, secured to suitable approved plugs with screws in an approved manner, at an interval of not more than 60 cm, on either side of couplers or bends or similar fittings, saddles shall be fixed at a closer distance from the center of such fittings. Slotted PVC saddles may also be used where the PVC pipe can be pushed in through the slots.

ii. Where the conduit pipes are to be laid along the trusses, steel joists etc. the same shall be secured by means of saddles or girder clips as required by the Engineer-in-charge. Where it is not possible to use these for fixing, suitable clamps with bolts and nuts shall be used.

6. ADDITIONAL REQUIREMENTS FOR RECESSED CONDUIT WORK :-

i. **Making chase :-**

a. chase in the wall shall be neatly made, and of ample dimensions to permit the conduit to be fixed in the manner desired.

b. In the case of buildings under construction, the conduits shall be buried in the wall Before plastering, and shall be finished neatly after erection of conduit.

c. In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

ii. **Fixing conduits in chase :-**

a. The conduit pipe shall be fixed by means of staples, or by means of non-metallic saddles, placed at not more than 40 cm apart, or shall be fixed by any other approved means of fixing.

b. At either side of the bends, saddles/staples shall be fixed at a distance of 15 cm from the center of the bends.

iii. **Erection in RCC work :-**

a. The conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.

b. Fixing of standard bends or elbows shall be avoided as far as practicable, and all Curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing of conductors.

c. Location of inspection/junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

iv. **Fixing inspection boxes :-**

a. Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.

b. These shall be mounted flush with the wall or ceiling concrete. Minimum 65 mm Depth junction boxes shall be used in roof slabs.

c. Suitable ventilating holes shall be provided in the inspection box covers.

v. **Fixing switch boxes and accessories :-**

Switch boxes shall be mounted flush with the wall. All *outlets such as switches, socket outlets etc. shall be flush mounting type, unless otherwise specified in the additional specification.

vi. **Fish wire :-**

To facilitate subsequent drawing of wires in the conduit, GI fish wire of 1.2 mm (18 SWG) shall be provided along with the laying of the recessed conduit.

7. **BUNCHING OF CABLES :-**

a) Cable carrying alternating current, installed in metal conduit, shall always be bunched so that the outgoing and return cables are drawn into the same conduit.

b) Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.

c) In case of three phase loads, separate conduits shall be run from the distribution boards to the load points, or outlets as the case may be.

8. EARTHING REQUIREMENTS :-

i. A protective (earth) conductor shall be drawn inside the conduit in all distribution circuits to provide for earthing of non-current carrying metallic parts of the installation. These shall be terminated on the earth terminal in the switch boxes, and/or earth terminal blocks at the DB's.

ii Protective conductors of large size which may not be possible to be carried inside the conduits (as in the case of some sub mains etc.) may be laid external to the conduits and clamped thereto suitably.

iii. Gas or water pipes shall not be used as protective conductors (Earth medium).

TABLE - 3.

Dimensional details of rigid non-metallic conduits.

(All dimensions in mm)

S.No.	Nominal outside diameter (In mm)	Maximum outside diameter (In mm)	Minimum inside diameter (In mm)	Maximum permissible eccentricity (In mm)	Maximum permissible ovality (In mm)
1.	20	$20^{+0.3}$	17.2	0.2	0.5
2.	25	$25^{+0.3}$	21.6	0.2	0.5
3.	32	$32^{+0.3}$	28.2	0.2	0.5
4.	40	$40^{+0.3}$	35.8	0.2	0.5
5.	50	$50^{+0.3}$	45.0	0.4	0.6

TABLE - 4

Maximum number of PVC insulated 650/ 1100 Volt grade copper conductor cable that can be drawn into rigid pvc conduit.

Nominal cross sectional area of conductor in Sqmm.	20 mm	25 mm	32 mm	40 mm
1.50	5	10	14	-
2.50	5	8	12	-
4.00	3	8	10	-
6.00	2	5	8	-
10.00	-	3	5	6
16.00	-	-	3	6
25.00	-	-	2	4

Note :-

The above table shows the maximum capacity of conduits for a simultaneous drawing of cables.

TABLE - 5.

Ordinary clips or girder clips.

S.No.	Size of conduit	Width	Thickness
1.	20 mm & 25 mm	19 mm	20 SWG (0.9144 mm)
2.	32 mm & above	25 mm	18 SWG (1.219 mm)

EARTHING

1. SCOPE :-

This chapter covers the essential requirements of earthing system components and their installation. For details not covered in these specifications. IS code of Practice on Earthing (IS:3043-1987) shall be referred to.

2. INSTALLATION :-

1. ELECTRODES :-

i. Plate electrode shall be buried in ground with its faces vertical, and its top not less than 3 m below the ground level. The installation shall be carried out as per standard drawing.

ii. When more than one electrode is to be installed, a separation of not less than 2 m shall be maintained between two adjacent electrodes.

iii. a) The strip or conductor electrode shall be buried in trench not less than 0.5 m deep.

b) If condition necessitate the use of more than one strip or conductor electrode, they shall be laid as widely distributed as possible, in a single straight trench where feasible, or preferably in a number of trenches radiating from one point.

iv. Earth Electrodes shall be kept clear of the building foundation & in no case shall it be nearer than 2 meters from the outer surface of the wall.

3. WATERING ARRANGEMENT :-

i. In the case of plate earth electrodes, a watering pipe 20mm dia. medium class pipe shall be provided and attached to the electrodes. A funnel with mesh shall be provided on the top of this pipe for watering the earth.

ii. The \watering funnel attachment shall be housed in a masonry enclosure of size not less than 30cm*30cm*30cm.

iii. A cost iron/MS frame with MS cover, 6 mm thick, and having locking arrangement shall be suitably embedded in the masonry enclosure.

4. EARTHING CONDUCTOR (Main earthing lead) :-

i. The earthing conductor shall be securely terminated on to the plate with two bolts, nuts, check nuts and washers.

ii. A double C-clamp arrangement shall be provided for terminating tape type earthing conductor with GI watering pipe coupled to the pipe earth electrode. Galvanised "C" shaped strips, bolts, washers, nuts and check nuts of adequate size shall be used for the purpose.

iii. The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a medium class 15 mm dia GI pipe in the case of wire, and by 40 mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30 cm deep (to be increased 60 cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth in due co-ordination with the building work.

iv. The earthing conductor shall be securely connected at the other end to the earth stud/earth bar provided on the switchboard by:

a. Soldered or preferably crimped lug, bolt, nut and washer in the case of wire, and,

b. Bolt, nut and washer in case of strip conductor.

c. Earthing Terminal / neutral point / earth bus in case of equipments / sub stations.

5. **PROTECTIVE (Loop earthing/earth continuity) CONDUCTOR :-**

i. Earth terminal of every switchboard in the distribution system shall be bonded to the earth bar/terminal of the upstream switchboard by protective conductor(s).

ii. Two protective conductors shall be provided for a switchboard carrying a 3 phase switch gear thereon.

iii. All the mountings of industrial type switchboards shall be bonded to the earth stud/earth bar using a protective conductor looping from one to another. Loop earthing of individual units will not be however necessary in the case of cubical type switchboards.

iv. The earth connector in every distribution board (DB) shall be securely connected to the earth stud/earth bar of the corresponding switchboard by a protective conductor.

v. All metallic switch boxes and regulator boxes in a circuit shall be connected to the earth connector in the DB by protective conductor (also called circuit protective or loop earthing conductor), looping from one box to another up to the DB.

vi. The earth pin of socket outlets as well as metallic body of fan regulators shall be connected to the earth stud in switch boxes by protective conductor. Where the switch boxes are non-metallic type, these shall be looped at the socket earth terminals, switch or at an independent screwed connector inside the switch box. Twisted earth connections shall not be accepted in any case.

vii. Double earthing strips in rising mains, bus trunking etc. shall be securely connected to the earth bar/earth stud at the sending end switchboard. In the case of overhead bus bar systems, protective conductors shall be provided in addition to feeder cable armouring connection.

6. EARTH RESISTANCE :-

i. The earth resistance at each electrode shall be measured. No earth electrode shall have a greater ohmic resistance than 5 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be up to 8 ohms.

ii. Where the above stated earth resistance is not achieved, necessary improvement shall be made by additional provisions, such as additional electrode(s), different type of electrode, or artificial chemical treatment of soil etc., as may be directed by the Engineer-in-charge.

iii. If the earth resistance is too high and the multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding sodium chloride, calcium chloride, sodium carbonate, copper sulphate, salt and soft coke or charcoal in suitable proportions.

7. MARKING: -

i. Earth bars/terminals at all switchboards shall be marked permanently either as "E".

ii. Main earthing terminal shall be marked "SAFETY EARTH - DO NOT DISCONNECT".

LIGHTNING PROTECTION SYSTEM

1. GENRAL :-

i. The entire lightning protective system should be mechanically strong to withstand the mechanical forces produced in the event of a lightning strike.

ii. Conductors shall be securely attached to the building, or other object to be protected by fasteners, which shall be substantial in construction, not subject to breakage, and shall be of galvanized steel or other suitable materials, which suitable precautions to avoid corrosion.

iii. The lightning conductors shall be secured not more than 1.2 m apart for horizontal run, and 1.0 m for vertical run.

2. AIR TERMINATION :-

All air terminals shall be effectively secured against overturning either by attachment to the object to be protected, or by means of substantial bracing and fixings which shall be permanently

and rigidly attached to the building. The method and nature of the fixings should be simple, solid and permanent, due attention being given to the climatic conditions and possible corrosion.

3. DOWN CONDUCTORS :-

i. The down conductor system must, where practicable, be directly routed from the air termination to the earth termination network, and as far as possible, be symmetrically placed around the outside walls of the structure starting from the corners.

ii. a) Practical reasons may not be some times allow the most direct route to be followed. While sharp bends, such as arise at the end of a roof are in-escapable (and hence permissible), re-entrant loops in a conductor can produce high inductive voltage drops so that the lightning discharge may jump across the open side of a loop. As a rough guide, this risk may arise when the length of the conductor forming the loop exceeds 8 times the width of the open side of the loop.

b) When large re-entrant loops as defined above can not be avoided, such as in the case of some cornices or parapets, the conductors should be arranged in such a way that the distance across the open side of a loop complies with the requirement indicated above. Alternatively, such cornices or parapets should be provided with holes through which the conductor can pass freely.

iii. **Bonding to prevent side flushing :-**

Any metal in, or forming a part of the structure, or any building services having metallic parts which are in contact with the general mass of the earth, should be either isolated from, or bonded to the down conductor. This also applies to all exposed large metal items having any dimension greater than 2 m whether connected to the earth or not.

4. JOINTS AND BONDS :-

4.1 Joints :-

i. A lightning protective system should have as few joints as possible.

II. Joints should be mechanically and electrically effective, for example, clamped, screwed, bolted, crimped, riveted or welded.

iii. With overlapping joints, the length of the overlap should not be less than 20 mm for all types of conductors.

iv. Contact surfaces should first be cleaned, then inhibited from oxidation with a suitable non-corrosive compound.

v. Joints of dissimilar metals should be protected against corrosion or erosion from the elements, or the environment, and should present an adequate contact area.

4.2 Bonds :-

i. Bonds have to join a variety of metallic parts of different shapes and composition, and cannot therefore be of a standard form.

ii. There is the constant problem of corrosion and careful attention must be given to the metal involved, i.e. the metal from which the bond is made, and those of the items being bonded.

iii. The bond must be mechanically and electrically effective, and protected from corrosion in, and erosion by the operating environmental.

iv. External metal on, or forming part of a structure, may have to discharge the full lightning current, and its bond to the lightning protective system should have a cross sectional area not less than that employed for the main conductors.

v. Structures supporting overhead electric supply, telephone and other lines must not be bonded to a lightning protective system without the permission of the appropriate authority.

vi. Gas pipe in no case shall be bonded to the lightning protective earth termination system.

5. TEST JOINTS :-

Each down conductor should be provided with a test joint in such a position that, while not inviting unauthorized interference, it is convenient for use when testing.

6. EARTH TERMINATION NETWORK :-

i. An earth station comprising one or more earth electrodes as required, should be connected to each down conductor. This shall be specified.

ii. Each of the earth station should have a resistance not exceeding the product given by 10 ohms multiplied by the number of earth electrodes to be provided their in. The whole of the lightning protective system, including any ring earth, should have a combined resistance to earth not exceeding 10 ohms without taking account of any bonding.

iii. If the value obtained for whole of the lightning protection system exceeds 10 ohms, a reduction can be achieved by extending or adding to the electrodes, or by interconnecting the individual earth terminations of the down conductors installed below ground, some time referred to as a ring conductor. Buried ring conductors laid in this manner are considered to be an integral part of the earth termination network, and should be taken into account when assessing the overall value of resistance to earth of the installation.

iv. A reduction of the resistance to the earth to a value below 10 ohms has the advantage of further reducing the potential gradient around the earth electrode when discharging lightning current. It also further reduces the risk of side flashing to metal in, or of structure.

v. Earth electrodes should be capable of being isolated and a reference earth point should be provided for testing purposes.

CABLES

1. GENERAL

All cables shall be supplied, inspected, laid tested and commissioned in accordance with drawings, specifications, relevant Indian standards specifications and cable manufacturer's instructions. The cable shall be delivered at site in original drums with manufacturer's name clearly written on the drum.

The recommendations of the cable manufacturer with regard to jointing and sealing shall be strictly followed.

The laying of cable shall be done as per IS 1255 amended up to date.

Cable Identification

i. Cable identification shall be provided by embossing on the outer sheath the following:

ii. Manufacturer's name or trade mark

iii. Voltage grade

iv. Year of manufacture

v. Type of insulation

vi. Printing of cable length on each meter

Core Identification

Respective cores of power/control cables shall be identified with the following pattern :

2 core : red (R), black (BK)

3 core : 5 core red (R), yellow (Y),blue (BL)

4 core : red (R),yellow (Y),blue (BL), black (BK)

5 core : red (R), yellow (Y),blue (BL), black (BK) & grey (GY)

7&14 cores : cores shall be numbered.

Tests

i. Shop Tests

The cables shall be subject to shop tests in accordance with relevant standards to prove the design and general qualities of the cables as below:

ii. Routine tests on each drum of cables.

iii. Acceptance tests on drums chosen at random for acceptance of the lot.

iv. Type tests on each type of cable, inclusive of measurement of armour D.C. resistance of power cables.

2. MATERIAL

11 kV HT Cables

The 11 KV cable shall be cross linked polyethylene insulated, GI strip armoured, PVC inner and outer sheath (to be extruded type) earthed grade cable. The outer sheath shall be resistant to water, fungus, termite & rodent attacks. Colour of outer sheath shall be black. The cable shall be confirming to IS : 7098 (Part – II) with aluminium conductor as per I.S. 8130.

L T Power Cables

The 1.1 KV cables shall be XLPE insulated PVC sheathed aluminium conductor armoured conforming to IS : 7098 (part - 1) amended up to date or PVC insulated, extruded PVC inner sheath, steel strip armored and extruded PVC overall sheath conforming to 15:1554 (PI).as mentioned in the Bill of Quantities and drawings, laid in trenches, ducts and underground as shown on drawing or as per instruction given by engineer-in-charge.

Control Cables

Control cables shall be of stranded annealed copper conductors with cross section area of 1.5/ 2.5 sq.mm, PVC insulated, colour coded or with core identification, extruded inner sheathed, steel wire armoured and over all PVC extruded outer sheath etc. The cable shall conform to 15: 1554 (P-I).

Cable Termination

a) HT Cable Terminations

Cable termination shall be heat shrinkable type/cold shrink type suitable for sizes as specified in BOQ, XLPE insulated 11 kV (E) grade, and aluminum conductor armoured cables. Termination shall confirm to IS 3573 with latest amendment.

b) L T power, control cable termination

i. L T cable termination shall be provided with compression cable glands of brass suitable for holding the armour of the cable.
ii. Lugs shall be crimping type and shall be of copper suitable for copper conductor cable and of aluminum for aluminum conductor cable.
iii. Termination shall be carried out as per details furnished in this specification.

Compression Glands

Cable glands shall be made of brass casting, machined accurately to the required size with protective coating of nickel.

Cable glands shall be of heavy duty type and shall consist of: gland nipple, neoprene seal for inner sheath, armour clamping cone, gland body, neoprene seal for outer sheath, skid washer, gland body nut.

The Aluminium conductor shall be stranded, grade H4 class 2 as per IS 8130 and copper conductor shall be annealed copper class 2 as per IS 8130.
Technical data sheets for above cables, including all electrical & mechanical parameters shall be furnished with offer.

11 KV TWO POLE STRUCTURE SYSTEM

a. Two pole structure is intended to receive 11 kV 3 Ph. 50 Hz power supply through 11 kV XLPE cable from overhead line of State Electricity Board.
b. Two pole structure shall be fabricated from steel member and shall comprise of 11 kV Lightning Arrestors, Isolator, Drop out fuses (DO), Supporting channel, ACSR, Disk & pin insulators for cable suppor, Conductor, Outdoor end termination disc and pin insulators for XLPE 11 kV cable, 150 dia. GI pipe for cable protection, nut, bolts etc.

c. All structural work shall conform to relevant Indian Standards, specifications & codes etc.

d. Necessary guy wires shall be provided for supporting the structure (wherever required).

e. The structure shall be painted with two coats of red oxide.

f. Lightning arrestors shall be in single pole assembly heavy duty, station type suitable for outdoor installation & suitable to mount on steel structure.

g. Lightning arrestors shall be adequately rated to discharge the energy of voltage surges and shall be provided complete with mounting brackets as well as line and earth connections.

h. Lightning Arrestors shall be suitable for termination to ACSR conductor.

i. Isolator shall ,be suitable to mount vertically on two pole structure

j. Isolator shall have operating handle with locking arrangement

k. Isolator shall have operating handle with necessary arrangement to operate the isolator from ground

l. Isolator shall also be suitable for ACSR conductor termination

m. Drop out fuses shall be provided of suitable rating.

11 KV HT SWITCHGEAR

1. Design Criteria

a. 11 KV HT Panel shall be used to receive the power from SEB and to feed supply to the plant through the step down transformer.

b. Switchgear shall be located in a clean but hot, humid and tropical atmosphere.

c. For continuous operation at specified ratings. temperature rise of the various switchgears components shall be limited to the permissible values stipulated in the relevant standards.

d. The switch gears and components thereof shall be capable of withstanding the mechanical forces and thermal stresses of the short circuit current listed in the annexure without any damage or deterioration material.

e. Circuit breakers, instrument transformers, bus-bars cable compartment etc. shall be housed in separate compartment within the cubicle. The design shall be such that failure of one equipment shall not affect the adjacent units.

f. Circuit breakers of identical rating shall be physically and electrically interchangeable.

2. Specific Requirements

a) Construction Features

i. The Switchgear shall be indoor, metal-clad, floor mounted, drawout type.

ii. The Switchgear shall be such as to allow extension at either end.

iii. The Switchgear enclosure shall conform to the degree of protection IP4X.

iv. The minimum thickness of sheet steel used shall be 2 mm.

v. The switchgear shall be dead-front, free standing type vertical cubicle.

vi. Switchgear shall have a front hinged door with latches and a removable back cover.

vii. All covers and doors shall be provided with neoprene gaskets.

viii. All relays, meters, switches and lamps shall be flush mounted on the respective cubicle door or on control cabinet built on the front of the cubicle.

ix. The complete structure shall be free, rigid, self supporting, free from twist and bends etc.

b) Bus and Bus Taps

i. The main buses and connections shall be of high conductivity aluminium / aluminium alloy, sized for specified current ratings with maximum temperature limited to 85 degree C (i.e. 35 degree Crise over 50 degree C ambient)

ii. Busbars and connection shall be fully insulated for working voltage with adequate phase! ground clearances. Insulating sleeves for busbars and cast-resin shrouds for joints shall be provided.

iii. All buses and connections shall be supported and braced to withstand stresses due to maximum short circuit current and also to take care of any thermal expansion.

iv. Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear, when viewed from front of the switchgear assembly.

c) Circuit Breakers

i. Circuit breakers shall be triple pole, single throw and shall be Vacuum type / SF6 type.

ii. Circuit breakers shall be drawout type, having SERVICE, TEST and DISCONNECTED position with positive indication for each position.

iii. The operating time (break time) of the breaker shall be maximum of 3 cycles.

iv. Circuit breaker shall have motor wound spring charged trip free mechanism with anti-pumping feature and shunt trip. In addition, facility for manual charging of spring shall be provided.

v. For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. One open-close open operation of the circuit breaker shall be possible after failure of power supply to the motor.

vi. Mechanical safety interlock shall be provided to prevent:

- The circuit breaker from being racked in or out of the service position when the breaker is closed.
- Racking in the circuit breaker unless the control plug is fully engaged.

vii. Automatic safety shutters shall be provided to fully cover the female primary disconnects when the breaker is withdrawn.

viii. Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indication, an operation counter and mechanism charge! discharge indicator.

ix. Each breaker shall be provided with following:

- Auxiliary switch, with 6 NO + 6 NC contacts, mounted on the drawout portion of the switchgear.
- Position/cell switch with 3NO + 1 NC contacts, on each for TEST and SERVICE position.

x. Control & Indication:

Breaker cubicle shall be equipped with following:

- One (1) No. spring return type TNC switch for closing and tripping of the breaker.
- One (1) No. Push button operated mechanical mechanism for tripping.
- Three (5) Nos. indicating lamps on front of compartment

GREEN	Breaker Open	
RED	Breaker Closed	
AMBER	Breaker Trip	
	BLUE	Spring Charged
	WHITE	Trip circuit healthy

- Lamps shall be of LED type. Lamps and lens shall be replaceable from the front.
- Each circuit breaker shall be provided with a anti-pumping relay. Trip coil supervision relay and fast trip relay in addition to those shown in the drawing.
- Metering device and protective relays for switchgear shall be provided as shown in the attached drawings.

d) Current Transformers

i. Current transformer shall be cast resin type. All secondary connections shall be brought out to terminal blocks where wye or delta connections will be made.

ii. Accuracy class of Current Transformers shall be :

- Class 5P20 for relaying
- Class 1.0/0.5 as specified and ISF<5 for metering.

e) Voltage Transformers

i. Voltage Transformers shall be of cast-resin type having accuracy class of *1.0/* 0.5 and shall be mounted on drawout trolly.

- High voltage winding of voltage transformer shall be protected by current limiting fuse. The voltage transformer and fuse shall be completely disconnected and visibly grounded in fully draw-out position.

ii. Low voltage fuses, sized to prevent overload, shall be installed in all ungrounded secondary leads. Fuse shall be suitably located to permit easy replacement while the switchgear is energised.

f) Relays

i. Relay shall be of drawout design with built - in testing facilities. Small auxiliary relays may be in non-drawout execution and mounted with in the cubicle.

ii. Relays shall be rated for operation on secondary voltage and secondary currents as shown on drawings. Number and rating of relay contacts shall suit the job requirements.

g) Meters

Indicating instruments (96 x 96 mm) shall be digital meter, switch board type and accuracy class of + (1% full scale + 1 count).

h) Secondary Wiring

i. The switchgear shall be fully wired at the factory to ensure proper functioning of control, protection, transfer and interlocking schemes.

ii. Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, switches and other devices shall be wired upto terminal blocks.

iii. Wiring shall be done with flexible, 650V grade, PVC insulated switchboard wires with stranded copper conductors of 2.5 sq. mm for control and current circuits and 1.5 sq. mm for voltage circuits.

iv. Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per contractor's Wiring Diagram.

v. Wire terminations shall be made with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals.

i) Terminal Blocks

i. Terminal blocks shall be 660 V grade box-clamp type with marking strips similar to ELMEX 6 Sq. mm or equal. Terminals for CT secondary leads shall have provision for shorting.

ii. Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished.

j) Cable Termination

i. Switchgear shall be designed for cable entry from the bottom. Sufficient space shall be provided for ease of termination and connection.

ii. Power cables shall be XLPE insulated, armoured, overall PVC sheathed with stranded Aluminium conductor.

iii. Control cables shall be PVC insulated, armoured, overall PVC sheathed with 2.5 Sq. mm stranded copper conductor.

iv. The gland plates shall be minimum 4 mm thick. The gland plate and supporting arrangement for *IIC* power cables shall be such as to minimize flow of eddy current. In such case, gland plate shall be non ferrous metal.

v. Sufficient space shall be provided between the power cable termination (end-boxes) and gland plate. Core accommodated within this space.

k) Ground Bus

i. A ground bus, rated to carry maximum fault current, shall extend to full length of the switchgear.

ii. The ground bus shall be provided with two- bolt drilling with G.I. bolts and nuts at each end to receive 50 x 6 mm G.I flat.

iii. Each stationary unit shall be connected directly to the ground bus. The frame of each circuit breaker and drawout V.T. unit shall be grounded , through heavy multiple contacts at all times.

iv. Wherever the schematic diagrams indicate a definite ground at the switchgear, a single wire for each circuit thus grounded shall be run independently to the ground bus and connected thereto.

v. C.T. and P.T. secondary neutrals shall be earthed through removable links so that earth of one circuit may be removed without disturbing other.

l) Nameplates

i. Nameplates of anodised aluminum shall be furnished at each cubicle and at each instrument, device mounted on or inside the cubicle.

ii. Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.

m) Space Heaters

Cubicle shall be provided with thermostat-controlled space heaters.

n) A.C/ D.C Power Supply

i. The following power supplies shall be made available at each switchgear by the, contractor:

AC. Supply : Single Feeder

D.C supply : Double Feeder

ii. Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4- pole, single throw for A.C. and 2-pole, double throw for D.C.

iii. Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switchfuse units shall be provided at each cubicle for *ACt* D.C. supplies.

iv. AC. load shall be so distributed as to present a balance loading on three-phase supply system.

o) Tropical Protection

i. All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

ii. Screen of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

p) Painting

i. All surfaces shall be sand blasted, pickled and grounded as required to produce a smooth, clean surface free of scale, grease and rust.

ii. After cleaning, the surfaces shall be given a phosphate coating followed by 2 coats of high quality primer and stoved after each coat.

iii. The panels shall be finished in Siemens Grey, RAL7032 with polyster enamel paint.

3. Tests

The switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

Routine Test

The tests shall include but not necessarily limited to the following:

a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme & proper functioning of the equipment.

b. All wiring and current carrying part shall be given appropriate High Voltage test.

c. Primary current and voltage shall be applied to all instrument transformers.

d. Routine test shall be carried out on all equipment such as circuit breakers, instrument transformers, relays, meters etc.

Type Test

Type test reports of similar switchgear shall be furnished.

Test Witness

All tests shall be performed in presence of *Owner's* representatives, if so desired by the Owner's. The Contractor shall given at least fifteen (15) days advance notice of the date when tests are to be carried out.

4. SYSTEM DESCRIPTION & REQUIREMENTS

System Description

a) System Details

i. Voltage : 011/12 KV (Nom. / Max.)

ii. Nos. of Phase : 3

iii. Frequency : 50 Hz. ± 5%

iv. System Neutral : Non effectively earthed

b) Insulation Level

i. 1 minute 50 Hz withstand : 28 KV rms.

ii. Impulse withstand : 75 KV peak

c) Short Circuit Rating

i. Interrupting : 350 MV A

ii. Withstand time : 1 Sec.

d) Circuit Breaker

i) Breaking Current : 18.3 kA

e) Auxiliary Power supply available : 24V DC

f) Heater/Lamp/Socket : 415V/240V±10%

50 Hz± 5% 3Ph./1 Ph.

g) Spring wound motor for circuit breaker : 220V-240V 1 Ph. 50 Hz

h) Shunt trip coil & Closing coil : 24V DC

TRANSFORMER

1. DESIGN CRITERIA

a) Transformer is intended to step down incoming 11 KV power supply to 433 V for feeding power supply to 415V Main L T PCC for further distribution.

b) Transformer shall be installed indoor in hot, humid and tropical atmosphere. All equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.

c) The transformer shall be capable of withstanding the short circuit stresses due to a terminal fault on one winding with full voltage maintained on the other winding for minimum period of three (3) seconds.

d) The transformer shall be free from annoying hum or vibrations. The design shall be such as not to cause any undesirable interference with radio or communication circuits.

e) Transformer shall be provided with **OFF LOAD TAP CHANGER** on HV side.

f) The safety clearances of all live parts of equipment shall be as per relevant standard.

2. SPECIFIC REQUIREMENTS

a Tank

a) Tank shall be of all welded construction and fabricated from good commercial grade low carbon steel of adequate thickness. All seams shall be properly welded. All welding shall preferably be stress relieved.

b) The tank wall shall be reinforced by stiffener to ensure rigidity so that it can withstand without any deformation, mechanical shock during transportation and during oil filling by vacuum.

c) Transformer tank shall be provided with one set of bi-directional flanged wheels for rolling the transformer parallel to either center line.

d) All heavy removable parts shall be provided with eye bolt for ease of handling.

e) Hand holes of sufficient size shall be provided for access to leads, windings, bottom terminals of bushings and taps.

b Core & Coils

a) The transformer may be of core type. The core shall be built up with high grade, non-aging, low loss, high permeability, grain oriented, cold-rolled silicon steel laminations specially suitable for core material.

b) The coils shall be manufactured from electrolytic copper conductor and fully insulated for rated voltage.

c) Insulating material shall be of proven design. Coils shall be so insulated that impulse and power frequency voltage stresses are minimum.

d) Coil assembly shall be suitably supported between adjacent sections by insulating spacers and barriers. Bracing and other insulation used in assembly of the winding shall be arranged to ensure a free circulation of the oil and to.reduce the hot sport of the winding.

e) All leads from the windings to the terminal board and bushings shall be rigidly supported to prevent injury from vibration or short circuit stresses. Guide tube shall be used where practicable.

c Radiators

a) Radiators shall be made from pressed steel and shall be detachable type.

b) Radiators shall be interchangeable type. Top and bottom shut off valve shall be provided for each radiator.

c) Each radiator shall be provided with air release plug, drain valve and lifting lugs.

d Tapings

a) Off load taps shall be provided on the high voltage winding.

3. Insulating Oil

a) The transformer shall be filled with mineral insulating oil suitably inhibited to prevent slugging.

b) First filling of oil along with 10% excess shall be furnished for each transformer. Oil shall be supplied in non-returnable containers suitable for outdoor storage.

4. Terminal Arrangements

a) Terminals on HV shall be through HT cable where as the LV side shall be through bus duct.

b) Cable-end box shall be weatherproof, air filled type with sufficient space inside for termination and connection of cables.

c) Cable-end box shall be furnished complete with removable gland plate.

d) A separate LV. neutral bushing shall be provided for connection to station earthing. Necessary insulators shall be provided on transformer body for bringing down the conductor.

5. Marshalling Box

a) A sheet steel, weatherproof, IP55 marshalling box shall be provided for each transformer. The box shall contain all auxiliary devices except those, which must be located directly on the transformer.

b) All terminal blocks for cable connection shall be located in this box. The terminal blocks shall be Phoenix 10 sq.mm.

6. Wiring

a) All control, alarm and indication devices provided with the transformer shall be wired upto the terminal blocks.

b) Wiring shall be done with PVC wires in conduit or PVC armoured cable. Minimum wire size shall be 2.5 sq. mm copper. Not more than two wires shall be Connected to a terminal. 10% spare terminals shall be provided.

c) All devices and terminal blocks within the marshalling box shall be identified by symbols corresponding to those used in applicable schematic or wiring diagram.

7. Grounding

a) Two grounding pads, located on the opposite sides of the tank, shall be provided for connection to station ground mal

b) Grounding pad shall have dean buffed surface with two tapped holes, M10 GJ. bolts and spring washers for connection 50 x 6 mm G.I. flat.

c) Ground terminals shall be also provided on marshalling box to ensure its effective Earthing.

d) Bonding shall be provided between various non-current carrying parts of transformer wherever the same are connected thru' gaskets.

8. Fittings And Accessories

Each transformer shall be equipped with fittings and accessories as listed below:

a. Oil conservator with filter cap, drain plug and plain oil level gauge (with coloured prismatic front).

b. Silica gel breather with connecting pipe and oil seal.

c. Air release plugs.

d. Pressure release device. Explosion vent, should be double diaphragm type.

e. 150mm dial magnetic oil level gauge with low level alarm contact.

f. 150 mm dial oil temperature indicator with maximum reading pointer and electrically separate contacts for trip and alarm.

g. 150 mm dial winding temperature indicator with maximum reading pointer and electrically separate sets of contacts for trip and alarm.

h. Thermometer pockets.

i. Double float Buchholz relay with gas release cock, shut-off valve on either side and separate sets of contacts for trip and alarm.

j. Sampling valve/ Filter valve with threaded adopted (top and bottom).

k. Drain valve with threaded adopted.

l. Jacking pads, handling and lifting lugs.

m. Cover lifting eyes.

n. Bi-directional rollers and skids.

o. Radiators (Detachable type).

p. Clamping devices.

q. Two grounding pads.

r. Remote tap changer control panel.

s. Weatherproof marshalling box for housing control equipment and terminal connections.

t. Rating and terminal marking plates.

u. Neutral bushing with earthing conductor bringing down duly supported on insulators.

v. HT cable box! L T suitable for Bus Duct connection.

w. CTs in neutral as specified.

9. Painting

a) All steel surfaces shall be thoroughly cleaned by sand blasting or chemical agents, as required, to produce a smooth surface free of scales, grease and rust.

b) The internal surfaces in contact with insulating oil shall be painted with heat resistant insulating varnish, which shall not react with and be soluble in the insulating liquid used.

c) The external surfaces, after cleaning, shall be given a coat of high quality red oxide or yellow chromate primer followed by filler coats.

d) The transformer shall be finished with two coats of Siemens Grey (RAL 7032) polyster enamel paint.

10. TESTS

a ROUTINE TESTS

During manufacture and on completion, all transformer shall be subjected to the IS routine tests.

b TEST WITNESS

Tests shall be performed in presence of Owner's representative if so desired by the Owner. The Contractor shall give at least fifteen (15) days' advance notice of the date when the tests are to be carried out.

c SYSTEM DESCRIPTION & REQUIREMENT

a) Application : LT. Transformer.

b) Service : Outdoor/indoor, step-down.

c) Type : Oil immersed

d) Rated output : as per bill of quantities

e) Cooling : ONAN

f) Rated voltage (line to line) : 11 KV *I* 0.433 KV.

g) Number of phases : 3

h) Rated frequency : 50Hz.

i) System fault level at 11 KV : 350 MV A

j) Temperature rise above 50 Deg. C

i) In oil by thermometer : 45 deg. C.

ii) In winding by resistance : 50 deg. C.

k) Insulation level on HV side : *75/28* KV (peak rms)

I) Vector group : Dyn 11

m) Type of Radiator : Detachable type

n) Type of taps provided : Off Load

o) Taps provided on : HV. Winding.

p) Range of taps : + 10% and -15% in total of 15 steps

q) Percentage impedance : 6%

at 75deg.C on full load.

r) Method of tap changer control : a) Manual Mode

b) Electrical Local

c) Electrical Remote

s) Terminal Connection

HV Cable end box suitable : XLPE cable

for LV Terminal box suitable for : XLPE Cable

t) Additional Neutral Bushing for Earthing. : 1 No.

v) Full load Losses : 12.0 KW *(Maximum)

w) No Load Losses : 1.75 KW * (Maximum)

* Transformers having losses more than specified above are not acceptable.

DESIGN CRITERIA OF 415V L T PANEL

a) One nos. transformers of 1000 KVA each and two DG sets of 200 KVA each have been envisaged to cater the campus loads.

b) Generally in normal condition, Transformer shall feed power to Main L T Panel with bus coupler in open condition.

c) As long as SEB power supply shall be available, the whole plant load shall be fed through Transformers.

d) There shall be two positions selector switch (Auto/ Manual) on each breaker of L T panel

i. In Auto Mode: Closing/ switching off of breaker shall be automatic.

ii. In Manual Mode: Closing/switching off of breaker shall be manual through TNC switch, located on breaker panel.

iii. In no condition, two different supplies shall get paralleled.

e) There shall be three positions selector switch (Auto/test/Manual) on each DG set breaker panel

i. In Auto Mode of breaker panels:

All operation i.e. starting of required DG set, their parallel operations, load sharing (Active/Reactive), outgoing breakers closing, switching off breakers on power resumption, switching off DG sets etc. shall be totally automatic.

ii. In Manual Mode of breaker panels

All operation defined above shall be manual.

iii. In test mode of DG power Panel

It shall be possible to check the system without energizing its breaker.

f) In case of failure of power, following shall happen:

(If selector switches of breakers of L T panel & breakers of DG power panel are kept on Auto Mode).

(i) DG sets shall be started automatically (Based on load requirement) one by one.

(ii) DG set shall get paralleled automatically. Their breakers of DG synchronization panel (whatever is required) shall get closed on parallel operation. '

(iii) Outgoing breakers of DG Synchronization panel shall get closed automatically

(iv) At Main L T panel side, respective breaker from transformer supply shall open out and breakers from D G supply shall get closed automatically.

(v) DG Sets shall share active / reactive load automatically.

g) On resumption of power, following shall happen: (if selector switch of breakers of LT panel & breakers of DG Power Panel are kept on Auto mode)

(i) An Alarm shall be sounded for resumption of power for a fixed duration.

(ii) First one outgoing of DG Panel shall be switched off and through reducing the load of DG Sets.

(iii) After some time, second outgoing breakers shall be switched off.

(iv) Breakers from D G supply on Main Panel shall get switched off automatically.

(v) Subsequently breakers from Transformer supply shall be switched ON automatically.

(vi) DG sets shall run on NO Load for the prescribed time before they are switched off.

i) Main L T Panel shall receive power supply from transformer through cables & DG synchronization panel through cables and shall feed power supply various feeders / services

j) Further power distribution shall be as indicated in the enclosed single line diagram.

k) Operating height of boards shall be limited within 350 mm to 1900mm from floor level.

l) The type and rating of the Panels covered herein shall be as follows:

System voltage : 415V

System Frequency: 50 Hz

No. of phases : 3 Phase (4 wires)

Busbar rating : As specified in drawings.

High voltage Test : 2.5KV for 1 minute.

Degree of Enclosure : IP52 (as per IS 2147)

m) All switchgear and its components provided in the panel shall have same fault withstand capacity as indicated for bus bar in single line diagram.

L. T. PANEL

1. CONSTRUCTION FEATURES

a. Panels shall be indoor, metal clad, modular construction, fix type (except circuit breaker cubicles) air insulated and floor mounted type.

b. Unless otherwise mentioned, panels shall be of single front construction and shall be of dead front type.

c. All panels shall be extensible on both sides.

d. All panels shall be dust proof and vermin proof.

e. The panels shall have horizontal Busbar Chamber at top of the panel even for top cable entry.

f. All panels shall have provision for cable entry from top or from bottom or both as required. The same shall be confirmed to the Vendor during detailed engineering ! approval of shop drawing of panel manufacturer.

g. All panels including capacitor panels shall be fully compartmentalized with metal! Insulating partitions between individual compartments.

h. The Horizontal busbar chamber shall be separate & totally enclosed.

i. Minimum thickness of CRCA MS sheet member shall be 1.6 mm for non load bearing members and 2.0 mm for load bearing members.

j. All panels shall comprise a continuous line up of dead front, free standing vertical sections. The installation of circuit breakers shall be limited to the bottom two tiers only. In two tiers formation two nos. of upto 1000 Amp. breakers can be provided.

k. All doors and cutouts shall be provided with neoprene gaskets.

l. The back doors of the panels shall be double door leaf type where the panels have more than 400 mm width.

m. Strong concealed type hinges shall support all doors.

n. All relays, meters, and switches etc. shall be flush mounted type.

o. All incoming terminals shall be provided with shrouds. Support shrouds shall be transparent and shall be made of SMC/DMC material. However Bakelite/Hylam material is not acceptable and shall not be used any where in panels.

p. The complete structure shall be rigid, self-supporting free from vibration, twists and bends etc.

q. The panels housing circuit breaker feeders shall be in single front draw out execution. The incoming & bus coupler circuit breaker feeders shall be in single tier formation while the outgoing circuit breaker feeders may be in double tier formation, unless otherwise specified.

r. A suitable barrier shall be provided between the circuit breaker and the associated control.

s. The number of modules shall be so decided that the cable alleys are not over crowded. However the number of module in any panel shall not exceed six. The minimum size of module shall be 300mm and 225mm for starter and switch fuse / MCCBs feeders respectively. The minimum clear width of cable alley shall be 300mm.

t. In cable alley, outgoing terminals shall be identified with feeder number.

2 BUS AND BUS TAPS

a. The main buses and connection shall be of high grade of aluminium bus bars conductivity aluminium 1 aluminium alloy (Grade EC-91 E), sized for specified current ratings with max, temp. limited to 85 deg.C (35 deg. above 50 deg. ambient temp.).

b. Vertical bus bars shall be designed depending upon the actual feeder requirement. Bimetallic connector shall be provided for connection between dissimilar metals.

c. Busbars and connections shall be fully insulated for working voltage with adequate phase 1 ground clearances. Insulating sleeves for Bus bars and shrouds for joint shall be provided. Minimum clearance of 25 mm is required between phases and between phase & earth.

d. Shrouds for busbars joints tapping points shall be of fiber glass only. Bus insulators shall be flame retardant, track resistant type with high creepage surface and of non-hygroscopic material such as epoxy SMC DMC.

e. Busbars shall be supported and braced to withstand the stresses due to max. short circuit current and also to take care of any thermal expansion. .

f. The bus bar size shall be of similar size as of busduct.

3 CHANGEOVER SWITCHES

a. Changeover switches shall be 4 pole, heavy duty, group operated load break fault make type with AC 23A duty.

b. The switches shall be capable of successfully withstanding the thermal stress for one sec. caused by the short circuit corresponding to the fault level specified.

c. The switches shall be able to withstand mechanical stresses caused by the peak short circuit currents corresponding fault level specified.

d. The switches shall be provided with operating handle compartment door and shall be so interlocked that on the hinged compartment door and shall be so interlocked that :

i) The door can be opened only when the switch is in OFF position.

ii) It shall not be possible to close the switch when the door is open.

e) The switch shall be provided with pad-locking arrangement for 250A and above rating.

f) The switch shall be provided with defeat interlock facilities.

4 FUSES

a) All fuses shall be HRC cartridge link type.

b) The fuses shall be provided with visible indication when they have operated.

c) Rating of the fuses shall be so chosen so as to have co-ordination with switch. Fuses shall preferably mounted directly on plug in type fuse bases & sufficient number of insulated fuse pullers shall be supplied.

d) Fuses and links functionally associated with the same circuit shall be mounted side by side.

Earthing and neutral links in main supply circuits shall be of silver plated copper & of bolted pattern.

5 CONTACTORS

a) Contactors shall be of double break, single throw and electromagnetic and non-gravity type.

b) Contactors shall be suitable for interrupted duty and shall be rated for class AC-3 duty.

c) Main contacts of contactors shall be silver faced.

d) Operating coils of contactors shall be suitable for operation on 220/240V AC, 1 phase, 50 Hz supply.

e) Contactors shall be provided with at least two pairs of 'NO' and 'NC auxiliary contacts.

f) Contactors shall not drop out at voltages down to 70% of coil rated voltages and min. pick up voltage shall be 85%.

6 OVERLOAD RELAYS

a) Overload protection for each motor feeder (wherever required) shall be provided by thermal overload relay on each of the three phases.

b) The relay shall be duly compensated against fluctuations on ambient temp. and frequency and shall have single phasing preventer feature.

c) Relay shall be hand reset type from the front of the cubicle door.

Overload relay for fan applications shall be of heavy duty type with provision of bypassing the same during starting of the fan.

7 CAPACITORS

a) The capacitor shall be of mixed dielectric type rated for 440Volts. Capacitors shall be provided with discharge resistors. The value of discharge resistors should be such that the residual voltage be less than 50V in one minute.

b) Capacitors shall be suitable for prolonged operation at an rms. voltage between terminals not exceeding 1.10 times the rated voltage, excluding transients.

c) Capacitors shall be suitable for continuous operation at an rms. line current not exceeding 1.30 times the current which occurs at rated sinusoidal voltage and rated frequency excluding transients.

d) The maximum continuous reactive output of a capacitor (including any due to flow of harmonic currents) shall not exceed 30% over rated reactive output of a capacitor.

e) Loss in the capacitors shall be kept as low as possible. (Max. 0.5W/KV AR).

f) Wherever capacitor consists of several elements inside the units, each element shall be provided with individual fuses, so that the unit need not be discharged or disconnected (although with moderate reduction in output), if one of short circuit to any of the elements.

8 AUTOMATIC POWER FACTOR CONTROL RELAY

a) Automatic Power factor control relay (APFCR) shall operate its auxiliary relay by sensing the power factor of the plant thru' current and voltage signals.

b) APFCR shall have no. of steps specified in drawings.

c) APFCR shall be provided with Built in PF meter (0.5 lag to 0.5 lead), calibrated setting dial.

d) APFCR shall be suitable for 5A secondary current.

e) APFCR shall be suitable for flush mounting in capacitor panel/MCCs.

f) Current rating of its auxiliary relay shall be compatible with switching and continuous energization of main contactor of capacitors. Otherwise, additional relay shall be provided.

9 COOLING

a) All the Capacitor Panels shall be properly ventilated. If required a small exhaust fan of suitable rating shall be provided on the rear door of the panel, with the opening properly covered with fine wire mesh. The fan shall start/stop automatically along with normal start/stop provision.

b) Louvers shall be provided on the door on rear side with a fine wire mesh.

10 CURRENT TRANSFORMERS

a) Current Transformers shall be cast - resin type .AII secondary connections shall be brought out to terminal blocks where connection will be made.

b) Accuracy class of the current transformers shall be:

i. Class 5P20 for protection.

ii. Class 1.0 for metering.

iii. Class PS for differential Protection & REF.

c) Current transformer shall be provided with test links and shorting on both secondary leads for setting purpose.

d) All current transformers shall be earthed by a separate earth link on terminal blocks.

e) Additional nameplate of CTs/ PTs shall be provided (if required) at such a place that it shall be possible to find out details of CTs/ PTs after mounting in the panel.

11 VOLTAGE TRANSFORMERS

a) Voltage transformers shall be cast-resin, fixed type and shall have an accuracy class of 1.0.

b) Low voltage fuses, sized to prevent overload, shall be installed in all ungrounded secondary leads. Fuses shall be suitably located to permit easy replacement while the board is energized.

12 RELAYS

Relays wherever provided shall be of draw-out design with built-in testing facilities. Small auxiliary relays may be in non-drawout execution-.

13 CONTROL AND SELECTOR SWITCHES

a) Control and selector switches shall be of rotary type having enclosed contacts, which are accessible by the removal of cover.

b) Control and selector switches shall be of flush mounted type and on front of panels. .

c) Selector switches shall be of stay-put maintained contact type.

d) Control switches shall be provided with escutcheon plate clearly marked to show the position.

14 INDICATING METERS AND INSTRUMENTS

Indicating instrument (96 x 96 mm) shall be digital meter, switch board type and accuracy class of 1 (1 % full scale ± 1 count).

15 INDICATING LAMPS

a. Indicating lamps shall be of LED type, low watt consumption and provided with appropriate value of resistors. The LEDs shall also have an in-built surge suppressor.

b. Bulbs and lenses shall be interchangeable and easily replaceable from the front of the panel.

16 PUSH BUTTONS

a) All push buttons shall be of the push to actuate the contact type.

b) All push buttons shall be oil tight and shall be provided with adequate no. of contacts.

17 POWER AND CONTROL CABLE TERMINATION

a. Suitable supporting arrangement shall be provided for all power and control cables entering the panel.

b. Removable undrilled gland plate of 3 mm thick of MS for multicore cables and 4mm thick of Aluminum for single core cables sufficient in size to accommodate all compression type, heavy duty brass glands shall be provided.

c. Adequate termination arrangement shall be provided for all power cables which shall be aluminium / copper conductor, PVC insulated, sheathed, armoured PVC sleeved overall, heavy-duty cables, 1.1 KV grade. Power cables termination shall be by means of crimping type lugs on conductor cables.

d. The terminal blocks shall be bolted lug type for cables. These shall be protected type and rated for 1100 Volts service. The minimum current rating of terminal block shall be 16 Amp. The construction shall be such that after the connection of cable by means of lugs, necessary clearance and creepage distance are available.

e. Wherever there is more than one equipment connected on the same feeder, separate terminals shall be provided.

18 INTERNAL WIRING

a. All internal wring shall be carried out with stranded copper conductors, PVC insulated, 1100/650 V grade.

b. Min. size of conductor for power wiring shall be 2.5 sq.mm, 1.5 sq.mm for AC control wiring and 4.0 sq.mm. for DC control wiring. Current transformer secondary wiring shall be with 2.5 sq.mm conductor.

c. All wiring shall be run on the sides of the panels and shall be neatly bunched and shall not affect access to equipment mounted in the panels.

d. Wiring shall be terminated on terminal blocks using crimping type lugs and without joints or tees on their runs.

e. Power wiring shall be done either by phase identifying coloured wires or suitably coloured PVC sleeves shall be provided at each end of wire.

The following wiring codes shall be used.

Instrument Transformer : Red, yellow or blue depending upon phase with which wire is associated.

A-C phase wire : White

A-C Neutral wire : Black

Earth connection : Green

f) PVC identification ferrules, yellow colour with black engraved letter shall be provided at each end of all control wires marked to correspond with equipment designation & termination numbers.

g) Ferrules provided shall be oil tight and numbered from left to right.

19 TERMINAL BLOCKS

a) Terminal blocks for control wiring shall be 650V grade 10 sq.mm size.

b) Terminal blocks shall be grouped depending on circuit voltage. Different voltage groups of terminals blocks shall be segregated.

c) Terminals blocks shall be numbered for identification and provision shall be provided for terminal labels.

d) Terminal blocks requiring duplication shall be provided with solid bonding links.

e) Terminal blocks for current transformer secondary lead wires shall be provided with shorting, disconnecting *I* earthing facilities.

f) Terminal blocks and control wiring shall be so arranged that only one conductor of external wiring required to be terminated in at each terminal.

20 GROUND BUS

a) A ground bus, rated to carry maximum fault current, shall extend to full length of the panel.

b) The ground bus shall be provided with two-bolt drilling with GJ. bolts and nuts at each end to receive 75X 10 mm G.I. flat. .

c) Each stationary unit shall be connected directly to the ground bus. The frame of each circuit breaker and shall be grounded through heavy multiple contacts at all times.

d) Wherever the schematic diagrams indicate a definite ground at the switchgear, a single wire for each circuit thus grounded shall be run independent to the ground bus and connected thereto.

e) C.T. shall be earthed through removable links so that earth of one circuit may be removed without disturbing other.

f) Frames and non current carrying metal parts of all equipment mounted shall be effectively to earth bus.

g) All hinged doors shall be connected to earth bus by flexible tinned bare copper wire.

h) Instrument and relay cabinets shall be connected to earth by 2.5 sq.mm stranded copper insulated wire 1100 V grade.

21 SPACE HEATERS

Each cubicle shall be provided with thermostat controlled space heaters.

22 AC/DC POWER SUPPLY

a) The panels shall be suitable to receive following power supplies.

AC Supply: Single Feeder

DC Supply : Double Feeder

b) Isolating switch fuse units shall be provided at each switchgear for the incoming supplies, 4-pole, single throw for AC.

c) Bus-wires of adequate capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating switch-fuse units shall be provided at each cubicle for AC supplies.

d) AC load shall be so distributed as to present a balance loading on three phase supply system.

23 NAME PLATES

a) Name plates of anodized aluminum shall be furnished at cubicle and at each instrument, device mounted on and inside the cubicle.

b) Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.

c) Name plates for feeders shall be provided on front and back of the panel.

24 TROPICAL PROTECTION

a) All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.

b) Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

25 PAINTING

a) All surfaces shall be sand blasted, pickled and grounded as required to produce a smooth, clean surface free of scale, grease and rust.

b) After clearing, the surfaces shall be given a phosphate coating followed by 2 coats of high quality primer and stoved after each coat.

c) The panels shall be finished with two coats of Siemens Grey (Shade RAL 7032) powder coated / Polyester enameled.

26 TESTS & INSPECTION

a) The following routine and acceptance tests shall be carried out during final acceptance list.

i) Mechanical operation test.

ii) Electrical operation test.

iii) High voltage test on power circuits.

iv) High voltage test on control circuits.

v) Millivolt test on the circuit breakers.

vi) Millivolt Drop test on Busbar joints

b) All tests shall be performed in the presence of Owner's representative, if so desired by the owner. The contractor shall give at least 15 days advance notice of the date when tests are to be carried out.

c) Contractor shall furnish test certificate indicating that equipment has been tested by their quality control department for compliance of technical specification and approved drawings. The same shall be forwarded to owner! consultants along with inspection call.

d) These inspections shall however, not absolve the vendor from the responsibility for making good any defect with may be noticed subsequently.

27. The bank at its discretion may purchase light fixtures and supply it to the contractor for installation. Contractor cannot claim any compensation for supply of fixtures by the bank.

BATTERY & BATTERY CHARGER

1. BATTERY

General

a) The battery shall be maintenance free type

b) The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuation of load.

2. BATTERY CHARGER

General

a) The charger shall be natural air cooled, solid state type with full wave, fully controlled, bridge configurations.

b) The charger shall be provided with automatic voltage regulation, current limiting circuitry smoothing filter circuit and soft start feature.

c) Voltage control shall be step-less, smooth and continuous.

d) The charger shall be self-protecting against all A-C and D-C transients and steady state abnormal currents and voltages.

e) Voltage setters shall be provided for setting the output of float boost charge. Setting shall be independent of each other so that setting of one voltage shall not require resetting other.

f) There shall be separate transformers for float and boost charger.

g) Charger A-C input and D-C output shall be electrically isolated from each other and also from panel ground.

h) Isolation shall also be provided between power and control circuits.

i) Batteries shall also be housed into the Battery Charger cubical.

Construction

a) The charger shall be freestanding, floor mounted with sheet steel enclosure with all access from the front.

b) The panel shall conform to the degree of protection IP 42. Minimum thickness of sheet metal used shall be 2 mm.

c) Access door shall be with concealed hinges and neoprene gaskets. Ventilating louvers shall be covered with fine wire mesh.

d) All equipment within the panels shall be arranged in modular units and laid out with sufficient space for easy maintenance.

e) Switches, meters, relays etc. shall be flush mounted on the front of the panels. Nameplates of approved size and type shall be provided for all circuits and devices.

Charger Equipment

a) All power diodes and control rectifiers shall be silicon type. Rectifier Transformer shall be dry type, double wound, with copper conductor and class B insulation.

b) Blocking diodes shall be fully rated and redundant so that failure of a single diode shall not incapacitate the system in any way.

c) Isolating switches shall be heavy duty, load break type, operated by an external handle with provision for padlocking in ON and OFF position.

d) Changeover switch shall be 3 position, 4 pole, load break type with 2 NO + 2 NC auxiliary contacts.

e) Contactor shall be air-break type with thermal overload relays having in built single phase preventor.

f) Fuses shall be HRC type and arranged for easy replacement. Semi conducting device fuses shall be fast-acting.

g) Indicating lights shall be low-watt filament type with series resistor. Both lamp and lens shall be replaceable from front.

h) Meters shall be 96 x 96mm switchboard type, 250 deg. scale, antiglare glass, :!: 2% accuracy with zero adjuster on the front.

Alarms

a) One (1) ten-points alarm facia shall be provided on charger panel, complete with proper actuating devices, circuitry and legends.

b) The arrangement shall be such that on occurrence of a fault the corresponding window will light up and stays lighted until the fault is cleared and reset button is pressed.

c) Each time a window lights up, a master relay will get energized to provide group alarm signals for Owner's remote panel.

d) Following minimum annunciation shall be provided:

i) A. C. Supply failure *

ii) D. C. Voltage low *

iii) D. C. Voltage high *

iv) D. C. System ground *

v) Charger overload *

vi) SCR fuse blown

vii) Filter fuse blown

viii) D. C. Output fuse blown

e) Alarm points marked with an asterisk (*) shall have electrically separate spare set of contacts wire_ up to the terminal block for Owner's use.

f) Alarm contacts shall be rated 2A at 24V D. C. And SA at 240V A.C.

Outgoing Feeders

a) Each Outgoing feeder shall be provided with double pole switch and with HRC fuses.

b) Outgoing feeders shall be located in separate module forming part of charger panel with separate cable alley for terminated outgoing cable.

Lamp / Space Heaters / Receptacles

a) The charger panels shall be provided with :

- Internal illumination lamp with door switch.
- Space heater with thermostat control.

b) Lamp, heater circuits shall have individual switch fuse units.

Wiring / Cabling

a) The panels shall be completely wired-up. All wiring shall be routed through wiring troughs. Wires shall be ferruled at both ends for identification.

b) Panels shall have removable gland plates at the bottom for cable entry. All incoming / outgoing cables shall be terminated in suitable terminal blocks.

c) Control terminal blocks shall be box-clamp type ELMEX 10 Sq. mm or approved equal.

Grounding

a) The charger panels shall be fully rated ground bus with two ground terminals, one at each end.

b) Each terminal shall comprise two-bolt drilling with M10 G.I. bolts and nuts to receive Owner's ground connection of 50 x 6 mm G.I. flat.

Tropical Protection

a) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.

b) Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

Painting

a) All surfaces shall be sand blasted, pickled as required to produce a smooth, clean surface free of scale, grease and rust.

b) After cleaning, the surfaces shall be given a phosphate coating followed by 2 coats of high quality primer and stoved after each coat.

c) The panels shall be finished in powder coated Siemens Grey, RAL7032 ..

Tests

a) All equipment and components there of shall be subject to shop tests as per relevant IS standards. The tests shall included but not limited to:

b) Tests on battery charger.

- Dielectric tests.
- Voltage regulation check from 0 to 100% load with ±10% input voltage variation.
- Ripple content measurement.
- Heat run test on current limiting value.

Test Witness

All tests shall be performed in presence of Owner's representatives, if so desired by the Owner. The contractor shall give at least fifteen (15) days advance notice of the date when tests are to be carried out.

3. REQUIREMENT

Battery

i) Type : Lead Acid

ii) Nos. of Cells per Battery : 12

iii) Battery nominal voltage : 24 V

iv) Ten hour rating to : 300 AH

1.85 Volt/Cell at 27 deg. C.

Battery Charger

i) Charger : Float & Boost

ii) Type : Solid state, rectifier

iii)Rating : 40A

iv)A.C. Input Supply : 415V, 3ph,4 w/230V, 1Ph., 50Hz.,
2 wire.

v)Ripple content in charger DC output : ± 1%

vi)Outgoing feeders - 12 Nos : Each consisting of double pole MCB of 32A

AIR CONDITIONING

TECHNICAL SPECIFICATIONS

A. BASIS OF DESIGN

INTRODUCTION

Air conditioning System shall be designed to provide year round thermal environment control for the INDIAN BANK , NAGAUR , BRANCH, JAIPUR.

SITE LOCATION : GROUND FLOOR

1. Out side Design conditions :

Outdoor Design Conditions for Jaipur shall be taken as :

SUMMER

DBT	:	110 °F (43 °C)
WBT	:	75 °F (24 °C)

MONSOON

DBT	:	95 °F (35 °C)
WBT	:	83 °F (28 °C)

2. Inside Design conditions :

Indoor Design Conditions for all the areas shall be taken as :

SUMMER

DBT	:	75 $\pm$ 2 °F (24 $\pm$ 1°C)
RH	:	not to exceed 60%

MONSOON

DBT	:	75 $\pm$ 2 °F (24 $\pm$ 1°C)
RH	:	not to exceed 60%

3. Design considerations :

a) All exposed glasses shall be covered with venetian blinds.

b) Fresh air quantities shall be one air change per hour

a) Lighting intensity shall be 1.5 Watt/ sq.ft. of floor area.

B. BRIEF DESCRIPTION OF THE PROPOSED SYSTEM

It is proposed to provide **CASSETTE/ SPLIT ACS** as per the details given below :

	TR	QTY	TTL. TR.	
GROUND FLOOR				
BANKING HALL	1.5	0	0.0	HI WALL SPLIT AC
BM CABIN	1.5	0	0.0	HI WALL SPLIT AC
SERVER ROOM	1.0	2	2.0	HI WALL SPLIT AC
ATM	1.0	2	2.0	HI WALL SPLIT AC

AIRCONDITIONING UNITS

1. SCOPE

The scope of this Section comprises the supply, erection testing and commissioning of the air-conditioning system confirming to these specifications and in accordance with the requirements given in Schedule of Equipments.

2. AIRCONDITIONING UNITS

The Air conditioning units shall be manufactured at the manufacturers' factories in India & Abroad. Assembled units i.e. Bought out Indoor and/or outdoor units are not acceptable. Chinese/Taiwan equipment is not acceptable.

The Air conditioning units shall be unitary / packaged type fully assembled at the manufacturers' factory. Site assembled units are not acceptable. The prices of AC units quoted should be inclusive of independent controls (on/off) / Electronic Remote Controls, Voltage stabilizers, safety feature such as protection from voltage fluctuations, Single phasing, phase misbalancing / reversal, Fire Dampers etc. as per the specifications & requirement of the consultant.

Both Indoor units & outdoor units shall be factory assembled, tested and filled with first charge of refrigerant before delivering at site.

SPLIT UNITS :

The split unit shall comprise of an Outdoor and one set of Indoor units. Each unit have Indoor Unit and Outdoor unit to be connected with Copper Refrigerant piping and interconnected electrical wiring.

OUTDOOR UNIT

The outdoor units shall be factory assembled, wired, tested with all necessary controls etc. and filled with first charge of refrigerant before delivering at site.

This unit shall comprise of hermetically sealed Compressor designed to perform efficiently.

The Condenser coil shall be air-cooled type with Aluminium fins and copper tubes which shall not be less than1/2" O.D. The Condenser fan shall be propeller type and fan motor shall be permanent split capacitor type. The housing shall be fabricated out of minimum 1.2 mm thick powder coated MS sheet. The casing shall make the whole unit fully weather proof, suitable for outdoor installation.

- All the outdoor units above 5 TR. shall have minimum two scroll compressors and be able to operate even in case one compressor is out of order.
- In case of ODU with multiple compressors, the operation shall not be disrupted with failure of any compressor.
- The noise level shall be limited to 65 DB at a distance of 1 Meter from the outdoor unit.

The ODU shall be fitted with low noise aero spiral design fan with large air flow and should be designed to operate compressor linking technology. The unit should also be capable to deliver 55 Pa external static pressure to meet long exhaust duct connection requirement.

The units should be equipped with all the safety feature for protection from voltage fluctuations, Single phasing , phase misbalancing/reversal etc..

COMPRESSOR

This unit shall comprise of hermetically sealed Compressor designed to perform efficiently. Units above 2.0 TR. shall have Scroll Compressors.

HEAT EXCHANGER

The Heat Exchanger shall be constructed with Copper tubes mechanically bonded to aluminium fins to form a cross fin coil.

- The aluminium fins shall be covered by anti corrosion resin films.

REFRIGERANT CIRCUIT

The Refrigerant circuit shall include liquid and gas shut off valves at condenser end.

SAFETY DEVICES

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

Following safety devices shall be part of outdoor units :

- HIGH PRESSURE SWITCH
- FUSE
- FUSABLE PLUG
- OVER LOAD RELAY

 # INDOOR UNIT :

This section deals with Supply, Installation, Testing and Commissioning of various type of Indoor units confirming to general specifications and suitable for the system & duty selected. The type, capacity and size of indoor units shall be as specified in detailed Bill of quantities.

 # GENERAL

- The Indoor unit shall be HI-WALL or CEILING MOUNTED CASSETTE as specified in BOQ.

The IDU shall be basically a Fan coil unit suitable for Ceiling/Wall hung type. Each unit shall have Cooling coil, Blower, Filter, Drain pan and accessories. All the IDUs installed to have individual cordless Remote controls.

The Cooling coil shall have Aluminium fins and copper tubes which shall not be less than 3/8" O.D. The Fan section shall be dual suction, aerodynamically designed & balanced turbo, multi blade type blower to ensure low noise and vibration free operation and having multiple speed motor. The fan shall be direct driven type, mounted directly on motor shaft having support from housing. The Cassette units to have Automatic drain pump.

Unit shall have cleanable type filter fixed integrally moulded plastic frame. The filter shall be slide away type and neatly inserted.

 # CEILING MOUNTED DUCTABLE 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 galvanised. The body shall be light in weight & shall be able to suspend from four corners. The body shall be light in weight & shall be able to suspend from four corners. The unit shall have high static fan for ductable arrangement.

 # HI-WALL TYPE

The unit shall be wall mounted type. The units shall include pre-filter, fan section & DX coil section. The housing of the unit shall be powder coated galvanised. The body shall be light in weight. The unit shall have an attractive external casing for supply & return air.

3. INSTALLATION

3.1 Compressor, condenser and Fans shall be enclosed in a powder coated housing. Refrigerant piping shall be of IMPORTED Copper tube confirming to JIS–H3300 of minimum thickness 0.61 mm for sizes ¼" to 3/8" and 0.71 mm for sizes ½", 5/8" & 6/8" suitable for specified test pressures. The installation charges should be inclusive of five rmt. of refrigerant piping, interconnecting electrical wiring & drain piping. The Refrigerant piping shall be concealed in the chiseled walls/floors and exposed piping shall be covered in the PVC Channels 3" x 3" & flexible sleeves 3" dia or as required. The Electrical wiring shall be passed through separate PVC conduit pipes, as required by the consultant. The contractor shall supply foundation bolts, nuts, washers, leveling screws, mounting frame base plate, vibration isolation pad etc. as required by the consultant, and it shall be the responsibility of the contractor to see that all the above items are properly and securely placed in the position on the foundation and get it verified by the consultant. The Room units shall be suspended from ceiling with dash fasteners of good quality. Electronic Remote controls, Voltage stabilizers to be installed/located at the place desired by the consultant.

3.2 The contractor shall supply the required charges of refrigerant, lubricants and other consumables for testing and commissioning of the equipment.

3.3 The unit shall be properly leveled before grouting the foundation bolts.

3.4 All the equipments shall be thoroughly tested and checked for leaks. The refrigeration system shall be vaccumised to within 5 mm Hg. absolute and maintain for four hours. At the end of this period, the pumps shall be stopped and vacuum maintained for 24 hours without exceeding a vacuum drop of 1 mm Hg. absolute. The contractor shall certify that the vacuum was maintained as specified above.

3.5 All safety controls, low and high refrigerant pipe controls, LP-HP, internal OLP, Single phase preventor, auto-correction of phase imbalancing & phase reversal, starter overload trips shall be provided & suitably set and a record of all these settings shall be furnished to the consultant.

4. TESTING

4.1 Unit capacity in tons of refrigeration shall be computed as required by the consultant. Computed results shall tally with the figures furnished by the tenderers and as inspected during the pre dispatch inspection by the consultant at Manufacturer's factory.

4.2 All the instruments, services etc. needed for the test required for the computation of the capacities and the power consumption shall be furnished by the contractor.

5 PAINTING

5.1 All the equipments, mounting frames, stands etc. shall be painted with 2 coats of suitable paints of approved colour over the priming paint to prevent corrosion of the equipment.

ELECTRICAL EQUIPMENTS

1 SCOPE

1.1 The scope of this Section comprises the supply, erection, testing and commissioning of electrical switch gear and wiring installation.

2. GENERAL

2.1 Work shall be carried out in accordance with specifications, I.E. Act 1910 as amended up to date and rules issued hereunder, regulations of the local fire Insurance Association and Indian Standard code of Practice No. I.S. 732:1963.

2.2 A list of acceptable makes of material is given in the tender documents.

3 EQUIPMENT CABLING

3.1 Cables shall be laid generally to accordance with Indian Standard Code of Practice I.S. 1256-1950.

3.2 All cables shall be heavy duty PVC sheathed of 1.1 KV grade with Copper conductors. Interconnecting Cables between Indoor & Outdoor shall be of Size 1.5 Sq.mm – 4 core and Power supply cable shall be 2.5 Sq.mm. – 3-Core for Single phase units and be 2.5 Sq.mm. – 4 Core for Three phase units. All the units shall be properly earthed with 20 G GI wire.

3.3 Cables shall be laid on GI 'U' shaped channel cable trays. Where more than one cable is running, proper spacing shall be provided to minimize the loss in current carrying capacity. In no case power and control cables shall run on top and bottom of the tray simultaneously, but separate tray shall be used. For cables running on walls, proper saddles must be provided. In case of buried cables, the same shall be covered with sand, brick/ tiles.

4 TESTING

4.1 Before the commissioning of the plant, the entire installation shall be tested in accordance with I.S. 732:1963 and the test report furnished by a qualified and authorized person. The Electrical installation shall be got passed from local Electrical Inspector.

5 PAINTING

5.1 All panels, frame work, conduit, etc. shall be painted with two coats of an approved paint.

MODES OF MEASUREMENTS

1 PIPING WORK

a) The lengths of piping shall be measured as per distance between INDOOR & OUTDOOR UNITS and accessories and fittings shall be measured along its centre line in metres and no separate measurement for bends, elbows, tees etc. shall be made. As such fittings / accessories shall be treated as normal piping work. The piping between Indoor & Outdoor will be measured once only, i.e. it will be considered one circuit only.

b) All kind of supports, hangers etc. shall form part of the piping work and no extra measurements shall be made.

3 INSULATION

A) INSULATION OF DUCT

a) This shall be measured on the basis of centre line insulation and not the outer line of insulation.

b) For example, Measurement of 25 mm thick insulation on 500 x 300 mm one meter length:

$$\text{i.e.} = \frac{(500 + 25) + 300 + 25 \times 2 \times 1 \text{ mt}}{1000}$$

$$= \frac{525 + 325}{1000} \times 2 \times 1 = 1.7 \text{ sq. mt.}$$

All insulation of bends, transformation pieces elbows, etc. shall be treated as normal duct insulation. No extra measurements for accessories used for ducts insulation shall be measured separately.

B) INSULATION OF FALSE CEILING/ RETURN AIR BOXING/ CEILING/WALL INSULATION

It shall be done on the basis of bare surface of the surface to be insulated.

C) DUCT LINING

Measurement for bare inside surface of duct shall be accounted for. This shall remain true even in case of Kail Wood / Teak Wood/ GI frame used for fixing insulation material as acoustic lining.

4 ELECTRICAL CABLING WORK

All power cables/ control cables shall be measured in running length in meters without accounting for any wastage. No extra measurements for indicating lamps, volt meter, ammeter, Kilowatt meter, etc. shall be treated as part of equipment only. The Power will be supplied near Condensing units. The wiring will be measured between Indoor & Outdoor and will be measured once only, i.e. it will be considered one circuit only.

SERVICES TO BE PROVIDED BY CUSTOMER

a) Main incoming power supply near Indoor & Outdoor units along with suitable size weather proof Switch fuse unit.

b) Water & Electricity for erection, Testing & commissioning.

c) Any kind of exposed roof insulation work. Provision of Venetian blinds.

LIST OF APPROVED MAKE /VENDORS

1.	*G.I. Steel section IS 277-1985 Part I Certified*	1. INDIA GYPSUM 2. LAFARGE
2.	*Glass Reinforced Gypsum Board / tiles IS 2095-1982 certified*	1. INDIA GYPSUM 2. LAFARGE
3.	*Clear Float Glass*	1. MODI 2. SAINT-GOBIN
4.	*Flush doors* *IS: 2202 Certified Part I*	1. GREENLAM 2. DURO 3. ARCHIDPLY 4. EURO 5. MAYUR PLY 6. CENTURY
5.	*a) 19mm thk. Fire Retardant Ply*	1. GREENPLY 2. DURO 3. ARCHIDPLY 4. CENTURY
	b) Fire Retardant Ply (6mm, 8mm, 12mm)	1. GREENPLY 2. DURO 3. ARCHIDPLY 4. CENTURY
6.	*Laminate IS 2046 Certified*	1. GREENLAM 2. SUNMICA 3. OPTUS 4. ARCHIDPLY
7.	*HARDWARE* *Floor Springs*	1. DORMA 2. DOORKING 3. OZONE
	Hinges	1. EARL BIHARI 2 KAIF
	Drawer slides.	1. EARL BIHARI 2 KAIF 3. FLY RAIL
	Mortice lock with handles, Tubular Latch with Key	1. DOORSET 2. GODREJ 3. EQUAVALENT

	Key board Tray / CPU Trolley	1.	EBCL
		2.	GODREJ
		3.	HORIZON
8.	*Adhesive IS –4835 - 1979 Certified*		
	For wood	1.	FEVICOL
		2.	ARELDITE
	For Foam	1.	DUNLOP
		2.	CENTURY SR
9.	*Plaster Of Paris*	1.	SUPERFINE OR Equivalent
10.	*Plastic Emulsion*	1.	ASIAN PAINTS
		2.	DULUX
11.	*Synthetic Enamel Paint*	1.	DULUX
		2.	BERGER
12.	*Melamine*	1.	ASIAN PAINTS
		2.	SHALIMAR
13.	*Electrical Wiring*	1.	KALINGA
		2.	HAVEL'S
14.	Telephone wires	1.	DELTON
		2.	FINOLEX.
15.	*Conduits*	1.	KALINGA
		2.	PRECISION
		3.	AKG
16.	*Switches / Sockets*	1.	ANCHOR
		2.	NORTHWEST
		3.	M.K.
		4.	PHILLCONE
17.	*Light Fixture*	1.	CROMPTON GREAVES
		2.	PHILLIPS
		3.	BAJAJ
		4.	HAVEL'S
18.	*Fan & Exhaust fans*	1.	CROMPTON GREAVES
		2.	G.E.
		3.	HAVELLS
19.	*MCB, D.B, ELCB*	1.	MDS
		2.	HAVELLS
		3.	INDO ASIAN
20.	Information outlet	1.	HCL
		2.	D-Link
21.	Data cable & Patch Cord	1.	HCL
		2.	D-Link

LIST OF RECOMMENDED MAKES FOR AC RELATED WORK

1	Air-Conditioning Unit (Ductable Split Units / Window / Split / High Wall / Ceiling Mounted)	Voltas/ Blue Star / Carrier / Hitachi / Daikin
2	Voltage Stabilizer Insulation Foam Copper Pipes PVC Pipe (20 Kg density)	Logicstat / Micel Paramount / Supreme Met / Diamond / Ohtc (Imported) Poly Pack / Setia
3	GI pipes	ITC / Tata / Zenith or equivalent.
4	Glass wool Insulation / Fibre glass rolls	U.P. Twiga , FGR , Kimco , Owens corning
5	Power Cables	Phenolex , Kalinga
6	Control Cable Conduit for Elect. Wires	Phenolex, Kalinga AKG , Marshal , Plaza

NOTES: -

All materials shall be used only after quality check / inspection / approval by architect.

BILL OF QUANTITY

PREAMBLE:-

TO BE READ ALONG WITH DRAWINGS.

1. RATES TO BE QUOTED BOTH IN FIGURES AND WORDS.

2. ALL PAGES TO BE SIGNED AND STAMPED BY THE TENDERER.

3. THE RATE OF THE ITEMS SHALL BE APPLICABLE FOR ANY FLOOR LEVEL/ ANY NUMBER OF FLOORS, OR ANY QUANTITY.

4. THE SPECIFICATION OF THE ITEMS SHALL BE AS PER LATEST INDIAN STANDARD CODES UNLESS OTHERWISE SPECIFIED.

5. ALL MATERIALS SHALL BE AS PER APPROVED LIST AND SHOULD BE OF Ist QUALITY UNLESS OTHERWISE SPECIFIED.

6. THE RATES ARE INCLUSIVE OF ALL DUTIES AND TAXES OF ALL GOVERNMENT, MUNICIPAL OR ANY OTHER STATUTORY BODY APPLICABLE FROM TIME TO TIME.

7. RATES SHALL BE FOR ITEMS COMPLETE IN ALL RESPECTS AS PER DRAWING, INSTRUCTIONS AND APPROVAL OF THE ARCHITECT.

8. THE QUANTITIES ARE APPROXIMATE AND TENTATIVE WHICH MAY VARY DURING COURSE OF EXECUTION. THE RATES QUOTED AGAINST PARTICULAR ITEM SHALL NOT BE CHANGED WITH VARIATION IN QUANTITIES.

9. MAKING OF ANY CUTOUT / OPENING FOR ELECTRICAL / AIR – CONDITIONING WIRING / FITTING IN ANY OF THE ITEM OF FALSE CEILING, PARTITIONS, PANELING MASONRY WORK ETC. AND FINISHING EDGES JAMBS / CILLS / SOFFITS OF THE OPENING SHALL NOT BE PAID EXTRA.

10. THE TENDERER SHALL VISIT THE SITE AND SHALL SATISFY HIMSELF AS TO CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED. HE SHALL ALSO CHECK, ASCERTAIN THE LOCATIONS OF ANY EXISTING STRUCTURES OR EQUIPMENT OR ANY OTHER SITUATION WHICH MAY AFFECT THE WORK. NO EXTRA CLAIM AS A CONSEQUENCE OF IGNORANCE OR ON GROUND OF INSUFFICIENT DESCRIPTION WILL BE ALLOWED AT A LATER DATE.

11. THE QUOTED PRICE FOR ITEMS SHALL INCLUDE ALL ACCESSORIES, CONSUMMABLES ETC. AS REQUIRED TO MAKE THE ITEM COMPLETE IN ALL RESPECTS, COMPATIBLE WITH OTHER RELATED / ASSOCIATED ITEMS AND FULLY FUNCTIONAL.

12. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY ERROR, DIFFICULTY IN EXECUTION / DAMAGES INCURRED OWING TO DISCREPANCY IN DRAWINGS WHICH HAS BEEN OVERLOOKED BY HIM AND HAS NOT BEEN BROUGHT TO THE NOTICE OF THE ARCHITECT.

13. THERE ARE NUMBER OF ITEMS GIVEN IN THE TENDER WHERE IN BASIC RATES INCLUDING ALL TAXES EXPECTED HAS BEEN MENTIONED IN THE TENDER. THESE ITEMS SHALL BE PURCHASED BY THE CONTRACTOR FROM THE MARKET ONLY AFTER THE APPROVAL OF QUALITY AND RATES BY THE ARCHITECT.

14. ALL HIDDEN SURFACES OF BOARD / PLY / WOOD WORK TO BE PAINTED WITH ANTI BACTERIAL PAINT FROM NAV AIR INTERNATIONAL FR 881 (VIPER) (WHITE COLOUR AS PER MANUFACTURER'S SPECIFICATIONS ON WOOD / BOARD).

15. CONTRACTOR SHALL APPOINT TECHNICALLY QUALIFIED FULL TIME SITE SUPERVISOR TO MONITORING THE DAY TO DAY PROGRESS OF WORK AT SITE ON THEIR OWN COST.

SL.NO.	SUBHEAD		AMOUNT (Rs.)
SCHEDULE "A" FURNISHING WORK			
1.0	FALSE CEILING	:	Rs.
2.0	PARTITION WORK	:	Rs.
3.0	DOORS / WINDOWS	:	Rs.
4.0	WORKING COUNTER	:	Rs.
5.0	STORAGE	:	Rs.
6.0	ELECTRICAL WORK	:	Rs.
7.0	TELEPHONE WIRING	:	Rs.
	TOTAL (SCHEDULE "A")	:	**Rs.**
SCHEDULE - 'B' (FURNITURE & FIXTURE)			
1.0	TABLES	:	Rs.
2.0	ELECTRICAL FITTINGS & FIXTURES	:	Rs.
3.0	MAIN BOARD, DB'S	:	Rs.
	TOTAL (SCHEDULE "B")	:	**Rs.**
SCHEDULE - 'C' (SERVER ROOM INTERIOR WORK)			
I.	**FURNISHING WORK**	**:**	**Rs.**
II.	**ELECTRICAL WORK**		
1.0	ELECTRICAL WIRING	:	Rs.
2.0	CONDUITING & CABLING FOR DATA SYSTEM	:	Rs.
3.0	CONDUITING & CABLING FOR U.P.S. SYSTEM	:	Rs.
4.0	LIGHT FIXTURE & FITTINGS	:	Rs.
	SUB TOTAL "II"	:	**Rs.**
III.	**AIR CONDITIONING WORK**	:	**Rs.**
	TOTAL (SCHEDULE "C")	:	**Rs.**
SCHEDULE - 'D' (ATM WORK)			
1.0	INTERIOR WORK	:	Rs.
2.0	MISCLLANEOUS WORK	:	Rs.
3.0	PAINTING & PANELLING	:	Rs.
4.0	ELECTRICAL INSTALLATIONS	:	Rs.
	TOTAL (SCHEDULE "D")	:	**Rs.**

SCHEDULE - 'E' (MISC. WORK)

1.0	PIN UP / NOTICE BOARD	:	Rs.
2.0	BLINDS / CARPET	:	Rs.
			==========
	TOTAL (SCHEDULE "E")	:	**Rs.**
			==========

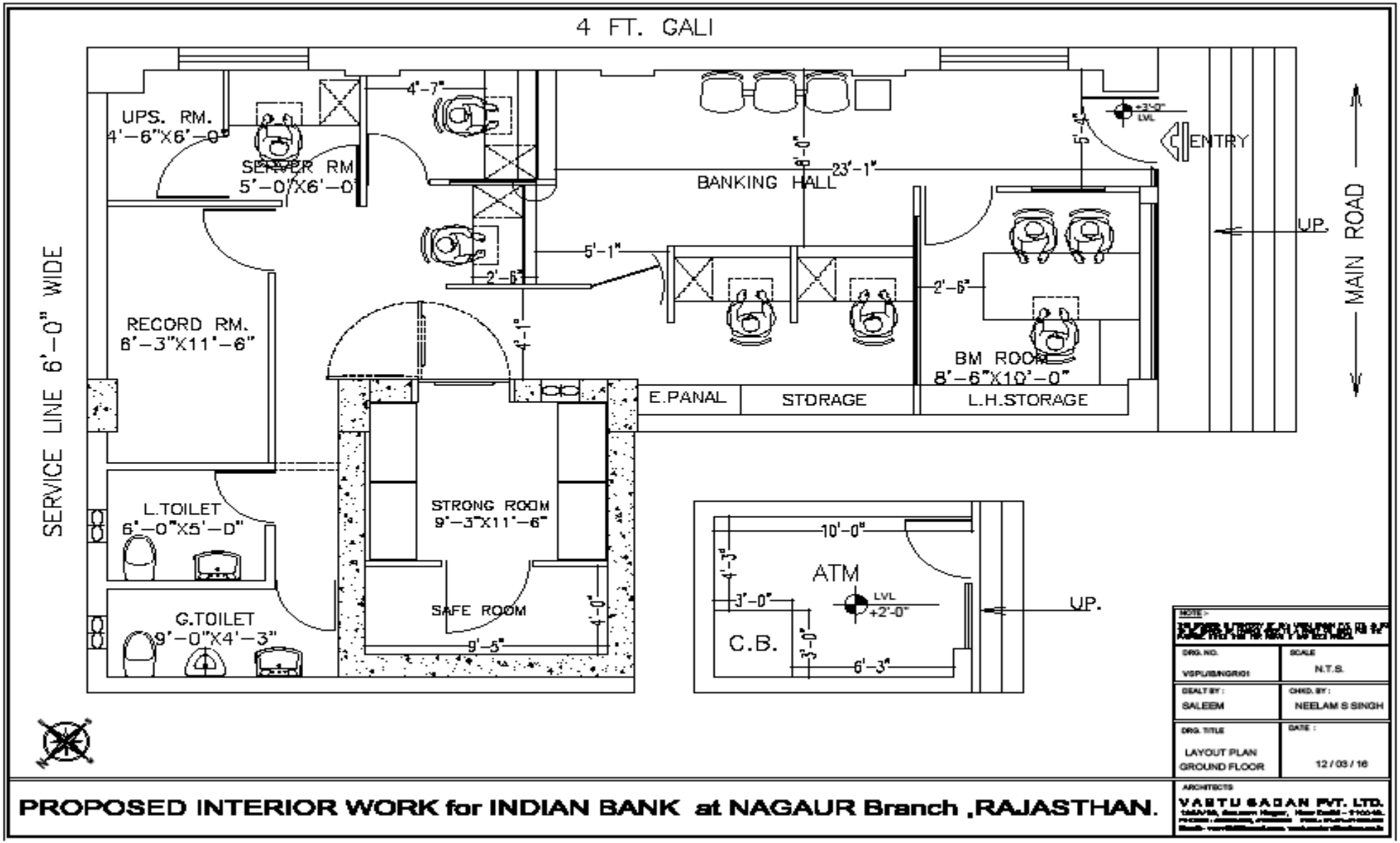
SCHEDULE - 'F' (PAINTING WORK)

1.0	PAINTING WORK	:	Rs.
			==========
	TOTAL (SCHEDULE "F")	:	**Rs.**
			==========

TOTAL "A + B + C + D + E + F "	**:**	**Rs.**
		==========
(-) DISCOUNT IF ANY	**:**	Rs.
		==========
GRAND TOTAL	**:**	**Rs.**
		==========

(**RUPEES**_____

_____**Only)**


4 FT. GALI
UPS. RM.
4'-6"X6'-0"
SERVER RM
5'-0"X6'-0"
4'-7"
BANKING HALL
23'-1"
6'-0"
5'-4"
+3'-0" LVL
ENTRY
UP.
MAIN ROAD
5'-1"
2'-6"
2'-6"
4'-1"
RECORD RM.
6'-3"X11'-6"
BM ROOM
8'-6"X10'-0"
E.PANAL
STORAGE
L.H.STORAGE
SERVICE LINE 6'-0" WIDE
L.TOILET
6'-0"X5'-0"
STRONG ROOM
9'-3"X11'-6"
SAFE ROOM
9'-5"
4'-0"
G.TOILET
9'-0"X4'-3"
10'-0"
4'-3"
ATM
LVL
+2'-0"
3'-0"
C.B.
3'-0"
6'-3"
UP.
NOTE :-
DRG. NO.
VSP/LIB/NGR/01
SCALE
N.T.S.
DEALT BY :
SALEEM
CHKD. BY :
NEELAM S SINGH
DRG. TITLE
LAYOUT PLAN
GROUND FLOOR
DATE :
12 / 03 / 16
ARCHITECTS
VASTU SADAN PVT. LTD.
PROPOSED INTERIOR WORK for INDIAN BANK at NAGAUR Branch ,RAJASTHAN.