

**Roads & Building Department
Government of Gujarat**

Division_____

**TENDER
FOR
ELECTRICAL WORK**

Name of work _____

Estimated Cost Rs._____

Date of issue of tender_____

Last Date of Receiving fender_____

Name of Works _____

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Last Date of Receipt of Tenders by R.P.A.D.Dt.

Issued to M/s. _____

Divisional Accountant / D.A.O.
Executive Engineer..

Instructions to Tenderers

1. Tenders, sealed and marked on the outside for

"will be received by the undersigned

Upto the

day of 200

in the form of "Tender for Electrical Works" hereto annexed

2. The tenderers shall state precisely in his tender the type and description of the materials, plant and stores he proposes to use for the work. If he proposes to use materials, plant or stores of other than Indian manufacture he must clearly state this in his tender, together with the name, manufacturer and of the country of origin of the same.
3. The officer with whom cash deposits are to be made, or to whom securities are to be endorsed in accordance with clause 3 of the General Conditions of Contract for Electrical Works, is the Ex. Engr. _____
4. The work must be carried out in accordance with the General Conditions of Contract " for Electrical Works, and the general specification for electrical works in Government building.
5. Plans may be seen, in the office of the Ex.Engr. _____
_____Division.
Department _____
6. The Governor of Gujarat does not undertake to accept the lowest or any tender.

Date : - - 200

Executive Engineer

Original

Form of Tender for Electrical Works

Department

1. I/We do hereby tender to execute the whole of the work

Described in the accompanying tender for the several sums, and in the case of measured works, at the several rates, set forth in the tender hereto attached and signed by me/us and should this tender be accepted. I/We further undertake to complete the work within the time stated below reckoned from the date of acceptance of tender, namely.

2. I/We do agree and bind myself/ourselves to abide by and fulfill the general conditions of contract and the Special Conditions of Contract annexed to the Specification or in default thereof to pay to the purchaser, as reasonable compensation for such breach of such conditions, the sums of money mentioned in the said condition.

3. I/We further agree to make good at my/out own expense all defect in the installation which appear within twelve months from the date bringing the installation into beneficial use when such defects are due to defective workmanship or material executed or supplied by me/us.

4. I/We hereby declare that my/our near relative are not working in this Division or in its sub-division as an Ex. Engineer, Deputy Executive Engineer, Additional Assistant Engineer, Overseer, Divisional Accountant, Store Keeper, Manager of Atithi/Vishram Gruha and in the circle as a Superintending Engineer in addition for Panchayat Works not working nor having posting as Chairman of P.W. Committee or as incumbent in Jilla Panchayat at today.

Signature(s)

Dated at

The date of 200

The above tender is hereby accepted by me for and on behalf of the Governor of Gujarat.

Dated at

The date of 200

Executive Engineer,

Duplicate

Form of Tender for Electrical Works

Department

1. I/We do hereby tender to execute the whole of the work

Described in the accompanying tender for the several sums, and in the case of measured works, at the several rates, set forth in the tender hereto attached and signed by me/us and should this tender be accepted. I/We further undertake to complete the work within the time stated below reckoned from the date of acceptance of tender, namely.

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Signature(s)

Dated at

The date of 200

The above tender is hereby accepted by me for and on behalf of the Governor of Gujarat.

Dated at

The date of 200

Executive Engineer,

GENERAL CONDITIONS

1. The work of the Electrical Installation shall be carried out as per I.S Specifications I.S. 732-Code Part I, II & III - 1982-83 of practice of Electrical wiring and fitting in building.
 For Hospitals I.S. 7732 of 1985
 For Educational Installation I.S. 108941-1984
 For Aluminium Conductor I.S. 398-1984 Part III
2. The fitting should be fixed with mild steel hooks to be supplied and erected and duly grouted in the cement concrete by the contractor wherever possible the decision of the Ex. Engr. in respect of the feasibility of providing such hooks in the cement concrete, shall be final and binding on the contractors.
3. The work shall have to be completed within the prescribed time limit unless the extension in the time limit at the instance and the request of the 'contractors is granted by the authorities in which case, the application for the extension in time limit have to be made by the contractors by registered post before the date of expiry of the schedule time limit under the agreement.
4. The amount of Rs. 1-00 for each empty wooden box of ceiling fan and 0-50 paise for each empty wooden box of Table fan issued to the contractors for* the work as per Schedule B of the work shall be recovered from the Contractors.
5. Materials required for the work shall be supplied to the contractor as per rates mentioned in the Schedule 'A' attached herewith and the cost of materials will be recovered from their bills.
6. The tender documents required shall have to be filled in either in ink or by ballpen.
 (G.R.B. & C. Dept. No. TNC-1175-1113-853/198 V. dtd.8-6-79.)
7. In addition to the above the tender will also be liable to be rejected outright if
 - (i) Any of the pages of the tender is/are removed or replaced.
 - (ii) In the case of "item rate" tender, the rates are not entered in ink. in figures and words and the total of each item and grand total are not struck by the tender or in ink in the last column of schedule 'B' under his signature.
 - (iii) All corrections, additions or pasted slips are not initialed by the tenderer,
 - (iv) Any erasure is made by him in the tender AND
 - (v) The tenderer in the case of a firm, each partner or the person holding the power of attorney thereof does not sign or the signature is/are not attested by witness on page 8 of the tender in the space provided for purpose.
8. A certificate of registration as approved contractor should be attached with the tender.
9. In respect of tenders from the co-operative society a solvency certificate of an amount equal to 20% of the amount of the work put to tender will have to be produced along with the tender or a certificate, regarding the borrowing capacity of the society issued by the legal Assistant, Directorate of Cottage Industries will have to be produced along with the tender.
10. The several documents forming the contract are the essential parts of the contract and requirement occurring in one is as binding as though occurring in all, they are intended to be mutually explanatory and complementary and to describe and provide for a complete work.
11. In the event of any discrepancy the several documents forming the contract or in any one document the following order of procedure should apply:
 - (a) Dimension and quantities:
 - (i) Drawing
 - (ii) Schedule 'B' of the tender form
 - (iii) Specification
 On drawing figures, dimensions unless obvious in contract will be followed in preference to sealed dimension.
 - (b) Description:
 - (i) Schedule 'B' of the tender form
 - (ii) Drawings
 - (iii) Specifications
 In case of defective description or a ambiguity, the Ex. Engineer in charge should issue further instructions directing in what manner the work is to be carried out is being understood that the last modern practice is to be followed. The contractor should forthwith comply with such instruction.
12. The contractor should take no advantage of any apparent error, omission in drawings or a specifications and the Ex. Engineer in charge should be permitted to make fulfill the intent of the plans and specifications.
13. Controlled materials (Essentially certificate)
 - (i) As regards "Controlled materials, the R. & B. Dept. will help to arrange for the permits as far as possible and hold the contractor in securing the same. All incidental charges in procuring these materials shall be borne by the permit as far as possible by the contractor himself. Though the R. & B. Dept. will help to arrange for the permit as far as possible and help the contractor in obtaining the materials, it shall not accept any responsibility for any delay or loss or account of delay caused to the contractor while obtaining the same.
 - (ii) The contractor shall submit the monthly returns in the prescribed forms at to the receipts and actual use of the controlled materials during the month to the Ex. Engr. of every calendar month.
 - (iii) The contractor shall submit the Ex. Engineer or his representatives to inspect the stock of the controlled

materials by him at any time whenever the Ex. Engineer or his representatives so desire.

14. The tender for the work shall remain open for a period of 90 days (Ninety days) from the date of opening of tenders for the work. The offer having validity less than 90 days will be rejected outright. The tenderes will not be allowed to withdraw or modify the offer on his/their own during the course of finalization of tender.
15. The contractor shall employ only such labourers who shall produce a valid certificate of having been vaccinated against small pox within a period of last three years.
16. The contractor shall provide drinking water facilities to the workers, labourers to comply with the provisions, the engineer in charge shall give notice facility to the workers, Labourers within a period of ten days from the date of the notice in writing, the Engineer in charge shall there upon make the arrangement for the drinking water at the cost of the contractor.
17. The contractor shall provide the amenity of shade and shelter to the workers, labourers and their children on Govt. work as soon as the work starts" If the contractor fails to provide shade and shelter than the Govt. Shall provide the same at the cost of the contractor.
Govt Resolution PWD No. TNC-2172 (i) 76-C Dt, 4-7-1973.
18. Challan for earnest money @ 1% of the estimated cost must accompany the tender. Tenderer may pay earnest money up to Rs. 50,000 in cash or on the form of Crossed demand Draft or in case of tenderer is member of only IEEMA DEPOSIT AT CALL receipts of Nationalized or scheduled Bank drawn in favour of Executive Engineer, Divisional Officer concerned. However in respect of the works estimated to cost above Rs. 50 lacs, the amount of earnest money in excess of Rs. 50,000 Can be offered by the contractor, at his choice, in the form of Bank Guarantee of the Scheduled Bank only. The Bank Guarantee in such cases will be furnished in the following form. In such cases also, the amount of first Rs. 50,000 will be paid in the form of cash or crossed demand drafts or fixed deposit receipts or deposit at call receipts worth the validity period of not less than the 6 Months of the nationalized or Scheduled Banks.

The Contractors, who have secured exemption Certificate for payment of earnest money by depositing Lump Sum earnest money, but produce the certified copy of the exemption certificate along the tender.

BANK GUARANTEE

Where as M/s. _____ (hereinafter called the Tenderer) is desirous and preferred to tender for works in accordance with the terms and conditions of tender for the work of _____ and where as We, Bank agree to give the tenderer a guarantee for the Earnest Money.

1. Therefore, we hereby affirm that we are guarantors on behalf of the Tenderer up to total rupees _____ in words) Rs. _____ (in figures) and we undertake to pay to Executive Engineers _____ Division _____ Department of Government of Gujarat the _____ (name of Govt. previous notice of judicial or to be specified). up to his first written demand, without demur, without delay and without the necessity of a previous notice of judicial or administrative procedures and without the necessity to prove to the Bank the defects or shortcomings or debits of the contractor any sum within the limit of Rs. _____

2. We further agree that the Guarantee herein contained, shall remain in full force and effects during the period that would be taken for the acceptance of tender.

However, unless a demand of claim under this Guarantee is made on us in writing on or before the _____ (Date to be specified-will not be less than 180 days from the date of opening the tender) we shall be discharged from all liabilities under the guarantee thereafter.

3. We undertake not to revoke the guarantee during currency except with the previous consent of the Executive Engineer _____ Division _____ in writing.

4. We lastly undertake not to revoke the guarantee for any charge in constitutions of the Tenderer or of the Bank.

Date

Signature & Seal of Guarantor _____

Bank Address _____

19. Wires of I.S.I. mark will be allowed to be used on the work.
20. The rates should be written both in words and figures inclusive of all taxes and duties.
21. The percentage additions in total amount tendered of any items is not allowed however if over all reduction in

*Strike out whichever is not applicable.

and figures. If no reduction is to be made the gap should be filled in by the word 'NIL'.

Note : As per Govt. Resol. No. CDN/1269/PAC/51-C.dt. 15/4/1978

22. Safeguards :

- That the percentages and the tender amount by each contractor shall actually be shown to the other contractors who may be present at the time of opening the tenders.
- That a tender with any erasures and/or over writing in percentage (both in word and in figures) shall be rejected outright.
- That insertions and or correction in the percentage quoted (both in words and in figures) resulting into increase in the value of the work shall be liable to be rejected outright unless it is authenticated by the officer opening the tender at the time of opening tender as well as the contractors they may be present at the time of opening tender and.
- That any other correction or insertions shall be authenticated by the officer opening the tender and the intending bidders who may be present.

23. Wherever secured advance has been granted the contractor should provide necessary sign board indicating the face of hypothecation of the materials to the Govt. and exhibited the same publically prominently.

(Govt. in P.W.D. Resol. No. PWD-2675-IB-905-66-C. dtd.30-11-77).

24. The contractor should give a written undertaking while applying for the grant of secured advance in case of the agreement indenture bond already prescribed to the effect that he has not taken or caused to be taken not shall he take or caused to be taken any advance on the same materials on which secured advance is applied for from any other person/firm, corporation, limited company or any financing institution like Bank etc. by hypothecating or pledging the materials (Govt. in P.W.D. Resolution No. PWD-2675 B/905/66-C dtd.30-11-77)

25. Any error in quantity or amount in Schedule 'B' showing items of works to be carried out shall be adjusted in accordance with the following rules:

- In the event of a discrepancy between description in words and figures quoted by a tenderer in the rates column, the description in words shall prevail.
- In the event of an error occurring in the amount column of the Schedule 'B' showing item of works, as a result of wrong multiplication of the unit rate and quantity, the unit rate shall be regarded as firm and multiplication shall be amended on the basis of the rate.
- All errors in totaling in the amount column, and in carrying forward totals shall be corrected.
- Any rounding off of amounts against items of in totals shall be ignored. The tendered sum so altered shall for the purpose of tendered be substituted for the sum original tendered and considered for acceptance.

26. Battens shall be teakwood for acceptable quality and shall be varnished before fixing in position.

27. Wooden-cup board should be polished on both the sides.

28. Income-tax clearance certificate in a revised form should invariably be attached with the tender papers Otherwise tender may not be considered.

29. Whenever Government materials are issued, the contractor shall be responsible for the safe custody and proper use of the materials.

30. Loose electric fitting connection should be done at the time of handing over possession of building to the concerned civil or administrative department and accordingly after taking over possession of these connection concerned Civil/Administrative department is responsible for fittings.

31. (i) Late tenders (i.e. tender received after the specified time of opening) Delayed tender (i.e. tenders received before the time of opening but after the due date time or receipt of tenders) and post tender offers shall not be opened and considered at all.

31. (ii) The tenders received (by registered post after the time of date specified in the tender notice) shall not be received by the concerned office from the postman, for which date and time may be recorded on the cover of the tender as to when tender was refused by the Divisional Accountant or the Divisional Head or any other person in charge.

૩૧. ૧ કરોડથી વધુ રકમનાં વર્ક્સ કોન્ટ્રાક્ટ સંબંધે રકમની ચુકવણી વખતે ચૂકવવાપાત્ર થતી રકમમાંથી નીચે મુજબન ૧ થી ૩ ની રકમ બાદ કર્યા પછી રહેતી સિલક ઉપર ૨ ટકાની રકમની કપાત કરવામાં આવશે. (૧) આંતર રાજ્ય વાણિજ્ય અને વપાર દરમ્યાનનાં વેચાણ થયેલ માલની કિંમત (૨) વર્ક્સ કોન્ટ્રાક્ટની રકમમાં સંડોવાયેલ મજૂરીની રકમ (૩) આંતર રાજ્ય વાણિજ્ય અને વેપાર દરમ્યાનની ખરીદી અથવા રાજ્ય બહારથી આયાત કરેલ માલની ખરીદીની કિંમત. પરંતુ (૬) મુજબ રાજ્ય સરકારે રાખેલ વર્ક્સ કોન્ટ્રેક્ટ પરત્વે રાજ્ય સરકારે ચુકવવાની થતી રકમના પ્રસંગે તા.૧-૪-૨૦૦૨ પછી ચુકવણી કરવાની થતી રકમ પરત્વે કલ ૫૭-ખ ની ટી.ડી.એસ.ની જોગવાઈ લાગુ પડશે નહીં.

ઉપરોક્ત બાદ કરવાની રકમ નક્કી કરવાનાં હેતુથી સેલ્સ ટેક્સના નમુના ૫૭-ક નાં નિયત કરેલ ફોર્મમાં લેખિત નિવેદન કોન્ટ્રાક્ટરે રજૂ કરવાનું રહેશે. (વેચાણવેરા કમિશ્નરશ્રી ગુજરાત રાજ્યનો તારીખ ૨૨-૪-૦૨ તથા ૨૦-૮-૦૨ નો જાહેર પરિપત્ર ક્રમાંક ગુજકા/ ૧૦-ક/ ૫૪૮/ ક-૫૭-ખ/ વેલીડેશન એક્ટ/ ૨૦૦૨-૦૩ જા.૧૧૭૭/૭૦૨)

Executive Engineer.

Signature of contractor/s

Division

**GENERAL CONDITIONS OF CONTRACT FOR ELECTRICAL WORKS IN THE BUILDING AND COMMUNICATION
DEPARTMENT
GENERAL CONDITIONS OF CONTRACT**

1. Definition of terms:

In construing these general conditions and the annexed specification the following words shall have the meaning here assigned to them unless there is something in the subject or context inconsistent with such constructions:

The "GOVERNOR OF GUJARAT" shall include his successors and assigns.

The "Engineer" shall mean the Ex. Engineer, Electrical Division, for the time being attached to the Public Works Department of the Gujarat state or such other officer as may be appointed by the Ex. Engineer, Electrical Division to supervise the work on behalf of the Governor of Gujarat.

The "CONTRACTOR" shall mean, the Tenderer whose tender, shall be accepted by the Governor of Gujarat, and shall include the tenderer's legal personal representatives or successors and assigns.

"PLANT" shall mean and include any machine, fixed or movable, used for the generation or transmission of power, or actuated by power.

"WORK" or "WORKS" shall mean the whole of the plant and material to be provided and work to be done, executed or carried out by the contractor under the contract.

The "CONTRACT" shall mean all the documents by which the agreement by the contractor to be provide to execute or carry out the plant work or works shall be constituted or in or by which the terms of such agreement or any of them are contained or set forth specially as per these General conditions, any special conditions attached to or issued, with these conditions, the specification, the Drawings, the invitation for Tenders (if any) or any other letter, notice or document upon or with reference to which the Tender is made and the schedule of prices (if any) furnished by the contractor with his Tender.

The "SPECIFICATION" shall mean the specification annexed to these General conditions and the Schedule thereto (if any).

The "SITE" shall mean the whole of the premises, buildings and grounds in or upon which the Plant work or works is or are to be provided, executed, erected, done or carried out.

The "DRAWINGS" shall mean the drawings issued with the specification which will ordinarily be identified by being signed by the Engineer and any further drawings submitted by the contractor with his tender and duly signed by him and accepted or approved by the engineer and all other drawings supplied or furnished by the contractor or by the Engineer in accordance with these General conditions.

The "SPECIAL CONDITIONS" shall mean the special conditions of contract (if any) attached to general conditions.

The "SCHEDULE" shall mean the schedule or schedules attached to the specification.

2. Contractor to inform himself fully:

The contractor shall be deemed to have carefully examined the invitation for Tenders(if any) the general and any special conditions, the specification and Drawings and the Schedule of price(if any). In case of discordance or want of agreement between or amongst the several things herein described as the grounds or data of the contract, then these conditions shall have precedence of and be held to be more correct and binding than the specification or any condition referred to therein, or in any other documents forming part of contract, and in like manner detailed drawings shall be held to be more correct, and binding than general drawings and in like manner drawings made to a large scale, or for special instruction, shall be held to be more correct and binding than drawing made to a smaller scale, or for general instruction and figured dimensions shall be held to be more correct than dimensions by scale but subject nevertheless in case of doubt or dispute as to any of the matters aforesaid to the determination and decision of Engineer as hereinafter is more particularly mentioned and provided always that nothing herein contained shall limit the powers of the engineer hereinafter mentioned

3. Security Deposit:

The person/ persons whose tender is accepted (hereinafter called the "Contractor" which expression shall, unless excluded by, or repugnant to the context include his Legal heirs, executors, administrators and assignees) shall (a) Deposit Government securities (as mentioned in Para 2088 of Gujarat Public Works Department Manual Vol. 1) duly transferred in the name of the Executive Engineer or fixed deposit or Term Deposits of Narmada Project in the name of the Executive Engineer within a period of 10 days from the date of the Notification of acceptance of his tender, or (b) (i) deposit fifty percentage of the total security deposits as specified in the tender form with the Executive Engineer in form of small saving schemes or securities of Sarovar Narmada Nigam or F.D. Rs. of scheduled bank. However, the Contractor can deposit twenty five percentage of total security deposit in the form of Govt. security (as mentioned in Para 208 of Gujarat Public Works Department Manual Vol. 1) or Term Deposits of Narmada Project duly transferred in the name of

Executive Engineer, or fixed deposit receipts in the name of the Executive Engineer within a period of ten days from the date of receipt of notification of acceptance of his tender. If the security deposit is not paid within the above specified time, no work order will be issued till the issue about delay is finally decided by the competent authority. (b) (ii) The Government shall be deemed to have been authorized to deduct the balance of fifty percentage of the security deposit as specified in the tender form from the amounts that become payable to the contractor for the work done under the contract from time to time, such deduction shall not exceed ten percentage of the amount so payable and the whole amount paid in cash or by way of deduction shall be held by Government by way of security deposit. For the works whose estimated amount is more than rupees fifteen lacs, the Contractor shall have to give the performance bond supported by F.D.R. or Unconditional. So that same can be encashed without given any reason by the Executive Engineer Non Transferable and Irrevocable Bank Guarantee of any schedule bank equivalent to five percentage of the estimated amount put to tender along with the initial security deposits. All compensation, Liquidated damages or other sums or money payable by the contractor to Government under the terms of this contract shall be deducted from or recouped by the realization of a sufficient part of his security deposit, or from the interest arising there from or performance bond or from any which may become due by Government to the Contractor on any account whatsoever and whether in respect of this contract, any other contract, or otherwise. In the event of his security deposit being reduced by reason of any such deduction or recoupment as aforesaid, the contractor shall within ten days thereafter, make good in cash or in Government securities transferred as aforesaid any sum or sums required to make good the shortfall in the amount of the security deposit. The security deposit, when paid as above shall at the cost of the depositor, be converted into interest bearing Government securities in the name of Executive Engineer provided that the depositor has expressly desired this in writing. This is subject to the condition that twenty five percentage of the total security deposit must be held in the form of small saving Schemes or Term Deposits of Narmada Project. If the full amount of the security deposit to be paid as above within the period specified above, is not paid the tender/contract already accepted shall be considered as cancelled and legal steps shall be taken against the contractor for recovery of the amounts.

Fifty percentage of the Security Deposit along with performance bond shall become refundable within fifteen days after the final completion certificate is issued as per Clause-25. All dues under this contract or other contract, or otherwise; including the royalty charge if "No Due-Certificate" is not produced by the contractor shall be recovered from the aforesaid amount of fifty percentage of the said security deposit and the balance shall be refunded within fifteen days after the final certificate is issued as per clause-25. The remaining fifty percentage of the security deposit shall be refunded after the expiry of the Defect Liability period as per clause-33 after deducting there from the amount of expenses, if any due to Government under this contract.

Annexure PERFORMANCE BOND

(The date of this bond must not be prior to the date of the instrument in connection with which it is given)

Principal (Contractor)

Surety (Bank)

Sum of bond (express in words and figures)

Contract No. and date of contract

KNOW ALL MEN BY THESE PRESENTS, THAT WE, THE PRINCIPALS AND SURETY above named are held and firmly bound unto the _____ hereinafter called the Employer in the amount stated for payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrator and successors jointly and severally, firmly by these presents subject to the provisions of which the aforesaid Contractor on demand and without demand on a claim being made by the Employer.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principals have entered in to a contract with the Employer numbered and dated as shown above and hereto attached for the execution of work _____

NOW THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original terms of the said Contract and any extensions thereof that may be granted by the Employer with or without notice to the surety and during the life or any guarantee required under the contract and shall also well and truly perform and fulfill and the Undertakings, covenants, terms, conditions and agreements of any all duty and unduly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the surety hereby waived or shall pay over, make good and reimburse to the Employer all loss and damages which the employer may sustain by reason of failure or default on the part of said Principal so to do.

We _____ further agree that the guarantee herein Contained shall remain in full force and effect during the period that would be taken for the validity of the said Contract, and that it shall continue to be enforceable till all the dues of the employer under or by virtue of the Contract have been fully paid and its claims satisfied or discharged or till the Employer certifies that the terms and conditions of the Contract have been fully and properly carried out by the said Contractor and accordingly discharges the guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the _____ we shall be discharged from all liability under this guarantee thereafter.

IN WITNESS WHERE OF, the above bounded parties have executed this instrument under their several seals on the date indicated above the name and corporate seal of each corporate partly being hereto and these presents duly signed by its undersigned representatives, pursuant to authority of this governing body.

In the presence of witness _____

individual

Principal

1. _____ as to _____ (seal)
2. _____ as to _____ (seal)
3. _____ as to _____ (seal)
4. _____ as to _____ (seal)

Attested

by _____ affix Corporate Seal
Corporate surety
Business address

Affix by _____ Corporate Seal

Title

For and on behalf of the Employer

4. Mistake in contractor's Drawings:

The contractor shall submit such drawings as may be required and shall be responsible for any discrepancies, errors or omissions in any drawings or other particulars supplied by him notwithstanding that such drawings or particulars may have been approved by Engineer.

5. Patent Rights etc:

The contractor shall fully indemnify the Governor of Gujarat against all actions, suits, claims, demands, costs, charges and expenses arising from or incurred by reason of any infringement or alleged infringement, of any, letters patent, design, trademark or name copyright or other protected rights in respect of any machine, plant, work materials thing or system or method of using, fixing, working or arrangement used or fixed or supplied by the contractor but this indemnity shall not extend or apply to any action, suit, claim, demand, cost, charges or expenses arising from or incurred by reason of the use of the work or any part thereof otherwise than in the manner or for a purpose contemplated by the contract. All royalties and other similar payments which may have to be paid for the use of any such machine, plant, work, material, thing, system or method as aforesaid (whether payable in one sum or by installments or otherwise) shall be covered by the contract price and payable by the contractor.

In the event of any claim or demand being made or action or suit brought against the Governor of Gujarat in respect of any such matter or matters as all negotiations for the settlement of such claim or demand and such action aforesaid the contractor shall be duly notified, thereof, and he shall conduct or suit shall also be conducted by him subject if and so far as the Governor of Gujarat shall think proper under the Supervision & Control of Governor of Gujarat through the officer duly authorized on his behalf.

6. Excess over Tender quantities, Extra items & Variations in Specifications, Drawings etc.:

6.1 The Engineer-in-charge shall have power to make any alterations additions in or to the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Engineer-in-charge and such alternation shall not invalidate the contract and additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the manner above specified as part of the work shall be carried out by the contractor in the same conditions in all respects on which he agreed to do the work and at the same rate as are specified in the tender for the man work.

6.2 Except that when the quantity of any item exceeds the quantity as in the tender by more than 30% the contractor will be paid for the quantity in excess of 30% at the rate entered in the S.O.R. of the year during which the excess in quantity is first executed and for the materials consumed in excess quantity the rate for the materials to be charged would be the basic rate taken into account for fixing the rate for the S.O.R. above instead of the rate stipulated in Schedule-A.

6.3 If the additional or altered work includes any class of work for which no rate is specified in this contract, then

such class of work shall be carried out.

(i) At the rate derived from the item within the contract which is comparable to the one involving additional or altered class of work; where there are more than one comparable items, the item of the contract which is nearest in Superintending Engineer as to the nearest comparable item shall be final and binding on the contractor.

(ii) If the rate can not be derived in accordance with (i) above, such class of works shall be carried out at the rate entered in the Schedule of Rates of the Division for the year in which, the tender was received, increased or decreased by the percentage by which the tender received, increased or decreased by the percentage by which the tender amount is more or less as compared or decreased by the percentage by which the tender amount is more or less as compared to the amount arrived at the rates in the "Schedule of Rates" of the Division in the year in which the tender was received. If the Schedule of rates calculated considering such items which were included in the "Schedule of Rates" of the Division for the year and for materials consumed on such item the rate to be charged would be the basic rate taken into account for fixing the rate in S.O.R. referred to above, instead of the rate.

(iii) If it is not possible to arrive at the rate from (1) and (ii) above. Such class of work shall be carried out at the rate decided by the competent authorities on the basis of detailed rate analysis after hearing the contractor before a committee of two Superintending Engineer stationed at the same place or the nearest place.

6.4 If the additional or altered work, for which no rate is entered in the "Schedule of Rates" of the Division is ordered to be carried out before the rate is agreed upon, then the contractor shall within seven days of the date of receipt by him of the order to carry out the work, inform the Engineer-in-charge of the rate, which it is his intention to charge for such class of work and if the Engineer-in-charge does not agree to this rates, he shall by notice in writing be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner as he may consider it advisable, provided always that if the contractor's all commence work or incur any expenditure in regard thereof before the rates shall have been determined as lastly herein before mentioned, then in such cases he shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of the determination of the rate as aforesaid according to such rate or rates as shall be fixed by the Engineer-in-charge. In the event of the Dispute, the decision of the Superintending Engineer of the Circle shall be final.

Where, however, the work is to be executed according to the designs, drawings and specifications recommended by the contractor and accepted by the competent authority, the alternation above referred to shall be within the scope of such designs, drawings and specifications appended to the tenders.

The time limit of the completion of the work shall be extended in the proportion that the Increase in the cost occasioned by alternations bears to the cost of the original contract work and the certificate of the Engineer-in-charge as to such proportion shall final and conclusive.

7. Workmanship and Materials:

The work shall be carried out in all respects with workmanship and materials of the best and most substantial and approved qualities to the entire satisfaction of the Engineer who may reject any plant, apparatus of material or workmanship which shall in his opinion be of defective quality any such rejection to be final and conclusive. The contractor shall at his own expense provide all materials labour, haulage, power, tools, tackles and apparatus necessary to execute and complete the works and plant in the manner aforesaid.

8. Use of work pending completion:

The Governor of Gujarat shall be at liberty at any time to put into beneficial use the whole or any part of the work he may desire to use pending the formal completion and taking over of the same.

9. Subletting of contract:

The contractor shall not without the consent in writing of the Governor of Gujarat under the hand of the Engineer assign or sublet the contract nor make any sub contract with any person or persons for the execution of any portion of the work other than for raw materials, or for any part of the work of which the manufacturers are named on his contract.

10. Protection and liability for accidents, Theft and Damage:

The Contractor shall at all times until the commencement of the period maintenance as provided in clause 16 property and sufficiently cover up and protect all materials delivered on site from damage or injury by exposure to the weather and shall take every proper precaution against accident, damage or injury to the same from any cause. The contractor shall be and remain answerable and liable for all accident and damage thereto which until the commencement of the period of maintenance as provided for under clause 16 may arise or be occasioned by the acts or omissions of the contractor or his workmen, agents, servants or sub-contractors and all losses and damages arising from such accidents, damage or injuries as aforesaid shall be made good in the most complete and substantial manner by and at sole cost of the contract-and to the satisfaction of the Engineer.

Provided that should the Engineer certify, that the work has been completed but that owing to circumstances over which the contractor has no control the work cannot be taken over the contractor shall not be held liable for any loss of or damage to the work occasioned by such delay in taking over and occurring more than one month after the date of completion of the work as certified by the Engineer.

Until the work shall be or deemed to be taken over as hereinafter provided the Contractor shall also indemnify to Governor of Gujarat from and against all claims and demands, suits, proceedings, cost and expenses in respect of or in connection with any injury to person or damage to property by whomsoever sustained or by detective design work or material made, done, furnished or supplied by the contractor. The Contractor shall also be responsible for thefts of any property of the Governor of Gujarat or of others committed by any employees of his own or his subcontractors and shall be liable for the costs of replacing any property stolen.

11. Insurance:

Subject as hereinafter provided the Contractor shall at his own expense insure and at all times prior to the commencement of the period of maintenance keep insured against destruction or damage by fire or earthquake storm and tempest such plant and materials ordered for the work as may for the time being be upon the site for the full value of such plant and materials.

12. Materials brought on the site:

All materials, tools and tackle brought to and delivered upon the site for the purpose of the work shall from the time of their being so brought vest in and be the property of the Governor of Gujarat but may be used for the purpose of the work but for that purpose only and not on any account be removed or taken away by the contractor or any other person without the express permission in writing of the Engineer, but the Contractor shall nevertheless (Subject as hereinafter provided) be solely liable and responsible for any loss or destruction thereof or damage thereto unless resulting from causes beyond the Contractor's control not being causes insurance against destruction or damage from which is provided for in clause 11. The Governor of Gujarat shall have a lien on such materials, tools and tackle for any sum or sums which may to any time prior to the completion of the works be due or owing to him by the Contractor under in respect of or by reason of the Contract and shall be at liberty to sell and dispose of any of such materials, tools and tackle remaining after the completion of the works in such manner as he shall think fit, and to apply the proceeds in or towards the satisfaction of such sum or sums so due or owing as aforesaid but subject to such lien and power of sale and disposal such surplus materials, tools and tackle shall being to the contractor and may be removed and disposed of by him as he shall think fit after the lien is withdrawn by the Engineer in charge.

13. Default:

If the Contractor shall at any time fail in the opinion of the Engineer to proceed with, the work with due diligence and expedition, or shall refuse, neglect or omit to comply with any orders given to him in writing by the Engineer in accordance with the provisions of these conditions or shall commit any other breach of the provision of the contract, the Engineer shall be at liberty to give notice in writing to the Contractor to make good the failure neglect, omission or breach complained of and should the Contractor shall fail to comply with any such notice within such period as may be prescribed in such period as may be prescribed in such notice then and in such case the Governor of Gujarat shall be at liberty to employ workmen other than those of the contractor to perform and execute the work in respect of which the failure neglect or omission referred to in such notice shall have been committed or occurred. If the Governor of Gujarat shall be think fit, it shall be lawful for him to enter into a new contract with any other persons, or person, for the execution of such part of the work as may not have been executed and in that event the Governor of Gujarat shall, without incurring any liability to the Contractor be entitled to use all or any of the materials, tools, tackle or other things which may then be on the site for the purpose of completing the work or any part thereof and to provide any additional materials tools, or tackle required for the purpose and the cost of executing any such work and providing any such materials shall be paid by the contractor to the Governor of Gujarat on demand.

Subject to and after satisfaction of the lien of the Governor of Gujarat for any sum due to him by the Contractor for any expenses, cost or charges incurred in the completion of the work, all materials, tools, tackle or other thing remaining on the site and unsold after such completion shall forthwith hereafter be removed by the contractor.

14. Replacement of Defective work or material:

If during the progress of the work the Engineer shall notify in writing to the contractor that in his opinion the Contractor has executed any unsound or perfect work, or has supplied any materials inferior in quality to those stipulated for by the Contractor, the contractor shall at his own expense, within ten days of his receiving the notice, proceed with due expedition to remove or after and reconstruct or replace the work, or as the case may be supplied fresh materials up to

the standard of the specification. In place of the work or materials complained of by the notice (as the case may be) and in case the contractor shall fail to do so the Governor of Gujarat may after the expiration of ten days from the giving of such notice give a further notice in writing stating that the Governor of Gujarat intention so to do forthwith at the cost of the Contractor remove the work or materials complained of and perform all such work or (as the case may be) supply all such materials in place of those complained of as may be necessary or proper in order to comply with the Contractor and the cost as certified by the Engineer of any such removal and performance of work or supply of materials shall be paid by the contractor to the Governor of Gujarat on demand, provided always that nothing

in this clause shall be deemed to deprive the Governor of Gujarat or effect any other rights or remedies under the Contract or otherwise which he may have in the respect of such defects or deficiencies. No payment which have been made on account of materials delivered or work executed shall be looked on as acceptance of such or any work or materials.

15. Cutting away & making good:

The tender is to include all necessary cutting and making good for the purpose of the contract of the wood work, walls, floors, etc. of the site. The Contractor will be held responsible for, and will have to make good at his own expense, to the satisfaction of the Engineer, any damages to or disfigurement of the site which may have been caused by the acts or omissions of himself or his servants or agents in connection with the carrying out of the Contract.

16. Maintenance:

The Contractor shall make good at his own expense all defects due to faulty design material or workmanship on the part of the contractor which may during a period of 6 calendar months from the date on which the work is certified by the Engineer to have been brought into beneficial use or if no such certificate is given, from the date of the final payment for the work under clause 20, (which period is hereinafter called the "period of maintenance") develop under proper use in the work or any part thereof by replacing plant materials or work or otherwise as may be necessary. Any such making good by the Contractor shall in no case relieve him from his liability to make good any further defect in the work made good of replaced which may develop during the remainder of such period of twelve months. If any such defects are clearly, caused by the fault of the Contractor and are liable to recurrence the contractor shall make such alterations as are required to prevent any recurrence of such defects. If any defects or alterations which Contractor shall become liable to make good or make under this clause be not made good or made (as the case may be) within such time as the Engineer may prescribe for the purpose, the Engineer may proceed to make good or make the same (as the case may be) at the risk and expense of the- Contractor, but without prejudice to any other right or remedies which the Governor of Gujarat may have against the Contractor in respect of his default in making good or making the same as aforesaid and the cost of any such making good or making shall be paid by the Contractor to the Government or Gujarat on demand.

17. Contractor's Representative & workmen:

The Contractor shall employ at least one competent representative, whose name or names shall have previously been communicated in writing to the Engineer by the Contractor to Superintend the carrying out the works. The said representative, or if more than one shall be employed then, one of such representative, shall always be present on the site during working hours and any written orders or instructions which the Engineer or his duly authorized representative, whose name shall have been previously communicated in writing to the Contractor, may give to the said representative of contractor, shall be deemed to have been given to the Contractor.

The Engineer shall be at liberty to object to any representative or person employed by the Contractor in the execution of or otherwise about the Work who in the Engineers opinion shall misconduct himself or be incompetent or negligent and the contractor shall remove every person so objected to forth with upon receipt from the Engineer of notice in writing requiring him to do so.

17. A Minimum age of persons employed and employment of donkeys or other animals:

- (i) The contractor shall not employ any person who is under the age of 12 years.
- (ii) The Contractor shall not employ donkeys or other animals with breaching of string or thin rope. The breaching must be at least three inches side and should be of tape (Nawar)
- (iii) No animal suffering from sores, lameness or emaciation or which is immature shall be employed on the work.
- (iv) If contractor does not accept the proceeding conditions Nos. (i), (ii) & (iii) his tender shall not be accepted and his name shall be removed from the list of contractors.
- (v) The Engineer shall remove from the work any person or animal found working which does not satisfy these conditions and to responsibility shall be accepted by the Governor of Gujarat for any delay caused in the completion of the work by such removal.

18. Submission of Samples:

The contractor shall not without written sanction of the Engineer use for the execution of the work any materials plant or stores of any type of description other than those specified in his tender. He shall, if required to do so, or at his options, deposit samples, at the office of the Engineer for approval and the Engineer shall, within 14 days of the receipt of the samples, express in writing to the contractor his approval or otherwise of the samples deposited, and all materials, plant and stores used in the execution of the Work must be in every way equal to the deposited samples. All the deposited samples will be returned to the contractor within one month of the work being taken over.

19. Deduction from contract Price:

The amount of all costs of works, expenses or other sums which under the contract shall be payable by the contractor to the Governor of Gujarat from any moneys due or becoming due by him to the Contractor under contract, without prejudice to the Governor of Gujarat, right to- recover the same by the ordinary process of law.

20. Terms of payment:

Subject to any deduction which the Governor of Gujarat may be authorized to make under the Contract, the Contractor shall be entitled upon the certificate of the Engineer to the effect hereinafter stated **payments of R.A. Bills shall be made to the Contractor as per items, in measurable units executed according to the specifications.**

If at any time the contractor shall be prevented for any period of not less than 30 days from causes within the control of the Governor of Gujarat either first, from delivering on the site any plant or material ready in India for delivery or secondly from proceeding with the erection at any plant or materials which he had already delivered on the site, the Governor of Gujarat shall bear the cost of storage and protection, including Insurance in accordance with clause II, of the plant and material during such period in the first of such of Contractor shall be entitled to payment of 80% percent of the value certified as aforesaid of the plant or materials the delivery of which shall have been so prevented within one month from the date on which as certified by the Engineer such plant or material are so ready as aforesaid provided that all portions thereof have been suitably and sufficiently marked as being property of the Governor of Gujarat and are delivered into the custody of some person approved by the Engineer who has granted a receipt therefore.

Installments shall be due and payable by the Governor of Gujarat within one month from the date of each certificate of the Engineer.

21. Certificates of Engineer:

Every applications to the Engineer for a certificate must be accompanied by a detailed claim (in duplicate) setting forth (in the order of the Schedule of price if any) particulars of the Plant or materials delivered and work executed to the date of the claim, and the certificate as to such of the plant and work mentioned in the claim as is in the opinion of the Engineer in accordance with the contract shall be issued within 14 days of the application. No application for a certificate shall be made within 14 days of previous applications.

22. Certificate not to affect rights of the Governor of Gujarat or Contractor:

The Engineer may by any certificate make any correction or modification in any certificate previously issued by him, any payment shall be regulated and adjusted accordingly. No certificate of the Engineer shall, nor shall any payments on account by the Governor of Gujarat to the Contractor, nor extension of time for the execution of the works by the contractor which may be granted by or on behalf of the Governor of Gujarat affect or prejudice any of the rights of the Governor of Gujarat against the Contractor under or respect of the due performance of the contract, or be interpreted as approval of work done or of material supplied.

23. Suspension of work:

The Governor of Gujarat shall pay to the contractor all proper expenses arising from suspensions of the works by order in writing of the Engineer or any other officer on behalf of the Governor of Gujarat unless such suspension is due to some default on the part of the Contractor or any sub-contractor under him.

24. Damages for delay in completion:

(i) If the Contractor fails to complete the work under contract by the stipulated date, he shall pay liquidated damages of Rs. 0.1 percentage of the contract value per day from the date of delaying the said work upto the date of completion and handing over to the Government.

(ii) However also if the contractor fails to complete any part of the work Proportionate to by the time in relation to the value of such part, he shall pay Liquidated damages per day from the date of delaying the said part of the work up to the date of completion of the said designated part at the rates shown in the said schedule of the contract Value of such part for such failure till the said designated part is completed.

(iii) The aggregate maximum of liquidated damages payable under this clause shall not exceed Rs. 0.1 percentage of contract value per day and shall be subject to the maximum amount of ten percent of the estimated amount put to tender.

(iv) Delays requiring payment of ten percent liquidated damages of the amount put to tender for performance shall be sufficient clause for termination of contract and for forfeiture of security deposit. (including amount of performance bond in respect of works estimated to cost more than Rs. 15 lacs, for performance) and registration of the contractor shall also be kept in abeyance for three years from the date as fixed in all such cases.

24-A. If the Contractor shall desire an extension of the time for completion of work on the ground of his having been unavoidably hindered in it execution or on any other ground he shall apply in writing to the Ex. Engr. before the

expiration of the period stipulated in the tender or before expiration of 30 days from the date on which he was hindered as aforesaid on with the cause for making for extension occurred whichever, is earlier, and the Ex. Engr. may if in his opinion, there are reasonable and bonafide grounds for granting, and extension grant such extension as he thinks necessary or proper. The decision of the Ex. Engr. in this matter shall be final.

No applications for extension of time for completion of work shall be considered unless it is received by - registered post in the office of the Executive Engr. or left at his office and obtained receipt there of duly signed by the Ex. Engr. or his nominee authorized in this respect. :

The date of receipt, of application by the Ex. Engr. shall be considered as the date of application for the purpose of counting the period as mentioned above.

24-B. "If the contractor or his workmen, or servants shall break, deface, injure or destroy and part of the building, or the work in question in/or which they may be working or any building, road, fence, enclosure or grass-land or cultivated ground contiguous to the premises on which the work or any part thereof is being executed or if any damage shall be done to the work from any cause whatever before completion of the work or before the completion of the maintenance period whichever is later or any damages occurred/caused due to normal flood or rain or if any imperfection become apparent in it within three months from the grant of a certificate of completion, final or otherwise by the Engineer-in-charge, the contractor shall make good the same at his own expenses or in default, the Engineer-in-charge may cause the same to be made good by "other contractor, and deduct expenses (of which the certificate of the Engineer-in-charge shall be final) from any sums that may then be due or may thereafter become due to the contractor or from his security deposit or the proceeds of sale thereof a sufficient portion thereof."

24-C Force Major Clause:

Neither party shall be liable to the other for any loss or damage occasioned/caused by or arising out of acts of God, and in particular, Unprecedented floods, volcanic eruption, earthquake or other convulsion of nature and other -acts .such as but not restricted to, invasion, the act of foreign countries hostilities or warlike operations before or after declaration of rebellion military or Usurped power which prevent performance of the contract and which could not have been foreseen or avoided by a prudent person."

NOTE : "Unprecedented Flood" means the flood crossing the high flood crossing the high flood level of the Past_____year (s) which is on the available record.

(Modified Vide R & B D. G. R. No. TNC – 1096 – IB – 143 – (16) – C Dated 11-1-99)

25. Time of taking over:

The work shall for the purpose of all the provisions of these conditions be deemed to have been completed and taken over by the Governor of Gujarat when the Engineer, shall have certified in writing that it has been completed in accordance with the Contract conditions and such Certificate shall not be unreasonable withheld nor shall the Engineer delay its issue on account of commissions or defects which in his opinion do not effect the efficient use of the work, but such issue shall be without prejudice to the Contractor's liability to make good any such omissions and defects with the greatest possible expedition.

26. Death & Bankruptcy:

If the Contractor shall die, or become insolvent or bankrupt or have a receiving order made against him or compound with or make any proposal carrying on his business under inspection or for the benefit of his creditors, or commit an act of insolvency or bankruptcy, or being a corporation be ordered to be wound up or have a received of its business appointed the Governor of Gujarat shall be entitled forthwith by notice in writing to the Contractor his legal representatives to determine the contract and the Governor of Gujarat may in that event complete the contract in such time and manner and by such person as he shall think fit.

27. Disputes to be referred to Gujarat Public Works Disputes Arbitration Tribunal:

The Disputes relating to this Contract in so far as they fall within the jurisdiction of Gujarat Public Works Disputes arbitration tribunal shall be referred to the said Tribunal of Gujarat State.

However the reference to Arbitration Tribunal under this clause will not stay fulfillment of obligations of the contractor or rights of the Engineer-in-charge under this contract unless otherwise ordered to the contrary by the said Tribunal as Interim Relief measure.

(The following clause is to be deemed included in this conditions only when Plant or Machinery is included in the contract)

28. Contract Drawings:

The contractor shall submit to the Engineer, for his approval on or before the dates stipulated for this purpose in the Specification, copies, of all the drawings of the general arrangements of the plant as set out therein and of such detail

drawings as may be reasonably necessary.

Within Fourteen days from the receipt, by him of such copies the Engineer shall signify his approval or otherwise of the same and if he does not do so he shall be deemed to have approved thereof.

Within Fourteen days from the notification by the Engineer to the Contractor of his approval such copies, or in the absence of such notification within thirty days from the receipt of such copies, the copies in ink on tracing cloth or Ferro Gallic prints mounted on cloth, of all drawings as approved shall be supplied to the engineer by the contractor respectively and shall thereupon be signed by the contractor and become the property of the Governor of Gujarat.

Such signed copies of the drawing shall not be departed from in any way whatsoever except with the written permission of the Engineer. During the execution of the works of the signed copies shall be always kept available for reference on the site.

In the event of the Contractor desiring to keep in his own possession a signed copy of the drawings as approved he shall supply three copies instead of two and in this case the Engineer shall sign the third copy and return the same to the Contractor.

29. Manner of Execution, Quality of materials etc:

The plant shall be manufactured, constructed, provided, put in position and maintained in the best and most substantial and workmen like manner and materials of the best and approved qualities having regard to their respective uses.

30. Tests on site:

In all cases where the special conditions are provided for tests on the site whether of plant, materials or workmanship the Governor of Gujarat except where otherwise specifically, stipulated shall provide free of charge such labour, materials, fuel, stores, apparatus and instruments as may be requisitioned from time to time efficiently to carry out such tests in accordance with the condition.

Where electrical energy is required for tests on site and a supply is available on the site from an existing installation such electrical energy shall be supplied to the contractor by the Govt. free of charge at the pressure and frequency of the ordinary supply is available the electrical energy necessary for such tests shall be provided by the contractor.

One percent of estimated cost put to tender for this work after deducting the cost of materials as per Schedule 'A' valued at basic rate shall be deducted from the running account bills of the contractor for testing the quality of materials and workmanship, no additional testing charges in addition to the above shall be recovered from the contractor (Applicable to R & B Works only) R & BD GR No. TNC-1085-4-C, dated 20-12-91.

31. Delivery of plants & materials:

No Plant materials shall be tendered for delivery until an intimation in writing shall have been given to the contractor by the Engineer that Governor of Gujarat is ready to take delivery.

32. Tests on completion:

On the completion of the works on the site in accordance with the contract the contractor shall give the Engineer notice in writing of such completion. The Engineer shall after receipt of such notice by notice in writing under his hand for date and an hour on that date for the making of the test on site if any such are provided for the contract.

The contractor shall carry out such tests upon the date and at the hour so fixed and if the Engineer or his authorized representative shall attend on that date at that hours such test shall be carried out in the presence of the Engineer or such representative.

If any portion of the plant fails under the tests to satisfy the contract conditions similar tests according to the contract of the portion so failing shall if required by the Engineer or by the Contractor be repeated within a time to be fixed by the Engineer and the provisions of this clause shall apply to such repeat 20 test as if they were the original tests and the contractor shall pay to the Governor of Gujarat all reasonable expenses to which he may be put by such tests.

If the tests or any repeated tests so required as aforesaid be not made by the Contractor on the date fixed as aforesaid for the same by the Engineer may proceed to make such test himself at the contractor's risk and expense.

If in any test under this clause the plant tested shall fail to satisfy the contract conditions the Governor of Gujarat shall as from the date stipulated by the contract for completion nevertheless have the right of using such plant until the same shall satisfy such conditions and such use shall be at the contractor's risk. In the event of the question whether the works have been completed in accordance with the contract or any question regarding such completion being submitted to Arbitration as any portion of the plant the Engineer may certify to be capable of being used on condition of paying to the contractor a sum calculated (according to the period or the use) at the rate of 5 percent per annum upon the amount withheld or deducted in respect of such plant.

33. Rejection of Defective work:

If the works, or any portion thereof shall not in the opinion of the Engineer on the stipulated tests (if any) being made in accordance with the contract satisfy the contract condition within three months after the date stipulated for completion the engineer may give notice in writing to the contractor setting for the particular of the defects of particulars in respect of which the works in his opinion fail to comply with the contract conditions and requiring the contractor to make good, after or replace, the same within such time to be specified in the notice as the engineer may consider reasonable and the contractor shall make good, after or replace the same as required by such notice and so as to make it comply with the requirements

of the contract condition within the time so specified. Should he fail to do so within that time the Governor of Gujarat may make good alter or replace the same as so required and the cost of such making alteration good or replacement (less in the case of any replacement any sum which would have become due to the contractor under the contract in respect of the works replaced and which shall not have been paid to him) shall be paid by the contractor to the Governor of Gujarat on demand or should the Governor of Gujarat not make good, after or replace any defective works in respect of which such notice as aforesaid shall be given within six weeks from the date of the given of such notice the contractor shall repay to the Governor of Gujarat all sums (if any) paid by him to the Contractor in respect of such works. Nothing contained in this clause shall prejudice or affect the rights of the Governor of Gujarat under the contract whether in the way of enforcement of penalties or otherwise in respect of any delay in the completion of this work.

34. Use of plant of works pending making good:

If at expiration of the time specified for making good, altering or replacing the plant of works in any notice given by the engineer to the contractor under the last proceeding clause the contractor shall not have duly made good, altered or replaced the same in accordance with the contract the Governor of Gujarat shall be at liberty if he thinks fit to make use of the same for such time as shall be reasonably sufficient according to the circumstances to enable him, to make good after or replace the same (whichever he may see fit to do) provided that in respect of the period of such user, 'the Govt. of Gujarat shall not be entitled to any damages under clause 24 of these conditions and in the case of complete replacement the contractor shall be entitled to be paid in reasonable sum for the same.

35. Workman's compensation in case of injury:

The contractor shall be responsible for any compensation and shall pay to his workmen Compensation payable for injuries under, the workmen's Compensation Act, 1923 (VIII of 1923) herein after called the said Act. If such compensation is paid by Govt. as principal under subsection (1) of section 12 of the said Act, on behalf of the Contractor, it shall be recoverable by Government from the contractor under sub section (2) of the said section such compensation shall be recovered in the manner laid down in clause 3 and 19 of the condition of contract.

36. The Apprentices:

The contractors shall afford or procure as the case may be every facility to Indian apprentices for practical training in the factory.

Owned managed controlled or patronized by them, so as to enable the Indian Apprentices to acquire full knowledge of the technique and work of their trade industry, calling or profession.

37. Set-Off Clause:

Any sums of money due payee to the Contractor (including the security deposit returnable to the contractor under this contract shall be appropriated by the Government and shall be set off against any claim of the Government for the payment of sum of a money arising out of or under any other contract made by the contractor with the Government. When no such amount for purpose of the recovery from the contractor against any claim of the Government is available such a recovery shall be made from the contractor as arrears of land revenue.

38. Appointment of Local Labourers:

The contractor should as far as possible obtain the requirement of labourers skilled and unskilled from the nearest employment exchange, so as to utilize the local employment potential. If there are no local employment exchange or such exchanges are not able to provide the required labourers locally, suitable local labours should be utilized to the maximum extent possible.

39. Fair wages:

If a contractor fails to pay within 7' (seven) days to the labourer (s), worker (s) the minimum wages prescribed by the Government under the Minimum Wages Act, 1949 as in force from time to time the Executive Engineer or the officer of a equal rank shall be at liberty to deduct the amount payable to the labourer (s) workers from his (contractor's) bill or deposit(s) payable by the contractor after making due inquiries and shall not be entitled to any payment or compensation on account of any loss that he (contractor) may have to incur of the action as aforesaid Before the action as aforesaid is enforced notice in writing to the contractor shall be issued by the Executive Engineer, or the officer of the equal rank to pay the wages as per minimum Wages Act in force at the relevant time. If the contractor does not act as aforesaid within seven days then the action contemplated as above shall be taken against him.

Signature of Contractor/s

Executive Engineer

Division

SPECIFICATIONS FOR ELECTRICAL WORKS IN GOVERNMENT BUILDING SUBJECT TO THE GENERAL CONDITION OF CONTRACT IN FORCE

(1986)

GENERAL

1. Wiring Rules:

The installation generally shall be carried out. in conformity with relevant Indian Standard Specifications and code of practices prevalent, Indian Electricity Rules 1956 and Indian Electricity Act, 1910 as amended from time to time.

2. Definition:

The definition of terms shall be in accordance with Indian Standard code of Practice for Electrical wiring Installation IS-732-1982 except for the definition of point in case of Internal Electrical Installation. For definition of point wiring and measurement of Electrical works IS-5908-1970 shall be referred to.

3. Voltage and Frequency of Supply:

All current consuming devices shall be suitable for frequency of 50 C/s and system of voltage meant for unless otherwise specified.

4. Layout of wiring and its description:

(i) The wiring shall be carried out as per Schedule "power" wiring must be in screwed conduit and shall be kept separate and distinct from lighting wiring. All wiring must be done on the distribution system with main and branch distribution boards at convenient centers and without isolated fuses. All conductors shall be run as far as possible along the walls and ceiling as to be easily accessible and capable of being thoroughly inspected. The balancing of circuits will be arranged before hand by the Ex. Engineer Electrical Division.

(ii) With in one month of the taking over the installation, the contractor shall supply to the Ex. Engineer, Elect. Division a complete set of wiring diagrams of the same on drawings to be supplied when available by the Executive Engineer, Electrical Division, and to the satisfaction of the Ex. Engineer, Elect. Dn, and these wiring plans shall be "Drawings" within the meaning of the term as used in the General Conditions of contract.

5. Conductors:

All conductors unless otherwise specified shall not be less than 1.5 Sq. mm for point wiring and 2.5 Sq. mm for mains. Conductors for power and lighting circuits shall be of adequate size to carry the designed circuit load without exceeding the permissible thermal limits for the installation, and such sizes will be stipulated in specifications and or drawings.

6. Cables:

6.1 All cables shall conform to relevant Indian Standards

6.2 Conductors of all cables except the flexible cable shall be of aluminium. The smallest aluminium conductors for the final circuit shall have nominal cross sectional area of not less than 1.5 Sq. mm. The minimum size of the aluminium conductors for power wiring shall be 4 Sq. mm

6.3.1 Conductors of flexible cables shall be of copper. The minimum cross sectional area of such a cables shall be 1.0193 mm. The flexible cable shall have uniform and adequate insulation.

6.3.2 Unless the flexible cables and conductors are protected by armour or tough rubber or PVC Sheath, these shall not be used in workshops and other places where they are liable to mechanical damage.

6.3.3 Core flexible, cables shall be used for connecting single phase Appliances for phase, neutral & earth-connections.

7. Fall of Potential:

The cross sectional area of all conductors inside buildings shall be so proportioned to their lengths that the drop in voltage between main fuses and the farthest point or any lamp shall not exceed three percent of the voltage of the consumer's with all the consuming devices in use.

7.1 If the CABLE SIZE is increased to avoid the voltage drop in circuit current rating of the cable shall be more than that for which the circuit is designed. In each circuit or sub circuit every cable shall have a current rating not less

than that of the fuse which protects the circuit or sub circuit respectively for current higher than the full load current.

8. Ratings of lamps and fans socket outlets: Points and exhaust fans:

- 8.1 Incandescent lamps installed in residential and non- residential buildings shall be rated at 60 watts & 100 watts respectively.
- 8.2 Table fans and ceiling fans shall be rated at 60 watts, exhaust fan shall be rated according to their capacity.
- 8.3 5 Amp. socket outlet points and 15 Amp. sockets outlet points shall be rated at 100 watts and 1000 watts respectively for the purpose of load assessment unless actual values of the load are known or specified.

9. Tests:

- 9.1 Before the installation is commissioned following tests shall be carried out.

- (1) Insulation Resistance test.
- (2) Polarity Tests of Switches
- (3) Earth continuity tests
- (4) Earth electrodes Resistance test.

9.2.1.1 The insulation resistance shall be measured between earth and the whole system of conductors or any section thereof with all fuses in place and all switches closed, and except in earthed concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together- a direct current pressure of not less than twice the working pressure provided that it need not exceed. 500 volts for medium voltage circuits where the supply is derived from the three wire D.C. or a poly phase A.C. System, the neutral pole of which is connected to earth either direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral.

S.2.1.2 The insulation resistance shall also be measured between all conductors to one pole or phase conductor of the supply and all the conductors connected to the neutral or to the other pole or phase conductors of the supply with all lamps in position and switches in 'OFF' position and its value shall be not less than in that specified in Sub-Clause 9.2.1.3.

9.2.1.3 The insulation resistance in Megohms measured as above shall not be less than 50 Megohms divided by the number of outlets or when PVC insulated cables are used for wiring 12.5 megohms divided by number of outlets.

9.2.1.4 Where a whole installation is being tested, a lower value than that given by the formula, subject to a minimum of 1 megohm is acceptable.

9.2.1.5 A preliminary and similar test may be made before lamps, etc. are installed and in this event the insulation resistance to earth should be not less than 100 megohms divided by the number of outlets or when PVC insulated cables are used for wiring 25 megohms divided by number of outlets.

9.2.1.6 The term "Outlet" includes every switch except that a switch combined with a socket outlet, appliance or lighting fitting is regarded as one outlet.

9.2.1.7 Control rheostat heating and power appliance and electric sign may, if required, be disconnected from the circuit during the test, but in that event the insulation resistance between the case or frame work, and all live parts of each rheostat, appliance and sign, shall be not less than that specified in the relevant Indian Standard Specification or where there is no such specification shall be not less than half a megohm

9.2.2 Polarity Test:

9.2.2.1 In a two wire installation a test shall be made to verify that all switches in every circuit have been fitted in the same conductor through out & such conductor shall be labeled or marked for connection to the phase conductor or to the non-earthed conductor of the supply.

9.2.2.2 In a three wire or a four wire installation a test shall be made to verify that every non-linked single pole switch is fitted in a conductor which is labeled or marked for connection to one of the phase conductor of the supply.

- 9.2.2.3 The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp one lead of which is connected to the earth. Glowing of test lamp to its full brilliance, when the switch is in 'on' position irrespective of appliance in position or not shall indicate that the switch is connected to the right polarity.

9.2.3 Earth Continuity Test:

The earth continuity conductor including metal conduits and metallic envelops of cables in all cases shall be tested for electric continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

9.2.3.1 Earth Electrode Resistance Test:

Earth electrode Resistance test may be carried out by Megger Earth Testers containing a direct reading ohm-meter, a hand driven generator and auxiliary electrodes.

- 9.3 On completion of an electric installation (addition and alteration) a certificate shall be furnished by the contractor countersigned by the certified Supervisor under whose direction supervision the installation was carried out. This certificate shall be in the prescribed form as given in Appendix-'B' in addition to the test certificate required by Local Electrical Supply Authorities.

10. Joint and looping back:

Unless with the sanction of Ex. Engineer Electrical Divisions all joints in conductor shall be means of approved mechanical connectors in suitable and approved junction boxes but looping back system shall be preferable. IN wiring unless otherwise specified Phase and live conduct shall be looped at the switch box where an neutral conductor can be looped from light, fan or socket. In non-residential buildings, neutral and earth continuity wire shall be brought to each of the switch boards and terminated therein with suitable connectors in Switch boards should be of adequate size to accommodate at least one number of 5 Amps, socket outlet and control switch in future.

11. Switches:

Main Switchgears, Switch Board and their location:

- 11.1 All main switches (other than those of iron clad pattern) carrying current of 10 Amp. and above shall be fitted for back connections and shall be suitably protected.
- 11.2 All switches and circuit breakers shall be constructed in accordance with the I.S. 4237-1967. General requirement for switchgear and control gear for voltage not exceeding 1000 Volts and other relevant I.S. provided also that spring shall be either of phosphor bronze or if steel shall be copper or Nickel plated and that handle shall be so fastened that they do not tend to unscrew or become loose.
- 11.3 All main switches shall be either of metal clad enclosed pattern or of any insulated enclosed pattern which shall be fixed at close proximity to the point of entry of supply.
- 11.4 Switch boards shall not be erected above gas, stoves, or sinks or within 2.5 m of any washing unit in the washing rooms of laundries or in the bath rooms, lavatories, toilets or kitchens.
- 11.5 Switch boards, if unavoidably fixed in places likely to be exposed to weather, to drip, or to abnormal moist temperature the outlet casing shall be weather proof and shall be provided with glands or bushing of adopted to receive screwed conduit according to the manner in which cables are run. PVC and double flanged bushes shall be fitted in the holes of the switches for entry and exit of wires.
- 11.6 A switch board shall not be installed so that its bottom is within 1.25 m above the floor unless the front of the switch board is completely enclosed by a door or the switch board is located in a position to which only authorized persons have access.
- 11.7 Switch boards shall be recessed in the wall if so specified in the schedule of work or in the special specification. The front shall be fitted with hinged panel of other suitable material such as bakelite in wood frame with locking arrangement, the outer surface of door being flush with the walls. Ample room shall be provided at the back for connections and at the front between the switchgear mountings and the door.

- 11.8 Equipments which are on the front of a switch board shall be so arranged that inadvertently personal contact with live parts is unlikely during the manipulation of switchgears, changing of fuses or like operations.
- 11.9 No holes other than the holes by means of which the panel is fixed shall be drilled closer than 1.3 cms. from any edge of the panel.
- 11.10 The various live parts, unless they are effectively screened by substantial barriers of non-hydroscopic, non-inflammable insulating material, shall be so spaced that space shall not be maintained between such parts and earth.
- 11.11 The arrangement of gear shall be such that they shall be readily accessible and their connections to all instruments and apparatus shall also be traceable.
- 11.12 In every case in which switches and fuses are fitted on the same pole, these fuses shall be so arranged that the fuses are not alive when their respective switches are in the off position.
- 11.13 No fuses other than fuses in instrument circuit shall be fixed on the back of or behind a switch board panel or frame.
- 11.14 All the metal switchgears and switch boards shall be painted, prior to erection with one coat of antirust primer. After erection they shall be painted with two coats of approved enamel or aluminium paint as required on all sides wherever accessible.
- 11.15 All switch boards connected to medium voltage and above shall be provided with 'Danger Notice Plate' conforming to relevant Indian Standards

12. Control at Point of Commencement of Supply:

- 12.1 There shall be a linked main switchgear with fuse on each live conductor of the supply mains at the point of entry. The wiring through out the installation shall be such that there is no break in the neutral wire except in the form of a linked switchgear. The neutral shall also be distinctly marked. In this connection Rule 32(2) of the Indian Electricity Rules 1966 (See Appendix 'A') shall also be referred.
- 12.2 The main switchgear shall be situated as near as practicable to be termination of service line and shall be easily accessible without the use of any external aid.
- 12.3 On the main switchgear, where the conductor of a two wire system or an earthen neutral conductor of a multi-wire system or a conductor which is to be connected thereto, an indication of a permanent nature shall be provided to identify the earthen neutral conductor. In this connection Rule 32(1) of Indian Electricity Rules 1956 (see appendix 'A') shall be referred.

13.0 Switch Board & Distribution Boards:

Metal clad switch gear shall preferably be mounted on any of the following types of Board.

13.1 Hinged type Metal Boards:

These shall consist of a box made of sheet metal not less than 2 mm thick and shall be provided with a hinged cover to enable the board to swing open for examination of the wiring at the back. The joints shall be welded. A teak wood board, thoroughly protected both inside and outside with good insulating varnish conforming to IS : 347-1952 specification for varnish shellac, for General purpose, and of not less than 6.5 mm thickness, shall be provided at the back for attachment of incoming and outgoing cables. There shall be a clear distance of not less than 2.9 cm between the teak wood board and the cover, the distance being increased for larger boards in order that on closing of the cover, the insulation of the cables is not subjected to damage and no short length of cables is subjected to excessive twisting or bending in any case. The board shall be securely fixed to the wall by means of rag bolts, plugs or wooden Gutties and shall be provided with a locking arrangement and an earthing stud. All wires passing through the metal board shall be bunched. Alternatively, hinged type metal boards shall be made of sheet covering mounted on channel or angle iron frame.

Note : Such type of boards are particularly suitable for small switch-boards for mounting metal-clad switchgear connected to supply at low voltages.

13.2 Fixed type Metal Boards:

These shall consist of an angle or channel of iron frame fixed on the wall or on floor and supported on the wall at the top if necessary. There shall be a clear distance of one meter in front of the switch board. If there are attachments of base connections at the back of the switch board Rules 51(1) (c) of Indian Electricity Rules', 1956 shall apply.

Note : Such type of boards are particularly suitable for large switchboard for mounting large number of switchgears or higher capacity metal clad switchgears or both.

13.3 Teakwood Boards:

For small installations connected to a Single phase 230 volts supply teak wood boards may be used as main boards or sub-board. These shall be of seasoned teak or other durable wood with solid back impregnated with varnish of approved quality with all joints dovetailed.

13.4 In large size medium voltage installations, before proceeding with the actual construction of the boards, a proper drawing showing the detailed dimensions and design including the disposition of the mountings, which shall be symmetrically and neatly arranged for arriving at the overall dimensions, shall be prepared and 'approved by the engineer-in-charge.

13.5 Recessing of Boards:

Where so specified, the switch boards shall be recessed in the wall. The front shall be fitted with a hinged panel of teak wood or other suitable material, such as bakelite, or with unbreakable glass doors in teak -wood frame with locking arrangement, the other surface of the doors being flush with the walls. Ample room shall be provided at the back for connection and at the front between the switchgear mountings.

13.6 Arrangement of Apparatus:

- a) Equipment which is on the front of a switch board shall be so arranged that inadvertently personal contact with live parts is unlikely during the manipulation of switches, changing of fuses or like operation.
- b) No apparatus shall project beyond any edge of panel. No fuse body shall be mounted within 2.5 cm. of any edge of the panel and no hole other than holes by means of which the panel is fixed shall be drilled closer than 1.3 cms from any edge of the panel.
- c) The various live parts, unless they are effectively screened by substantial barriers of non-hygroscopic, non-inflammable insulating material, shall be so spaced that an arc cannot maintain between such parts and earth.
- d) The arrangement of the gear shall be such that they shall be readily accessible and their connections to all instruments and apparatus shall also be easily traceable.
- e) In every case in which switches and fuses are fitted on the same pole, these fuses shall be so arranged that the fuses are not alive when their respective switches are in the 'OFF' position.
- f) NO fuses other than fuses instrument circuit shall be fixed on the back of or behind a switchboard panel or frame.

13.7 Marking of Apparatus:

- a) Where a board is connected to voltage higher than 250 volts, all the apparatus mounted on it shall be marked in the following colours to indicate the different poles or phases to which the apparatus or its different terminals may have been connected.

Alternating Current

Three-phase-red

Yellow, & blue

Neutral-black

Direct Current

Three wire system-2 outer wires

Positive red & negative blue.

Neutral-black

Where fuse-wire three phase wiring is done, the neutral shall be in one colour and the other three wires in another colour.

- b) Where a board has more than one switch each such switch shall be marked to indicate which section of the installation it controls.
- c) All markings required under the rule shall be clear and permanent.

13.8 Main & Branch Distribution Board:

13.8.1 Main and branch distribution boards shall be of any type mentioned in 13.1

13.8.2 Main distribution board shall be provided with a switch or air circuit breaker on each pole of each circuit, a fuse on the phase or live conductor and a link on the neutral or earthed conductor of each circuit. The switches shall always be linked.

13.8.3 Branch Distribution Board:

13.8.3.1 Branch distribution boards shall be provided with a fuse or a miniature circuit breaker or both the adequate rating- setting chosen on the live conductor of each circuit and the earthed neutral conductor shall be connected to a common link and be capable of being disconnected individually for testing purposes. At least one spare circuit of the same capacity shall be provided on each branch distribution board.

13.8.3.2 In residential installations, lights and fans may be wired on a common circuit such sub circuit shall not have more than total of ten points of lights, fans and socket outlets. The load of such circuit shall be restricted to 800 watts. If a separate fan circuit is provided, the number of fans in the circuit shall not exceed ten. Power sub-circuits shall be designed according to the load but in no case shall there be more than two outlets on each sub-circuits.

13.8.3.3 In Industrial and other similar installations requiring the use of group control of switching operation, circuits, for socket outlets may be kept separate from fans and lights. Normally fans and lights may be wired on a common circuit, however, if need is felt separate circuits may be provided for the two. The load on any low voltage sub-circuit shall not exceed 3000 Watts. In case of new installation, all circuits and sub- circuits shall be designed by making provision of 20 per cent increase in load due to any future modification. Power sub- circuits shall be designed according to the load but in no case shall there be more than four outlets in each sub-circuits.

13.9 Installation of Distribution Boards:

13.9.1 The distribution fuse-boards shall be located as near as possible to the centre of the load they are intended to control.

13.9.2 These shall be fixed on suitable stanchion or wall and shall be accessible for replacement of fuses.

13.9.3 These shall be of either metal-clad type, or all insulated type. But, if exposed to weather or damp situations, they shall be of the weather proof type and, if installed where exposed to explosive dust, vapor or gas, they shall be of flame proof type.

13.9.4 Where two or more distribution fuse boards feed low voltage these distribution boards shall be:

- (1) Fixed not less than 2 m apart or,
- (2) Arranged so that it is not possible to open two at a time, namely, they are interlocked and the metal case is marked 'Danger 415 Volts', or
- (3) Installed in a room or enclosure accessible to only authorized persons.

13.9.5 All distribution boards shall be marked 'Lighting', 'Power', as the case may be, and also marked with the voltage and number of phases of the supply. Each shall be provided with a circuit list giving details of each circuit which it controls and the current rating of the circuit and size of fuse-element.

13.9.6 Triple pole distribution boards shall not be generally used for final circuit distribution unless specific approval of Engineer in charge is obtained. In special cases where use of Triple pole distribution boards are inevitable they shall be of H.R.C. fuse type only.

13.10 Wiring and Distribution Board:

- 13.10.1 In wiring a branch board, total load of the consuming devices shall be divided, as far as possible, evenly between the number of ways of the board leaving the spare circuit for future extension.
- 13.10.2 All connections between pieces of apparatus or between apparatus and terminals on a board shall be neatly arranged in a definite sequence following the arrangement of the apparatus mounted thereon, avoiding unnecessary crossing.
- 13.10.3 Cables shall be connected to a terminal only by soldered or welded or crimped lugs using suitable sleeve, lugs or ferrules unless the terminal is of such a form that it is possible to securely clamp them without the cutting away of cable strands.
- 13.10.4 All bare conductor shall be rigidly fixed in such a manner that a clearance of at least 2.5 cms. is maintained between conductor of opposite polarity or phase and between the conductors and any material other than insulating material.
- 13.10.5 If required, a pilot lamp shall be fixed and connected through on independent single-pole switch and fuse to the bus- bars of the board.
- 13.10.6 In a hinged type board, the incoming and outgoing cables shall be fixed at one or more points according to the number of cables on the back of the board leaving suitable space in between cables, and shall also, if possible, be fixed at the corresponding points on the switch board panel. The cables between these points shall be arranged to form a 'U' or 'S' shaped loop which shall be of such length as to allow the switchboard panel to swing through an angle of not less than 90°.

14.0 Capacity of Circuits:

- 14.1 Lights and fans may be issued on a common circuits and such a circuit shall not have more than a total of ten points of lights, fan, and socket outlets, or a load of 800 watts whichever is less. The power circuits shall be designed with a maximum of two outlets per circuits generally when load is not known or specified. In non-residential buildings at important District centers however one outlet per .circuit may be preferred. The circuit shall be designed based on the loading of the circuit where not specified the load shall be taken as 1 KW per outlet. Where the load is more than 1 KW it should be controlled by a isolator switch or miniature circuit breaker.

15.0 Passing Through Walls and Floors:

- 15.1 Where conductors pass through walls one of the following methods shall be employed. Care shall be taken to see that wires pass very freely through protective pipe or box and that the wires pass through in a straight line without any twist or cross in wires, on other ends of such holes.
 - (a) A teak wood box extending through the whole thickness of the wall shall be buried in the wall and casings or conductors shall be carried so as to allow 1.3 cms air space on three sides, of the casing conductor.
 - (b) The conductor shall be carried either in a rigid steel conduit conforming to *IS : 1653-1964 specification for Rigid Steel conduits of Electrical wiring (Revised) or a rigid non-metallic conduit conforming to *IS : 2509-1963 specification for Rigid Non-Metallic conduits for Electrical Installations, or in a porcelain tube of such size which permits easy drawing in. The end of conduit shall be neatly bushed with porcelain, wood or other approved material.
 - (c) Insulated conductors while passing through floors shall be protected from mechanical injury by means of rigid steel conduit (See *IS : 1653-1964) to a height not less than 1.5m above the floors and flush with the ceiling below. This steel conduit shall be earthed and securely bushed.
- 15.2 Where a wall tube passes outside a building so as to be exposed to weather, the outer end shall be belt mounted and turned down-wards, and properly bused on the open end.

16.0 Fixing to Walls and Ceilings:

Plugs for ordinary walls or ceilings shall be of well seasoned teak or other approved hardwood not less than 5 cm long and 2.5 cm. square on the inner end and 2 cm. square on the outer end. They shall be cemented into walls to within 7.5 mm of the surface, the remaining being finished according to the nature of the surface with plaster or lime punning.

- 16.1 Where owing to irregular crossing or other reasons the plugging of the walls or ceiling with wood plugs presents difficulties, the wood casing, wood batten, metal conduit, or cleat (as the case may be) shall be attached to the wall or ceiling in an approved manner. IN the case of new building, wherever possible, teak wood plugs shall be fixed in the walls before they are plastered.
- 16.2 To achieve neatness, plugging of walls or ceiling may be done by an approved type of asbestos, metallic or a fiber fixing plug.

17.0 Branch Switches:

Where the supply is derived from a three-wire or four-wire source, and distribution is done on the two wire system, all branch switches shall be placed in the outer or live conductor of the circuit and no single-phase switch or fuse shall be inserted in the middle wire, earth or earthed neutral conductor of the circuit. Single-pole switches (Other than for multiple control) Carrying not more than 15 amperes may be of tumbler type which shall be 'ON' when the handle known is down.

18.0 Fittings:

Where conductors are required to be threaded through tubes or channels formed in the metal work of fittings these must be free from sharp angles or projecting edges and such size that will enable them to be wired with the conductors used for the final sub Circuits without removing the boarding, taping or outer covering. As far as possible, all tubes and channels should be of sufficient size to permit 'Looping back; of wires cables and flexible cords other than those designed for high temperature shall not be used for wiring fittings except for portable fittings. All fittings must have not less than a half inch male nipple. Fittings and lamp holders for gas filled lamps shall be adequately ventilated.

- 18.1 Where light fitting is supported by one or more flexible cords, the maximum weight to which the twin flexible cords may be subjected shall be as follows:

Nominal cross sectional Area cord mm ²	No. & Dia in mm of wires	Max. Permissible weight Kg.
0.5	16/0.2	1.7
0.75	24/0.2	2.6
1.0	32/0.2	3.5
2.5	48/0.2	5.3
3.5	80/0.2	8.8
4	128/0.2	14.0

- 18.2 NO inflammable shade shall form a part of light fitting unless such shade is well protected against all risks of fire. Celluloid shade or light fitting shall not be used under any circumstances.

18.3 Fitting of Wire:

The use of fitting wire shall be restricted to the internal wiring and the lighting fittings. Where fitting wire is used for wiring, for the sub-circuit loads shall be terminated in a ceiling zone or connector from which they shall be carried into the fittings.

19.0 Lamp Holders:

Lamp holders for use on brackets and the like shall be in accordance with *IS: 1258-1967, specification for Bayonet lamp holders and all those for use flexible pendants shall be provided with cord grips. All lamp holders shall be provided with shade carriers. Where centre contact Edison screw lamp holders are used, the outer or screw contacts shall be connected to the middle wire, the neutral, and the earthed conductor of the circuit.

20.0 Outdoor Lamps:

External and road lamps shall have weather proof fittings of approved design so as to effectively prevent the admission of moisture. An insulating distance piece of moisture proof materials shall be inserted in the fittings. Flexible cord and cord grip lamp holders shall not be used where exposed to weather. In verandahs and similar exposed situations where pendants are used, they shall be of fixed rod type.

21.0 Lamps:

All incandescent lamps, unless otherwise required and suitably protected, shall be hung at a height of not less than 2.5 m above the floor level. They shall be in accordance with IS : 418 : 1957 specification for Tungsten Filament General Service electric lamp:

22.0 Fans, Regulators and Clamps:

22.1.0 Ceiling fans:

Ceiling fans including their suspension shall conform to *IS 374- 1960 specification for electric ceiling fans and regulators (Revised) & to the following requirements:

- (a) All ceiling fans shall be wired to ceiling roses or to special connector boxes, to which fans rod wires shall be connected and suspended from hooks or shackles with insulators between hooks and suspension rods. There shall be no joint in the suspension rod, but if joints be avoidable then such joints shall be screwed to special couplers of 5 cm minimum length and both ends of pipes shall touch together within couplers, and shall in addition be secured by means of split pins; alternatively, the two pipes may be welded.
- (b) Fans clamps shall be of suitable design according to the nature of construction of ceiling on which these clamps are fitted. In all cases fan clamps shall be fabricated from tested new metal of suitable sizes and they shall be as close fitting as possible. Fan clamps for reinforced concrete roots shall be buried with the casting and due care shall be taken that they shall serve the purpose. Fan clamps for wood beams shall be of suitable flat iron fixed on two sides of the beam and according to the size and section of the beam one or two mild steel bolts passing through the beam shall hold both flat irons together. Fan clamps for steel joint shall be fabricated from tested flat iron to fit in rigidly to the bottom flange of the beam. Care shall be taken during fabrication that the metal does not crack while hammering to shape. Other fan clamps shall be made to suit the position, but in all cases care shall be taken to see that they are rigid and safe.

Note : All fan clamps shall be so fabricated that fans revolve steadily.

- (c) Canopies on top and bottom of suspension rod shall effectively hide suspensions and connections to fan motors, respectively.
- (d) The lead-in-wire shall be of nominal cross-sectional area not less than 1.0 mm² with copper and 1.5 mm² with aluminium and shall be protected from abrasion.
- (e) Unless otherwise specified, the clear distance between the ceiling fan and the floor shall not be less than 2.75 m.

22.2.0 Exhaust Fans:

For fixing of an exhaust fan, a circular hole shall be provided in the wall to suit the size of the frame which shall be fixed by means of rag-bolts embedded in the wall. The hole shall be neatly plastered with cement and brought to the original finish of the wall. The exhaust fan shall be connected to exhaust fan point which shall be wired as near to the hole as possible by means of a flexible, cord, care being taken that the blades rotate in the proper direction.

23.0 Attachment of fittings and accessories:

23.1 In other than conduit wiring, all ceiling crosses, brackets, pendants and accessories attached to walls or ceilings shall be mounted on substantial teak wood blocks twice varnished after all fixing holes are made in them. Blocks shall be not less than 4 cms. deep, Brass screws only shall be used for attaching fittings and accessories to their base blocks.

24.0 Interchangeability:

Similar part of all switches, lamp holders, distribution fuse- boards ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be inter-changeable in each installation.

25.0 Conduit Wiring System:

25.1.1 Type and size of conduit - All conduit pipes shall be conforming to *IS : 1653-1964, furnished with galvanised or stove enamelled surface. All conduit accessories shall be of threaded type and under no circumstances pin grip type or clamp type accessories be used. No steel conduit less than 16 mm in diameter shall be used. The number of insulated conductors that can be drawn into rigid steel conduit are given in Table II.

25.1.2. Bunching of cables - Unless otherwise specified, insulated conductors of AC supply and DC supply shall be bunched in separate conduits.

25.1.3 Conduit-joints-Conduit pipes shall be joined by means of screwed couplers and screwed accessories only (*IS : 2667-1964).

Specification for Fittings for Rigid Steel Conduits for Electrical Wiring) In long distance strance straight runs of conduit, inspection type couplers at reasonable intervals shall be provided or running threads with couplers and jam-puts (in the latter case the bare threaded portion shall be treated with anti-corrosive preservative) shall be provided. Thread on conduit pipes in all cases shall be between 11 mm to 27 mm long sufficient to accommodate pipes to full threaded portion of coulers or accessories. Cut ends of conduit pipes shall have no sharp edges nor any buries left to avoid damage to the insulation of conductors while puling them through such pipes;

TABLE-II MAXIMUM PPERMISSIBLE NUMBER OF 250-V
GRADE SINGLE CORE CABLES THAT CAN BE DRAWN INTO
RIGID STEEL CONDUIT

(CLAUSE 6.5.1.1)

Size of cable		Size of Conduit (mm)													
Nominal	Number	16	:	20	:	25	:	32	:	40	:	50	:	63	:
Crossectional	and	(No. of Cable Max)													
area.	Diameter in	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	mm of														
	wires														
		S	B	S	B	S	B	S	B	S	B	S	B	S	B
1.0	1/1.12	5	4	7	5	13	10	20	14	-	-	-	-	-	-
1.5	1/1.40	4	3	7	5	12	10	20	14	-	-	-	-	-	-
2.5	1/1.80	3	2	6	5	10	8	18	12	-	-	-	-	-	-
4	) 1/1.24 (3/1.06*) (7/0.85)	3	2	4	3	7	6	12	10	-	-	-	-	-	-
6	) 1/2.80 7/1.06*)	2	-	3	2	6	5	10	8						
10	) 1/3.55+	-	-	2	-	5	4	8	7	-	-	-	-	-	-
	) 7/1.40*	-	-	2	-	4	3	6	5	8	6	-	-	-	-
16	) 7/1.70	-	-	-	-	2	-	4	3	7	6	-	-	-	-
25	) 7/2.24	-	-	-	-	-	-	2	-	4	3	7	6	9	7
35	) 7/2.50	-	-	-	-	-	-	-	-	2	-	5	4	6	5
50	) 7/3.00+	-	-	-	-	-	-	-	-	2	-	5	4	6	5

* For Cu. Conductors only.

+For Al. Conductors only.

Note : 1 The cable shows the maximum capacity of conduits for the simultaneous drawing-in of cables. The table applies to 250 volts grade cable. The columns headed 'S' apply-to runs of conduit which have distance not exceeding 4.25

M between d/aw in boxes, and which do not deflect from the straight by angle of more than 15°. The columns headed 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15°.

Note : 2 In case of inspection type draw-in box has been provided and if the cables is first drawn through one straight conduit, then through the drawn box, and then through the second straight conduit, such systems may be considered as that of a straight conduit even if the conduit deflects through the straight by more than 15°.

25.1.4 **Protection against dampness** – In order to minimize condensation or seating inside the tube, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects as far as possible.

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

25.1.6 **Fixing of conduit** – Conduit pipes shall be fixed by heavy gauge saddles, secured to suitable wood plugs or any other approved plug with screws in an approved manner at an interval of not more than one meter but on either side of couplers or bends or similar fittings, saddles shall be fixed at a distance of 30 cm. from the centre of such fittings.

25.1.7 **Bends in conduit** – All necessary bends in the system including diversion shall be done by bending pipes, or by insuring suitable solid or inspection type normal bends, elbows or similar fittings; or by fixing cast iron inspection boxes whichever is more suitable. Conduit fitting shall be avoided as far as possible. On conduit system exposed to weather, where necessary, solid type fitting shall be used. Radius of such bends in conduit pipes shall be not less than 7.5 cm. No length of conduit shall have more than the equivalent of four quarter bends from outlet, the bends at the outlets not being counted.

25.1.8 **Outlets** – All outlets for fitting switches etc. shall be boxes, of suitable metal or any other approved outlet boxes for other surface mounting or flush mounting system.

25.1.9 **Conductors** – All conductors used in conduits wirings shall preferably be stranded. No single - core cable or nominal Cross-sectional area greater than 130 mm² shall be enclosed in a conduit and used for alternating current.

25.1.10 **Erection and earthing of conduit** – The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirements specified under 7 by means of special approved type earthing clamp efficiently fastened to conduit pipe in a workmanlike manner for a perfect continuity between each wire and conduit. Gas or water pipes shall not be used as earth medium. If conduit pipes are liable to mechanical damage, they shall be adequately protected.

25.2 **Recessed Conduit wiring system with Rigid Steel conduits** – Recessed conduit wiring system shall comply with all the requirements for surface conduit wiring system specified in 6.5.1.1. to 6.5.1.10 and in addition, conform to the requirements specified in 6.5.2.1. to 6.5.2.4

25.2.1 **Making of chase** – The chase in the wall shall be neatly made and be of ample dimensions to permit the conduit to be fixed in the manner desired. In the case of buildings under construction, chases shall be provided in the wall, ceiling etc., at the time of their construction and shall be filled up neatly after erection of conduit and brought to the original finish of the wall.

25.2.2 **Fixing of conduit in chase** – The conduit pipe shall be fixed by means of staples or by means of saddles not more than 60 cm. apart. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a lounge radius which will permit easy drawing-in of conductors. All threaded joints of rigid steel conduit shall be treated with some approved preservative compound to secure protection against rust.

25.2.3 **Inspection boxes** – Suitable inspection boxes shall be provided to permit periodical inspection and to facilitate removal of wires, if necessary. These shall be mounted flush with the wall. Suitable ventilating holes shall be provided in the inspection box covers.

25.2.4 **Types of accessories to be used** – All outlets such as switches and wall sockets, may be either of flush mounting type or surface mounting type.

(a) **Flush mounting type** – All flush mounting outlets shall be of cast iron or mild steel boxes with a cover of approved insulating material or shall be a box made of a suitable insulating material. The switches and

other outlets shall be mounted on such boxes as would be approved. The, metal box shall be efficiently earthed with conduit by an approved means of earth attachment.

- (b) **Surface mounting type** – If surface mounting type outlet box is specified, it shall be of any approved insulating material and outlet mounted in an approved manner.

25.2.5 When crossing through expansion joints in buildings, the conduit sections across the joint may be through flexible conduits of the same size as the rigid conduit.

25.3 Conduit Wiring System with Rigid Non-Metallic Conduits:

Rigid Non-Metallic conduits are used for surface, recessed and concealed conduit wiring.

25.3.1 **Type and size** – All non-metallic conduits used shall conform to IS : 2509-1963 The conduit may be either threaded type or plain type as specified in IS : 2509-1913* and shall be used with the corresponding accessories (See IS : 3419-1965) specification for Fittings for Rigid Non-Metallic Conduits).

25.3.2 **Bunching off cables** – Conductors of AC supply and DC supply shall be bunched in separate conduits. The number of insulated cables that may be drawn into the conduits are given in Table III. IN this table the space factor does not exceed 40 percent.

TABLE-MI MAXIMUM PERMISSIBLE NUMBER OF 250 VOLTS GRADE SINGLE- CORE CABLE THAT MAY BE DRAWN INTO RIGID NON-METALLIC CONDUITS

Size of cable Nominal Crossectional area. mm ²	No. Diameter in mm of wires	Size of conduit (mm)					
		16	20	25	32	40	50
		(No. of cable max)					
1.0	1/1.12*	5	7	13	20	-	-
1.5	1/1.40	4	6	10	14	-	-
2.5	1/1.80	3	5	10	14	-	-
	3/1.06*						
4	1/1.24	2	3	6	10	14	-
	7/0.85*						
6	1/2.80	-	2	5	8	11	-
	7/1.06*						
10	1/3.55+	-	-	4	7	9	-
	7/1.40*						
16	7/1.70	-	-	2	4	5	15
25	7/2.24	-	-	-	2	2	6
35	7/2.50	-	-	-	-	2	5
50	7/3.00+	-	-	-	-	2	3
	19/1.80						

*For copper conductors only.

+For aluminium conductors only.

25.3.3 **Conduit joints** - shall be joined by means of screwed or plain couplers depending on whether the conduits are screwed or plain. Where there are long runs of straight conduit. Inspection type couplers shall be provided at intervals. For conduit fittings and accessories reference may be made to IS : 3419-1965.

25.3.4 **Fixing of conduits** – The provision of 25.1.6 shall apply except that the spacing between saddles or supports is recommended to be 60 cms for rigid non-metallic conduits.

25.3.5 **Bends in conduit** – Wherever necessary, bends or diversions may be achieved by bending the conduits (See 6.5.3.9) or by employing normal bends, inspection bends, inspection boxes, elbows or similar fittings.

- 25.3.6 Conduit fittings shall be avoided, as far as possible on outdoor system.
- 25.3.7 **Outlets** – All the outlets for fittings, switches, etc. shall be boxes of substantial construction. In order to minimise condensation or sweating inside the conduit, all outlets of conduit system shall be properly drained and ventilated, but in such a manner as to prevent the entry of insects, etc. as far as possible.
- 25.3.8 For use with recessed conduit wiring system the provisions of 6.5.2.1 to 6.5.2.4 shall apply.
- 25.3.9 Heat may be used to soften conduit for bending and forming joints in case of plastic conduits. As the material softens when heated, fitting of conduit in close proximity to hot surfaces should be avoided. Caution should be exercised in the use of the conduit in locations where the ambient temperature is 50°C or above. Use of such conduits in place where ambient temperature is 60°C or above is prohibited. -

PVC INSULATED AND P.V.C. SHEATHED OR T.R.S. WIRING SYSTEM

26.0 GENERAL

This system of wiring, is suitable for low pressure installation, and shall not be used in places exposed to sun and rain nor in damp places, provided they are sheathed in the special approved protective covering and well protected to withstand dampness.

26.1 Attachment to walls and ceiling:

- 26.1.1 All cables on brick walls, stone or plastered walls and ceiling shall be run on well seasoned, perfectly straight and well varnished on four sides, teak wood or any approved hardwood battens not less than 10 mm finished thick, width of which shall be such as to suit total width of cables laid on the batten, prior to election, these shall be painted with one coat of varnish or approved paint of colour to match with surrounding. These battens shall be secured to wall and ceilings by flat head wood screws to raws plug or phill plug at an interval not exceeding 75 cm. Wood plug can be used only with special approval of the Engineer-in-charge. The flat head wood screws shall be counter within wood batten and smoothed down with file.
- 26.1.2 Where wiring is to be carried out along the face of the rolled steel joists, a wooden batten of adequate width shall first be laid on the same and dipped to it as inconspicuously as possible. The wiring should then be fixed to this backing in the ordinary way. Where wiring passes through structural steel work, the holes shall be suitably bushed to prevent the abrasion of the cables.
- 26.1.3 Attachment to false ceiling: In no case, the open wiring shall be run above the false ceiling without the approval of Engineer-in-charge.
- 26.20 **Link clips:** Only aluminium alloy clips/joint clips shall be used. The thickness shall be 0.32 mm (30 SWG) for lengths of 25 mm to 40 mm and 40 mm (28 SWG) for lengths of 50 mm to 80 mm. The width shall not be less than 8 mm in all these cases. Link clips/joint clips shall be so arranged that one single clip shall not hold more than two core or three single core TR3 of PVC insulated and PVC sheathed up to 2.5 sq. mm above while a single clip shall hold a single twin core or two single core cables. The clips shall be fixed on varnished wood batten with iron pins and space at interval of 15 cm both in the case of horizontal and vertical runs.
- 26.3.0 **Bends in wiring:** The wiring shall not in any circumstance be bent so as to form an abrupt right angle but must be rounded off at the corners to a radius not less than six times the overall diameter of the cable.
- 26.4.0 Protection of wiring from Mechanical Damage:**
- 26.4.1 In cases where there are chances of any damage to wiring, such wiring shall be drawn complying with all the requirements of conduit wiring system.
- 26.4.2 Such protective covering shall in all cases be fitted on all down drops within 1.5 m from the floor, or from floor level up to the switch board whichever is less.
- 26.5.0 **Passing through floors:** All cables taken through floor shall be enclosed in heavy gauge steel conduit extending 1.5 m above the floor or up to the switch board whichever is less and flush with the ceiling below or by means of any approved type of metallic covering. The ends of all conduits or pipes shall be neatly bushed with porcelain wood or other approved material. The conduit pipes, shall be securely earthed.
- 26.6.0 **Passing through walls:** When conductors pass through walls, any one of the following methods shall be employed. Care should be taken to see that wires pass very freely through protective pipe or box and that wires

pass through in a straight line without any twist or cross in wires on either ends of such holes.

- (a) A box of teak wood or approved hard wood extending through the hole thickness of the wall shall be buried in the wall and casings or conductors and casing or conductors shall be carried so as to allow 1.3 cm air space on the three sides of the casing or conductor.
- (b) The conductors shall be carried in an approved heavy gauge solid drawn or lap weld conduit or in a porcelain tube of such a size that it permits easy drawing in, the ends of conduit shall be neatly bushed with porcelain, wood or other approved material.

26.6.1 Where a wall tube 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. The conduit shall be neatly arranged so that the cables enter them without bending.

26.7.0 **Buried cables:** The TRS or PVC sheathed cable shall not normally be buried directly in plaster. Where so specified in the special specification they may be taken in teak wood channeling of ample capacity or conduit pipe buried in the wall.

26.8.0 **Stripping of outer covering.** While cutting and stripping of the outer covering of the cable, care shall be taken that the sharp edge of the cutting instrument does not touch the inner insulation of the conductors. The protective outer covering of the cables shall be stripped off near connecting terminal and this protective covering shall be maintained upto the close proximity of connecting terminals as far as practicable. Care shall be taken to avoid hammering on link clips with any metal instrument after the cables are laid. Where junction boxes are provided they shall be made moisture proof with a plastic compound.

27.0 PAINTING WORK IN GENERAL:

27.1 **Paints:** Paints, oils, varnishes, etc. of approved make in original to the satisfaction of the Engineer-in-charge shall, only be used.

27.2 **Preparation of surface:** The surface shall be thoroughly cleaned and dusted before painting is started. The proposed surface shall be inspected by Engineer-in-charge or his authorized agent and shall have received the approval before painting is commenced.

27.3 **Application:** Paint shall be applied with brush. The paint shall be spread as smooth & even as possible. Particular care shall be paid to rivets, nuts, bolts and cover lapping. Before drawing cut, it shall be continuously stirred in the smaller containers with a smooth stick while it is being applied.

Each coat shall be allowed to dry out sufficiently before a subsequent coat is applied.

27.4 **Scope:** Painting on old surface in indoor situations will not include primer coat except where specially mentioned in the schedule of work or special specification. However, where rust has formed on iron and steel surfaces the spots will be painted with one anti-rust primer coat.

27.5 **Precautions:** All furniture fixtures, glazing floors, etc. shall be protected by covering. All stains, smears, splashing, dropping of every kind shall be removed. While painting of wiring etc. it shall be ensured that painting of wall and ceiling etc. is not spoiled in any way.

27.6 **Painting of conduit and accessories:** After installation, all accessible surface of conduit pipes, fittings switch and regulator boxes, etc. shall be painted with two coats of approved enamel paint or aluminium paint as required to match the finish ' surrounding wall, trusser, etc.

28. Link clip:

The clip for batten wiring shall be of Aluminium conforming to I.S. specification No. 2415-1975.

APPENDIX-'A'

Important Clauses of Indian Electricity Rules 1956. Following clauses of Indian Electricity Rules, 1956 shall in particular be taken care of in the execution of electrical works

Clause No.	Subject
3.	Authorization:
29.	Construction, installation, protection, operation and maintenance of electric supply lines and apparatus.
31.	Cut-out on consumer's premises.
32.	Identification of earthed and earthed neutral conductors and position of switches-and cutouts therein.
33.	Earthed terminal on consumer's premises.
36.	Handling of electric supply lines and apparatus.
41.	Distinction of circuits of different voltages.
42.	Accidental charge.
43.	Provisions applicable to protective equipment.
44.	Instructions for restoration of persons suffering from electric shock.
45.	Precautions to be adopted by consumers, owners, electrical contractors, Electrical workmen and suppliers.
46.	Periodical inspection and testing of consumer's, installation,
48.	Precautions against leakage before connection.
50.	Supply to consumers.
51.	Provisions applicable to medium, high voltage installations.
58.	Point of commencement of supply.
59.	Precautions against failures of supply; Notice of failures.
61.	Connection with earth, (Low and Medium Voltage system).
64.	Use of energy at high and extra-high voltage system.
67.	Connection with earth. (High & Extra-high voltage system.)
68.	General conditions as to transformation and control of energy. All clauses under Chapter VIII on Overhead Lines!
137.	Mode of entry.
138.	Penalty for breaking seal.
139.	Penalty for breach of rule 45.
140.	Penalty for breach of rule 82.
141.	Penalty for breach of rules.

APPENDIX -'B'

Form of Completion Certificate

I/We certify that the installation detailed below has been installed by me/us and tested and that to the best of my/our knowledge and belief, it complies with Indian Electricity Rules 1956, as well as the C.P.W.D. General Specification for Electrical Works 1972.

Electrical Installation at Voltage and system of supply

(1) Particulars of works :

(a) In Internal Electrical Installation	No. Total Load of wiring.	Type or system
(i) Light point		
(ii) Fan point		
(iii) Plug point		
(a) 3 pin 5 Amp.		
(b) 3 pin 15 Amp.		

(b) Others:

Description	HP/KW
(a) Motors: (i)	
(ii)	
@ X1 = (iii)	

(c) Other Plants:

(d) If the work involves installation of over head line/or under ground cable:

- | | |
|-----|--|
| (a) | (i) Type, & Description of overhead line. |
| | (ii) Total length & No. of spans, |
| | (iii) No. of street light & its description |
| b) | (i) Total length of under ground cable & its size, |
| | ii) No. of joint |

End joint:
Tee joint:
St. through joint:

2) Earthing:

- | | |
|-------|-------------------------------------|
| (i) | Description, of earthing electrode: |
| (ii) | No. of earth electrodes: |
| (iii) | Size of main earth lead: |

3) Test Results:

a)	Insulation Resistance :	
(i)	Insulation resistance of the whole system of conductors to earth.	Megohms
(ii)	Insulation resistance between the phase conductors and neutral.	Megohms
	Between phase R and neutral	Megohms

Between phase Y and neutral Magohms

Between phase B and neutral Magohms

(iii) Insulation resistance between the phase conductors incase of poly phase supply.

Between phase R & phase Y Magohms

Between phase Y & phase B Magohms

Between phase B & phase R Magohms

(b) Polarity Test

Polarity of non linked single pole branch switches.

(c) Earth continuity Test :

Maximum resistance between any point in the earth continuity conductor including metal conduits & main earthing lead.

(d) Earth Electrode Resistance :

Resistance of each earth electrode.

i) ohms

ii) ohms

iii) ohms

iv) ohms

e) Lighting Protective System:

Resistance of the whole of lighting protective system to earth before any bonding is effected with electrode and metal. in/on the structure.

ohms

Signature of Supervisor

Signature of contractor

Name & Address

Name & Address

SPECIFICATIONS

All Specification, standard, publication etc. specified mean the latest standards, publication etc. pertaining to Electrical Installation and should conform to the following wherever applicable.

- 1) Indian Electricity Act 1910 with its amendments.
- 2) Indian Electricity Rules 1956 and its amendments.
- 3) Indian Electricity supply Act, 1948.
- 4) Regulation for Electrical Equipment in building by I.E.F. London.
- 5) The Factory Act 1948 and its amendments.
- 6) I.S.-732-1982 Part-I, II & III code of practice for Eletrical wiring and fittings in buildimgs for low and medium voltages.
- 7) I.S. 4064-1967 H.D. Air break switches and fuses for Voltages not exceeding 1100 volts.
- 8) I.S. 3043 – Earthing code of practice for
- 9) I.S. - 1554 Part-I - 1970 PVC insulated (Heavy duty) Electrical Cables for working voltages upto and including 1100 volts.
- 10) IS : 694 - 1964 Part-II - PVC insulated cable with Alluminium conduits (revised) for voltages upto 1100 volts.
- 11) IS : 5908-1970 - Electrical installations in buildings, method of measurements of.
- 12) IS : 4237-1967 - General requirement for switchgear and control gear for voltage not exceeding 1000 volts.
- 13) IS : 1653-1964 - Rigid steel conduits for electrical wiring (revised).
- 14) IS : 2509-1973 - Rigid steel conduits for electrical installation. (First revision).
- 15) IS : 1258-1967 - Beyonet landholders (First revision)
- 16) IS : 418-1957 - Tungsten-Filament General service electric lamps (Third revision)
- 17) IS : 374-1966 - Fans and Regulators, ceiling type, electric (Second revision)
- 18) IS : 2667-1964 - Fittings for rigid steel conduits for electrical wiring.
- 19) IS : 3419-1976 - Fittings for rigid non-metallic conduits (First revision)
- 20) National Electric Code, 1986.

ANNEXURE-I

Abstract of the Wiring Rules of the Institution of Electrical Engineers (referred to in the specification)

DEFINITIONS (See Clause 2 of the Specification)

Systems:

All electrical system in which all the conductor and apparatus are electrically connected to a common source of supply.

- 1) **Earthed:** Effectually connected to the general mass of the earth. Solidly earthed means earthed without the Intervention of a fuse, switch, circuit-breaker, resistor, reactor or solenoid.
- 2) **Uninsulated Conductor:** A conductor without provision, by the interposition of a dielectric or otherwise, for its insulation from earth.
- 3) **Bare:** Not covered with insulating material
- 4) **Dielectric:** Any material which offers high resistance to the passage of an electric current.
- 5) **Bunch Conductor:** When more than one conductor is contained within a single duct or groove or when they are run enclosed and not spaced apart from each other.
- 6) **Points:** In wiring as per IS : 5908-1970-Method of measurements of electrical installation in Buildings.
- 7) **Switch board:** An assemblage of switchgear with or without instruments, but the term does not apply to a group of local switches in a final sub-circuit where each switch has its own insulating base.

Note : In the electricity (Factories Act) special regulations 1908 and 1944, the term "Switchboard" includes "Distribution board".

- 8) **Single pole switch:** A switch suitable for closing and or opening a circuit on one phase or pole only.
- 9) **Linked switches:** A switch the blades of which are so linked mechanically as to make or break all poles simultaneously or in a definite sequence.
- 10) **Fuse Switch:** A switch the moving part of which carries 'one or more fuses.

11) **Three Wire System:**

a) Outer Conductor: Those between which there is the greatest difference of potential. This use of the word outer must not be confused with the use of the word when, applied to the external conductor of a concentric main.

b) Neutral Conductors: The term includes the natural conductor of a 3 phase 4 wire system, the conductor of a single phase or d.c. installation which is earthed by the supply undertaking (or otherwise at the source of the supply) and the middle wire or common return conductor of a 3 wire d.c. or single phase a.c. system.

12) **Semi enclosed machine:** One in which the ventilating openings in the frame are covered with-

- a) Grids, expanded metal or wire gauge, with openings of less than 1/4 inch so as to obstruct free ventilation.
- b) Wire gauge, in which the openings are less than 1/4 inch but not less than 3/32 inch (diameter or width):
- c) Screens with smaller openings than the above.

13) **Totally – enclosed Machine:**

One in which the enclosing case and bearings are dust proof and which does not allow circulation of air between the inside and outside of the case.

- 14) **Pipe Ventilated Machine:** An enclosed machine in which the frame is so arranged that the ventilating air may be conveyed to it through a pipe attached to the frame, the ventilation opening maintained by the fanning action produced by the machine - itself.
- 15) **Forced draught machine:** An enclosed machine in which the ventilating air supply is maintained by an independent fan external to the machine itself.
- 16) **Protected Machine:** One having end shield bearings and in which there is free access to the interior without opening doors or removing covers.

SWITCHES AND CIRCUIT BREAKERS

(See clause II of Specifications)

17) Switches and Circuit Breakers:

Switches and circuit breakers (rules 2b. 36 and 37), whether fixed separately or combined with lamps, holders or fittings, must comply with the following requirements:

- (a) Overt heading must not take place at the point of contract or -elsewhere, when the full current flows continuously.
- (b) They must be so constructed or arranged that the contracts cannot accidentally close when left open.
- (c) The basis must be of incombustible, non-conducting and moisture proof material.
- (d) Circuit breakers must be so arranged and placed that no combustible material is endangered by their action.
- (e) Unless placed in an engine room or in a compartment especially arranged for the purpose, they must have their live parts covered. The covers must be of incombustible material and must be either non-conducting or of rigid metal and clear of all internal mechanism. For more than 6 amperes, at pressures exceeding 125 Volts metal covers must be lined with insulating material.
- (f) In positions where they are liable to injury or come into contact with goods, they must be further protected by an open fronted box or other suitable guard.
- (g) Handles must be insulated and so arranged that the hand cannot touch live metal, or be injured through and adjacent fuse blowing.
- (h) Switches having a handle projecting through an open slot in the cover, must not be used.

Signature of contractor/s

Executive Engineer,

SECTION F-1A

GENERAL REQUIREMENTS

1.1 Scope of Works:

The work covered by electrical specification consists supplying and installing, electrical wiring system complete in strict accordance with this specification and the applicable drawing and subject to the terms and conditions of the contract. It includes.

- (a) Conduit and wiring system for fans, lighting points, bells, clocks, sockets etc. including fixing of lighting fixtures and fans etc. and miscellaneous points.
- (b) Conduit and wiring system for exhaust fans, power sockets etc.
- (c) Panel boards, distribution boards, switch fuse units.
- (d) Complete power and lighting cable systems.
- (e) Grounding system.

- (f) Conduits for Telephone system.
- (g) Street lighting system.
- (h) Other miscellaneous electrical work.

1.2 Completeness of Contract:

Any work fittings, accessories or apparatus which may not have been specifically mentioned in the specification but which are necessary in the equipment for efficient working of the plant should be deemed to be included in the contract and should be executed and provided by the contractors. All plant and apparatus should be complete in all the details, where such details, are mentioned in the specifications or not.

Three prints and one permanent negative of each of the finally approved drawings incorporating all the modifications proposed by the Department should be submitted. No modifications should be made in a drawing already approved by the Engineer-in-charge without his prior consent.

Approval of the contractor's drawing will not relieve the contractor of any part of his obligation to meet all the requirements of the contract.

1.3 Guarantee:

The performance of all the equipments and the installations should be guaranteed at least for a minimum period of one year from the date of taking over the installation by the Department. All equipments must comply with the relevant IS-BS specifications

1.4 Interchangeability:

All corresponding parts of similar plant and equipment should be interchangeable in every way.

1.5 Tools:

All special tools required for dismentling and assembly of the equipment covered by the contract shall be supplied as obligation under the contract.

A list of items to be supplied by the Contractor should be submitted alongwith the tender.

SECTION F-2A

Specifications for Electrical Installation in Buildings

1. GENERAL

1.1 These specifications relate to the electrical installations in the buildings of P.W.D. Electrical. The specifications cover general requirements to be fulfilled. These general specifications are supplemented by the specifications for the particular buildings separately attached.

1.2 These specifications are governed by the General conditions of the contract attached hereto.

1.3 APPLICABLE RULES AND REGULATIONS:

1.3.1 Installation shall be carried out in conformity with the regulations for electrical equipments of buildings, published by the Institute of Electrical Engineers London (14th Edition 1966 and as amended upto date) herein after referred to as the I.E.E. wiring regulations. Where these specifications or the special specifications for the particular building attached hereto are at variance with the I.E.E. regulations these specifications or special specifications as the case may be shall be followed. The installation shall also comply with the requirements of the Indian Electricity Act, 1910 as amended upto date and rules issued there under and also the regulations for the Electrical Association of India. Where not specified otherwise, the installation should generally follow the Indian standard codes of practice and in their absence the relevant British Standard of practices. All the materials shall comply with the relevant Indian Standard or British Standard specifications.

1.4 DEFINITIONS:

1.4.1 The definitions of terms in the I.E.E. regulations shall apply in general.

1.5 DRAWINGS:

1.5.1 The preliminary drawings only indicate the general scheme of requirement. The exact position of all points, control switch boxes, runs of wiring and/or conduits joint boxes, inspection boxes, mains, and sub distribution boards, mains etc. shall be got approved by the Engineer-in-charge. All circuits shall be clearly numbered in wiring diagrams and building plans. The detailed design of a switch-board, special fixture or any other part of the electrical installation as may be called for by the engineer-in-charge shall also be supplied by the Contractor and should be got approved by the Engineer-in-charge. Three sets of completion drawings and wiring diagrams showing the installations as executed shall be supplied by the contractor along with the completion certificate.

1.6 MATERIALS:

All materials shall be new and of the best quality conforming to the relevant I.S.B.S. specifications. They must be the products of reliable manufacturers of many years or standings. All like parts of materials shall be interchangeable. In case of equipments such as circuit breakers, switch fuses etc. a descriptive and illustrated literature shall accompany the tender. The names of manufacturers of various materials shall be furnished in Performa in Appendix-I. Samples of materials wherever required should be approved by the Engineer-in-charge before use in the installation. One set of such approved samples shall be deposited with the Engineer-in-charge. All materials shall be rust-proof or rendered rust proof by application of suitable paints. The Supply of all equipments, switchgears etc. shall be complete with accessories, fittings and mountings as may be required for their proper performance, and as specified in the relevant IS-BS Code of Practice and standards.

1.7 WORKMANSHIP:

1.7.1 Good workmanship and neat finished appearance are the prerequisites for complying with the clauses of these specifications. With a view to ensure fine workmanship the tenderers shall employ licensed wiremen, with an experience of not less that 5 years in the type of work they are engaged. The work should be done under the supervisions of licensed Electrical Supervisors with good educational qualifications and considerable experience.

1.7.2 Tenderers, shall furnish the names of Supervisor and their wiremen who will be engaged in this work with details of their experience.

1.8 CO-OPERATION WITH CIVIL AND OTHER WORKS CONTRACTORS :

1.8.1 The tenderer, after the award of the contract, shall co- operate with the civil and other contractors and shall co-ordinate his work with the work of other contractors with .the least amount of dislocation and interference to the other works Tenderers shall go through the drawing carefully and shall furnish the Engineer-in-charge with all the details of openings in the walls etc. they may be required for concealing any of the electrical equipments or accessories. Where the contractor fails to furnish such information as may be required for the purpose of concealing the equipments etc. they shall be made at his (Contractor) cost and expense. Any alteration to parts of the building shall be carried out with prior permission of the competent authority. All chaises of the structural work shall be made good at the contractor's expense and brought to the original shape finish and colour.

1.9 TESTING:

The electrical contractor shall be completely responsible for the 'testing and commissioning of those installations covered by these specifications in compliance with the standard procedure, in obtaining permission of the Government Electrical Inspector. Any modification which is demanded by Government Electrical Inspector shall have to be carried out within the scope of the contract. The contractor shall submit four copies of drawings of installations as per regulations for shall be provided by the contractor for carrying out the installation work. All tests shall be carried out in the presence of the Engineer-in-charge or his authorized representative and his approval obtained for the test results.

1.10 COMPLETION CERTIFICATE AND MAINTENANCE GUARANTEE:

1.10.1 After the completion of the installation and testing, the contractor should furnish a certificate in the proforma in Appendix-III, at the time of taking over the installation by the Department. The installation shall be guaranteed for period of 12 months from the date of taking over by the Department. During the period of guarantee all defects in material or in workmanship shall be rectified or replaced free of cost to the Department.

1.11 TENDERER'S ABILITY:

1.11.1 In order to enable the Department to asses the ability of the tenderer to execute the work, the tenderer shall furnish evidence of his experience and capacity to carry out the work of the magnitude and nature.

1.12 RATES:

1.12.1 The rates of items shall include all taxes, transport, loading and unloading charge and all such charges that may be required to be incurred for the supply and installation of the materials at site. The rates shall be firm and variations in the market are not entertained. Break up figures as required in the schedule of work shall also be furnished. As far as possible indigenous materials only shall be included for supply. Where it is unavoidable, imported items may be included and tenderer should clearly indicate materials, quantity, rate and amount of these items.

1.13 STORAGE SPACE:

No covered storage space will be provided by the Department. The contractor has to make his own arrangement, However the Department may give an open space near the place of execution where the contractor can build his own stores for executing the work.

1.14 DEPARTURE FROM SPECIFICATIONS:

The tenderer should clearly indicate departure, if any, from the specifications with reasons for the same.

1.15 EXTRA ITEMS:

Rates for extra items shall generally be derived from the rates already available in the schedule. Where it is not possible, the rates shall be mutually agreed upon and the contractor shall furnish a detailed analysis of the rates claimed by him.

2. TECHNICAL SPECIFICATIONS:

2.1 Supply System:

The wiring installation shall be suitable for 3 phase 4 wire, 400-440 V 50 cycles system of supply. Colour code of different phase shall be followed as per standard.

2.2 Wiring for Lights and Fans:

2.2.1 Looping system of wiring shall be adopted. No joints shall be made at intermediate runs of cables and where they are unavoidable, such joints shall be through approved mechanical connections.

2.2.2 Point wiring:

Point wiring shall consist of the branch wiring from the switch board together with the controlling switch or push as far as and including the ceiling rose or any other approved connector or socket, outlets. In case of more than one light being controlled by one switch, the wiring up to the ceiling rose of the first light including the switch shall be considered as a 'Primary point, Loop wiring from light shall be considered as a 'Secondary' point and rates shall be quoted separately, including final connections to fixtures and plugs.

2.2.3 Conductors:

No conductor for final sub circuit wiring for light and socket outlets shall have across-section less than that of 2.5 sq.m. (aluminium).

2.2.4 Loading:

No final sub "limit radiating from the fuse board of a sub- distribution board and wires with 25 sq. m. (Al.) cable shall carry more than 10 lights, fans or socket outlets or a connected load of 800 watts whichever is greater. The following wattages may be assumed for estimating the load on each sub-circuit unless otherwise known or specified.

Incandescent Lamps	100 watts
Ceiling fans	60 watts
5-A Socket Outlets (lighting)	100 watts
4 ft. fluorescent tube	50 watts
5 ft. fluorescent tubes	100 watts

In each sub-distribution board at least one way preferably two ways shall be left spare for future requirement. A wiring diagram giving the details of the exact utilization of the ways shall be prepared and fixed in the sub-distribution board itself or any other family accessible place. The ways of sub-distribution boards shall be accordingly numbered.

2.2.5 Local Control Switches (General):

Local control switches for circuits carrying not less than 5-A shall be piano type and shall conform to relevant I.S. Standards. The switch shall be 'ON' when the knob is in the down position. All local control switches shall be connected in the phase or live conductor only and not in the neutral conductor, switches shall be fixed in iron clad box and shall be so placed that the centre of the switch box is 1.3 mtr. from the finished floor level unless otherwise stated. All switch boxes shall be provided with 1/8" thick Perspex cover fixed to the switch box with chromium plated counter sunk screws (brass).

2.2.5A Switches (Two way):

- Two way switches shall be piano type single pole, double throw, 250V, suitable for flush mounting and of 5A capacity as per the drawings. All switches shall be recessed in an embedded metal box.
- Each box shall have suitable outlet for fixing conduits directly.
- Each box shall have Perspex cover painted inside with the wall colour, if required.
- Each switch shall be suitable for the position in a corridor stairway wiring.

2.2.5B Switch Boxes (General):

Electrical circuits shall be written suitably on the cover of all switch boxes, as approved by the Engineer-in-charge (Elect) whenever different phase are terminated in a switch box bakelite partition shall be provide. Each case shall be provided with a G.I. Earth stud nut and washers for earth connectors.

2.2.6 Ceiling Rose:

Ceiling rose shall be used on circuits having a voltage normally exceeding 200V. Only one flexible cord shall be attached to a ceiling rose. Only 3-pin 5A socket outlet shall be provided in lighting circuits. All socket outlets shall be provided with a control switch and they shall be mounted in switch boxes in an approved manner.

2.2.7 Fittings:

These shall be of approved type as specified in the tender schedule. The sub circuits leads should terminate in a ceiling rose or conductor in the fitting and internal connection made there from. Wherever these fitting are suspended they shall be done so through the conduits and ball and socket joints. All fittings shall be grounded by a G.I. conductor not less than 16 S.W.G.

2.2.8 Flexible wiring:

Flexible cords of not less than 23/0076 size shall be used. The weight of suspension shall be governed by I.E.E. Regulations.

2.2.9 Ceiling Fans:

All ceilings fans shall be wired to ceiling rose and suspended from a hook shackle or clamp and insulated from the same. All joints in the suspension road shall be screwed and secured by means of split pins. The fan clamps supplied by the Contractor shall be suitable for the ceiling or proof member as the case may be. For Concrete roofs, fan hooks shall be buried in concrete during contraction in an approved manner and securely bound to the reinforcement.

2.2.10 Conduits and Earthing:

All conduits feeding lighting and fan circuits shall be provided with earth continuity G.I. conductor as specified for power wiring. All conduits shall be as specified for power wiring.

2.3.1 Point wiring:

Point wiring for power shall be as defined under section. 2.2.2 and shall include the switches and sockets.

2.3.2 Loading:

All distribution board for power wiring shall be not less than 15A per way. Loading per way shall not exceed normally 100 watts. The following loads may be assumed if exact figures are not known.

3-Pin 15A Outlets	1,000 Watts
3-Pin 5A Outlets	100 Watts

2.3.3 Wiring for Motors:

2.3.3.1 Final sub-circuits loop in motors shall be connected to separate ways of the Distribution board even if the current in the sub-circuit is less than 15A. No looping is permissible.

2.3.3.2 All wiring shall be carried in H.G. conduit as specified in I.S. specification for gauge for different sizes of conduits. When the motor is resiliently mounted flexible conduit with approved adopters shall be used for the last few feet. Where cables are used sufficient loop shall be left.

2.3.3.3 All switch fuse units controlling circuits feeding motor shall be provided with H.R.C. fuses or as specified.

2.3.3.4 The frame of every motor and its association control gear shall be earthed by two separate and distinct connections to earth connector shall be capable of carrying 3 times the rating of fuse or 1.1/2 time the setting or the circuit breakers but in no case less than No. 8 S.W.G. or 7064" or equivalent cross section of copper. Where practicable, the earth connections shall be visible for periodical inspection. Gas or water pipes shall not be used for earth connections.

2.3.3.5 Socket Outlets and Control Switches 5A and 15A:

All socket outlets shall be of 3 pin type, the third pin being connected to the earth stud of nearest distribution board by separate earthing wire. The socket shall conform to IS : 1293/1938, single pole, piano type. Each socket outlets shall be provided with a control switch of appropriate rating and as specified. The switch and socket shall be mounted inside the iron clad box provided with 1/8" Perspex cover as directed by the Engineer-in-charge or as specified in schedule of quantities. Inside switch box ample space shall be available around switches for connecting wires to switches. All socket outlets for power shall be mounted at the skirting level unless otherwise specified or as directed by the Engineer-in-charge.

The three phase plug receptacles shall have their earth terminals connected by independent earth wires to ring main earth strips on the building. In buildings where explosion proof fixtures are installed single phase plug receptacles as well as light points shall be connected to ring main ground bus installed in the building by separate; earth wires of approved size.

Socket outlet shall have some provision not to receive the matching plug unless the grounding pin is in correct position. The grounding pin of the plug shall make the contact first and break the contact last at the time of inserting or removing the plug respectively.

The grounding terminal shall be connected to the enclosed metal body by providing G. I. stud, nut washers welded to the box.

Each unit shall be suitable for flush mounting as required and indicated in the applicable drawings.

Combination unit of socket outlet and switch shall be complete with necessary internal wiring. The switch/socket shall be mounted on M. S. bracket enclosed in a box.

2.4 Conduit Wiring

2.4.1 Where conduit wiring is adopted the type and size of the conduit shall be as indicated in the drawing. The minimum of the conduit shall be 19 mm.

2.4.2 The contractor shall thoroughly study the structural and architectural arrangements of the buildings and wherever, necessary shall in consultation with Department's representatives at site, make suitable adjustments in the cable routings, earthing arrangements, and location boxes, fittings etc. with a view to avoid interference with any part of the building, structure, equipment or any other work in the building or to effect any improvement in the arrangement.

2.4.3 Protection of conduit against rust:

Conduit shall be given two coats of oxide paint before they are placed in position. All exposed conduit shall be painted after installation with the colour as approved by the Engineer-in-charge. This do not apply to galvanized conduit.

2.4.3 A Protection against insects and damp:

In order to minimize condensation or sweating inside the conduit, system shall be properly drained and ventilated in

such a manner as to prevent the entry of insects.

- 2.4.4. Conduit shall first be installed as a complete system without cables and shall be continuous from outlet to outlet from fitting to fitting and mechanically and electrically connected to all boxes and fittings.

2.5 SPECIFICATION FOR POWER CONTROL AND TELEPHONE CABLES:

1. SCOPE:

- i. The specifications cover the supply and installation of medium voltage power and control cables either in ground or trench depending on the conditions at site including accessories for the same. The work in general, consists of supplying, laying, jointing terminating and connecting all 11 KV APLSTS PVC power and control-cables.
- ii. The contractor shall supply all accessories including jointing and terminating materials, compound, tapes supporting materials, cleats cables lugs, concrete stabs, bricks sand, cable markers etc, as required to make the installation work including digging and backfilling of the trenches as required.

II. SPECIFICATIONS

- i. All power cables to be supplied mentioned as 'APLSTS' in the Schedule should be mass impregnated, non-draining, paper insulated lead sheathed, double steel tape armored and must comply with the latest ISI BS specifications.
- ii. All cabling materials such as cable compound, cable lugs, tapes, shall be of approved quality acceptable to the type recommended by the manufacturer of the cable for which it is and approved by the Department
- iii. Installation of all equipment shall also conform to the applicable. Codes and practice as per the IS and shall be executed to comply with the latest Indian Electricity rules as regards the safety, earthing of equipments and other essential provisions specified therein.
- iv. Only approved make of cables shall be used. ICC and CCI will be preferred
- v. The cables shall generally be laid as per IS code of practice.

III. GENERAL RULES FOR CABLE LAYING:

- i. Installation shall be carried out in a neat, workman like manner by skilled experienced and competent workmen in accordance with the standard practices.
- ii. Cables shall be laid preferably in one piece length to avoid joints. If straight joints are found necessary, these can be introduced with prior approval of the Engineer-in-charge. The cost of the straight joint however, shall not be borne by the Department, But in no case joint shall be within the conduit, G. I. pipe and duct.
- iii. Proper care should be exercised in handling the cable to avoid formation of kink etc. and should it become necessary a cable shall be bent to a radius not less than 20 times the overall diameter of the cable.
- iv. Method of installation, routing of cable etc. shall in every case be subject to the Department's approval and the contractor shall modify and or certify at no extra cost to the Department any portions of the installation which do not meet with the Department's approval. All damages to the civil and other works on this account shall be made good by the contractor at no extra cost to the Department.
The electrical contractor while notifying the building contractor for such work shall furnish the proper drawings, fully explaining the work involved or indicate at site actual work to be carried out as may be required by the building contractor. The electrical contractor shall also notify the building contractor in writing, for finishing up as required, of any such work as soon as the electrical work with respect to the same has been completed.
- v. Where cables pass through hume pipes, contractor shall fix hard wood bushed round the cables at the ends of hume pipes. Where the cables pass through the floors or chambers and in such other situations as the Engineer shall require, the contractor shall seal cable holes in a manner approved by Engineer-in-charge. Where cable pass through roads, nallahs, etc. cables must be protected by Class 'A' Hume pipe of diameter not less than 6" (15 cms).
- vi. The cable route shall be the shortest and these shall be minimum interference with built up areas, lawns etc.
- vii. Care shall be exercised for providing suitable props for supporting other service lines on earth at the time of excavation. Where cutting of a lawn become inevitable it should be with the approval of the Engineer-in-charge.
- viii. Excavation of the trenches shall be executed with vertical sides and the trenches shall be kept as straight as possible. The exact location of each trench shall be settled by the Engineer-in-charge. On the site when the contractor is in a position to commence each portion of the work.
The trench shall be not less than 1/2 meter wide and 90 cms deep. If more, cables are to be laid, the width should be suitably increased.

- ix. After the cables are laid, the trench shall be filled in layers, the earth in each layer being well rammed by spraying water and consolidated and sufficient allowance made for settlement. The extra earth over the trench should be removed from the place of trench to a place as decided by the Engineer- in-charge at site.
- x. Ends of cables shall be properly sealed to prevent entry of moisture prior to installation.
- xi. Where it is as specified as 1/2 core cables, the 1/2 core shall be a neutral conductor having reduced section.
- xii. For all multicore cables each core and tails shall be brought out, marked and or coloured in on approved manner.
- xiii. Cable termination shall be done with suitable compression brass glands in the case of PVC cables and cast iron trifurcating boxes in the case of APLSTS cables. The armour should be connected to the right main earth in building with duplicate earth wires as per the relevant IS/BS specifications.
The core insulation over each conductor shall however be retained through out the run of the conductor upto the end where lugs shall be fitted thereon for connections. The -lugs shall be fitted by means of approved solder and flux such as a leap, and Eyre No. 7 liberally used. The joint shall be mechanically strong and pressure tested.

2.6 DISTRIBUTION BOARDS AND PANELS:

General Requirements:

- 2.6.1 All distribution panels shall comply with I.E.E. Rules 60-61. A clear distance of 0.91 meter in front of the switch board shall be kept. Where bare connections or attachments are provided at the back of the switch board the space behind the panel shall be either less than 0.299 meter or more than 0.762 main width there shall be a passage way from the furtherest outstanding part of any attachment or conductor. If the space behind the switch board exceeds 0.70 main width there shall be a passage way from either end of the switch board clear to height of 1.928 m width 0- 299 m. All wiring connection shall be made neatly and securely.
- 2.6.2 For crocoites carrying more than 10 Amps, tinned cable sockets shall be used. All connections shall be so made as to form their own diagram Circuit shall be clearly numbered to correspond to wiring diagram Names of the distribution boards shall be painted as directed by the Engineer-in-charge. All the switch fuse units and isolators D.Bs. shall be complete with earthing studs lugs neutral bar link, H.R.C. fuses and of approved make.
- 2.6.3 Skeleton type panels shall have a rigid form work adequately braced and supported. The switch and distribution boards shall be neatly arranged in the frame. The details of the frame work and the arrangement of switches shall be got approved by the Engineer-in-charge before the panel is fabricated.
- 2.6.4 All cubical type panels shall have rigid supporting frames adequately braced over which sheet metal shall be nearly secured. All switches, distribution boards etc. shall be neatly arranged on the panels and all connections made from the back of switches. The panels shall be rendered dust and vermin-proof. The interior of the panels shall not be accessible to unauthorized persons.
- 2.6.5 The recess type boards shall be embedded in wall in a cupboard with a metal hinged door with locking arrangement. In all recessed conduit work all distribution boards shall be recessed. Where recessing is not possible, free standing panel may be provided as approved by the Engineer-in-charge.
- 2.6.6 All individual components i.e. switch fuse units D.Bs. etc. shall be connected by earth continuity wire of appropriate size with the main earth bus of the panel D.B. etc. The panel switches or D.Bs. shall be earthed by not less than 2 distinctive paths to earth. Earthing of metallic parts or exposed metal shall not be effected through any structural metal work which houses the installation. Where metallic parts are not required to be earthed and are liable to become alive should the installation of the contractor become defective such metallic parts shall be separated by durable non-conducting material from any structural work.
 - (a) Power panels shall be 3 phase, 4 wire, 400/230 volts for the distribution of 3 phase or single phase power loads. Lighting panels shall be 3 phase, 4 wire 400/230 - volts for single phase lighting load distribution on all 3 phase.
 - (b) All panels shall be done or protected front type with no mechanical or electrical defects.
 - (c) Bus bars shall be of electrolytic copper or aluminium as specified and the properly tinned sizes as indicated on applicable drawings as required.
 - (d) All knock outs for branch circuits, conduit entries shall be drilled in and filled as required. For lighting panels the top and bottom cover plates shall be removable type.
 - (e) Main disconnect device for all panel boards shall be of switches of disconnect type and of the size as indicated shall be mounted directly below the panel or through a short thread conduit of required size.

- (f) The main disconnect for all panel boards shall have an entry suitable for PVC armoured cable from bottom.
- (g) All panel boards shall be provided with an earthing terminal and lug for connection to the grounding system.
- (h) Temperature rise of all electrical parts shall not be more than 300°C with full load amusers at room temperature.
- (i) Buses shall be securely supported so that ordinary vibrations will not cause any of the parts to become loose.
- (j) All barriers and supports of current carrying parts shall be of moisture resistant insulating material and shall not be adversely affected by arcing.
- (k) The locations of panels shown in the drawings are only tentative. Panels may be located at a place approved by the Engineer-in-charge.
- (l) All civil works connected with fixing such as grouting chasing and making good shall be the tenderer's responsibility.
- (m) Wires of adequate capacity with proper size of lugs shall be used for interconnections.
- (n) Panel should be self supported on angle channel iron frame work. It should be preferably of bolted construction in case of transportation and flexibility. The frames shall be of the required size for the mounting of the equipment on it. It shall be bolted or grouted rigidly after leveling and alignment.
- (o) The cupboard and D.B. should be of such size so to be accommodated in the existing room as per I.S. rules and IS codes of practice for installations of Medium Voltage switch gear.
- (p) Fabrication drawing showing the detailed dimensions and panels and its components indicating the frame work, earthing positioning of switches, D.Bs. cable boxes, adopter chambers etc. shall be furnished to the Engineer-in-charge for his approval. All material to be got approved by the Engineer-in-charge. Panel should be guaranteed for satisfactory operations for a period of one year after handing over.
- (q) The panel should be painted with anticorrosive paint suitable for humid and salty atmosphere on two coats of primer.

Switch Gears, Powers Panels D.B. and S.F. Us.

- 2.6.8 The main busbar shall have continuous current rating as specified with neutral bar having half of full load rating of the phase busbar. The sizes of the bus bars shall be so selected that the current density in bar does not exceed 150 amps, per sq.m. for copper. The length of bus-bar chamber should be as suitable length to fix all the switches etc. as per the prevailing standards, clear spacing of two adjacent buses shall be 11/2" minimum bar should be itaped all along with colour coated 11 KV grade PVC tape. The maximum internal of support for each unsupported length shall exceed 600 mm.

The bus bar shall be of copper/alluminium and fabricated to the relevant standards specification. In case alluminium bus bar is used special with high conductivity alluminium bus bar alloy E 91 C frame conforming to E.S.S. 2898 shall be used. The current density shall not exceed 800A per sq. inch. Hylam barriers will be provided over the joints to prevent any short circuit.

The bus enclosing shall be made out not less than 16 gauge M.S. sheet construct on with angle iron support. All interconnections between bus bars S.F. Us. and D. Bs. shall be of adequate size and details of such inter connection shall be furnished to the Engineer-in-charge for his approval.

The bus bar shall be air insulated extensible type rectangular one. The bus bars chamber shall be dust tight by providing gaskets secured properly -so as to tender it vermin proof.

The Combination Fuse-switch unit should comply with IS 4064 BS 861 and BBS 2510 wherever applicable. It should be suitable to accommodate High Rupturing Capacity Cartridge Fuse links complying with IS 2208 or BS 88 and having a certified rupturing capacity of not less than 35 MVA at 440 volts (ACS duly). The switch gear (panes. D.Bs. etc.) shall be installed generally as per IS-Part- I 3072 and as specified and shown in drawings.

All fuse switch units shall be provided with non-deteriorating HRC fuse links complying with IS 2208-1962 and having rupturing capacity of 35 MVA at 415 volts or as specified.

All switches above 60 amps, rating shall be provided with suitable size adapted boxes. All switches mounted on the top of the busbars shall be provided with detachable type reverse entry adapter boxes. Suitably engraved lables shall be provided for each circuit as well as for the board.

A meters sector switches and LMH metre shall be provided where specifically mentioned. Small wiring for the inter-connecting shall be colour coded and provided with numbered fuses for easy identification of circuits.

- (a) The distribution boards should be totally enclosed metal clad complying with B.S. 214. The M.S. sheet steel enclosures for recessed D.Bs. shall be of not less than 14 gauge.
- (b) The D.B. shall be with handed door and the locking arrangements as approved by the Engineer-in-charge.
- (c) All the components shall be enclosed in the enclosure. The mounting of D. B. shall be got approved by the Engineer-in-charge before carrying out the installation.
- (d) The D.Bs. shall have proper size cut outs for conduits entry or cabbie entry as required and these shall be made on site.
- (e) Adequate spacing shall be provided inside the D. Bs. for easy removal of the fuses and carry out the interconnection.
- (f) A set of insulating barriers have to be provided between incoming breakers switches and fuses.

Switch fuse Units:

- (a) All the D.P.T.P and T.P.N. switch fuse units shall be totally enclosed iron clad quick make, quick break type to best Indian make conforming to the I.S. or B.S. 3185 specifications. All the switch fuse units shall have mechanical interlock with a door, so that the door cannot be opened when the switches are in 'ON' position, The switches should be of double break solution type to ensure safely.
- (b) Each T.P. & T.P.N. switch fuse unit shall be earthed with two distinct earth connections.
- (c) Suitable insulator shall be provided between phase.
- (d) There shall be suitable natural link in the fuse box.
- (e) All T. P. & T. P. N. switch fuse units shall be rated for 500 volts and D. P. (required for single phase supply) and S.P.N. switches for 250 volts.
- (f) The H.R.C. cartridge fuse shall conform to H.S. 88 (1952).

The O.C.Bs., ACB shall be suitable for 400/440 volts 3 phase 50 cycle supply capable of interrupting a fault MVA of not less than 31. The circuit breaker shall conform to the BSS-936-1940 BSS 3659 with such tripping arrangement as may be required under special specifications for the building. Efficient and fool-proof mechanical interlocking shall be provided for the safe operation and maintenance The rate shall be inclusive of the first filling of oil.

2.7 Instrumentation:

The instruments and meters wherever necessary shall be housed in special sheet steel box located between switch fuses units and bus bar chambers. The instruments etc. shall be mounted on the hinged cover with their dial flushed. All instruments shall have protective H. R. C. fuse links. All interconnections and small wiring shall be neatly dressed arranged and duly coloured for easy identification of circuits.

Meters shall be provided as required in the Schedule, meters shall be dead head and be suitable for 400/440 volt 3 phase 4 wire 50 cycle (in balanced load) supply.

Each selector switch shall be 3 point and of minimum 250 volts grade with silver tipped contacts suitable for metering circuits, current transformers shall be of 5VA burden and commercial metering accuracy. Indicating lamps shall be panel mounting type preferably of 250V grade. Every unit shall be prewired and interconnected to the system for its required indicating performance. Indicating lamps shall have independent circuit fuse.

2.8 FIXING OF LIGHTING FIXTURES:

1. Location of fixtures their manner of fixing mounting height etc. are indicated in relevant drawing. Actual location and levels shall however be arrived at site in co-ordination with other service etc and prior approval of the Engineer-in-charge regarding the actual location. Manner of fixing shall be obtained before the work is taken up in hand.
2. In all cases the contractor shall provide necessary interconnection wiring earthing painting etc. all necessary for complete installation. The contractor shall also test and commission the fixtures during completion of the work.

3. General arrangement of fixtures layout is indicated in drawings. Care shall be taken to see that all light fixtures are in a row in a room or particular area, are in absolute line and plump and are symmetrically disposed with respect to finished surfaces of walls columns beams etc,
4. The inter-connections wiring from the light outlet point upto the fixture shall be carried out by means of flexible copper wire of section not less than 1.5 mm².
5. All fixtures suspended by means of conduits shall be done with all and socket joints or as per approved design.

2.9. Telephone System:

1. Empty conducting shall be done, recessed or exposed to surface along with pull boxes, junction boxes and telephone outlet boxes, in areas and location as indicated in the relevant drawing as per materials and methods as described in regard to conducting under section "Wiring in Conduits" except the G.I. pull wires of gauge not less than 20 SWG shall be kept pulled through conduits in all sections so that in future telephone wires can be pullet easily.
2. Location shown on the drawing are approximate and final location shall be decided in the field by the Engineer-in-charge.

SECTION G

SPECIFICATION FOR EARTHING

1. Installation of Earthing Plates :

All installation of earthing shall conform to Indian Electricity Rules IS-3043 latest edition and I.E.E. The copper earth plates should be tinned before installation. The earth plates of copper 60 cm x 60 cm x 3.515 mm. thick size as mentioned in the schedule be in separate pits at least 150 cms to 300 cms. away from the building at a depth necessary to reach moist earth surface but with a minimum depth of 2.5 mtr from the finished ground level up to the top vertical dodge of earth electrode. The earth plate shall be thoroughly cleaned to remove all dirt from the surface and be tinned property for electrical contact with the main ground. Each earth pit should be provided with 38 mm. dia G. I. pipe 2.5 Mts. long or more depending upon the depth of pit, put over the vertical edge of earth plate (with top end of pipe provided with a closed to coupler). Alternative layers of salt and coke shall be provided surrounding the plate. The pits shall be filled when the plates are in position and with the approval of Engineer-in-charge.

To facilitate watering the pit, a concrete compartment should be made with funnel with mesh and cover plate as per rules provided in ISI regulation. The masonry endousures shall be 25 cm x 25 cm x 25 cm (deep) with C. I. lid of 23 cm x 30 cms size. After installation, the earthing resistance of each earth plate should be measured by resistance meggar in the presence of Engineer-in- charge, three days after the completion of earthing work, and the value should conform to regulations.

Signature of contractor/s

Executive Engineer,

Division

-- List of Approved Products --

As per separate Booklet Attached

LIST OF THE APPROVED ELECTRICAL PRODUCTS (FOR THE YEAR 2006-2007)

LIST OF THE APPROVED PRODUCTS

CHAPTER – I

WIRING

1.1 SHOCKPROOF ACCESSORIES

(A) Concealed / Surface Type

Any I.S.I. marked switches and accessories approved by the Engineer-in-charge of work.

(B) Mini Modular Type

1. ANCHOR
2. VINAY
3. ELLE

(C) Modular Type

A. CATEGORY-I

1. ANCHOR
2. SG
3. ELLEYS

B. CATEGORY-II

1. MK
2. TOYOMA
3. LK
4. NORTH WEST

1.2 RIGID PVC PIPES/OVAL PIPES & FITTINGS

FIA Approved & ISI marked (Emossed)

1. VIRAJ
2. NIHIR
3. PRECISION
4. SHRINATH

1.3 OVAL /CASING & CAPING & PVC TRUNKING

1. PRECISION PLASTIC
2. CENTUR
3. M.K.
4. SHREENATH
5. TOYOMA
6. L.M.

CHAPTER – II

LAMPS & FITTINGS

2.1 FIAMENT LAMPS/ FLOURESCENT TUBES

(A) CAT-I

ANY ISI MARKED

(B) CATEGORY-II

1. SURYA
2. BAJAJ
3. PUSKAR
4. OSRAM

(C) Category-II

1. PHILIPS
2. CROMPTON

2.2 MERCURY VAPOUR LAMPS

(A) CAT-I

ANY ISI MARKED

(B) CATEGORY-II

1. SURYA
2. BAJAJ
3. OSRAM
4. MYSORE
5. MYNA

(C) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.3 SODIUM VAPOUR LAMPS

(A) CATEGORY-I

ANY ISI MARKED

(B) CATEGORY-II

1. PUSKAR
2. OSRAM
3. BAJAJ
4. MYNA

(C) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.4 COMPACT FLOURESCENT LAMPS

(A) CATEGORY-I

ANY OTHER THAN FOLLOWING MAKE

(B) CATEGORY-II

1. ANCHOR
2. OSRAM
3. SHAH
4. ORPAT
5. INDOASIAN
6. JOY LIGHTING
7. DECON
8. ARCO
9. SAMAY
10. MYNA

(C) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.5 METAL HALIDE LAMPS

(A) CATEGORY-I

ANY ISI MARKED

(B) CATEGORY-II

1. PUSKAR
2. SURYA
3. OSRAM
4. BAJAJ
5. MYNA

(C) VATEGORY-III

1. PHILIPS
2. CROMPTON

2.6 ENERGY SAVING FLOURESCENTTUBE FITTINGS (Box Type/ Industrial Type/ Mirror Optic/ Mirror Light/ Street Light)

(A) CATEGORY-I

ANY OTHER THEN FOLLOWING MAKE

(B) CATEGORY-II

1. DECON
2. SHAH
3. HAVELLS
4. ASIAN
5. SHAKTI
6. MYNA

(C) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.7 FLOURESCENT TUBE FITTINGS

[ELECTRONICS BALLAST]

(Box Type/ Industrial Type/ Mirror Optic/ Mirror Light/ Street Light)

(A) CATEGORY-I

ANY OTHER THEN FOLLOWING MAKE

(B) CATEGORY-II

1. SURYA
2. ARCO
3. ANCHOR
4. SHAKTI
5. DECON
6. HAVELLS
7. SHAH
8. FIXOLITE
9. MYNA
10. JOY LIGHTING
11. PRESTOLITE

(C) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.8 MERCURY VAPOUR LAMP FITTINGS (POST TOP LANTERN/ STREET LIGHTS)

(A) CATEGORY-I

ANY OTHER THAN FOLLOWING MAKE

(B) CATEGORY-II

1. SURYA
2. ARCO
3. SHAKTI
4. DECON
5. HAVELLS
6. BAJAJ
7. FIXOLITE
8. MYNA
9. JOY LIGHTING
10. PRESTOLITE

(B) CATEGORY-II

1. ANCHOR
2. SHAH

(C) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.9 SODIUM VAPOUR LAMP FITTINGS (POST TOP LANTERN/ STREET LIGHTS)

(A) CATEGORY-I

1. KUMAR
2. GLOLUX
3. G-LITE
4. ARYA

(B) CATEGORY-II

1. SURYA
2. ARCO
3. SHAKTI
4. BAJAJ
5. CANARA
6. FIXOLITE
7. MYNA
8. JOY LIGHTING
9. HAVELL'S
10. PRESTOLITE

(C) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.10. FLOOD LIGHTS WITH BC/ES/MV/SV/MH/ LAMPS (POSTTOP LANTERN/ STREET LIGHTS)

(A) CATEGORY-I

1. ARCO
2. GLOLUX
3. G-LITE
4. TWINKLE
5. KUMAR
6. ARYA

(B) CATEGORY-II

1. SURYA
2. FIXOLITE
3. DECON
4. SHAKTI
5. BAJAJ
6. JOYLIGHTING
7. HAVELL'S
8. PRESTOLITE

(C) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.11 TABLE FANS

(A) CATEGORY-II

1. DECON
2. BAJAJ

(B) CATEGORY-III

1. PHILIPS
2. CROMPTON

2.12 ELECTRONIC BALLAST

(A) CATEGORY-I

1. KUMAR
2. MARVEST
3. KELTRON
4. JOY LIGHTING
5. ARYA

(B) CATEGORY-III

1. L&T
2. SIEMENS

3. ASIAN
4. OSRAM
5. OPAL
6. HAVELLS
7. ACON
- (C) CATEGORY-III**
1. PHILIPS
2. CROMPTON

CHAPTER – III

SWITCHGEARS & DISTRIBUTION BOARDS

3.1 CAST IRON CLAD SWITCHES WITH REWIREBLE FUSE

(A) CATEGORY-I

ANY OTHER THEN FOLLOWING MAKE

(B) CATEGORY-II

1. NEW
2. MODI
3. SUPER
4. PEW

(C) CATEGORY-III

1. KEW
2. STENLY

3.2 METAL CLAD SWITCHES WITH REWIREBLE FUSE (A – 100 A)

(A) CATEGORY-I

1. SIGMA

(B) CATEGORY-II

1. MODI
2. HPL
3. SUPER
4. TRISUL
5. KEW
6. STATNDARD

(C) CATEGORY-III

1. HAVELLS
2. L&T
3. CROMPTON

3.3 METAL CLAD SWITCHES WITH HRC FUSE

(A) CATEGORY-II

1. STANDARD
2. SUPER
3. CROMPTON
4. KEW
5. HPL

3. C&S
4. GE
5. HAVELLS

3.4 MOULDED CASE CIRCUIT BREAKERS

(A) CATEGORY-II

1. HAVELLS
2. CROMPTON
3. STANDARD

(B) CATEGORY-III

1. L&T
2. C & S
3. G.E.
4. SIEMENS
5. BCH

3.5 AIR CIRCUIT BREAKERS

(A) CATEGORY-III

1. G.E.
2. SIEMENS
3. L & T
4. CROMPTON
5. C & S

3.6 CHANGE OVER SWITCHES

(A) CATEGORY-I

1. MODI
2. SIGMA

(B) CATEGORY-II

1. STANDARD
2. HAVELLS
3. SUPER
4. KEW
5. C & S
6. HPL

(C) CATEGORY-III

1. L&T
2. CROMPTON
3. G.E.
4. SIEMENS

3.7 MCB & MCB DISTRIBUTION BOX

(A) CATEGORY-I

1. SIGMA
2. BALKAM
3. S.G.

3.7 (B) CATEGORY-II

1. HAVELLS
2. STANDARD
3. HPL
4. KEW
5. INDO-ASIAN
6. AECO-MEFA
7. SUPER
8. ANCHOR
9. ELECON-CLIPSAL

(C) CATEGORY-III

1. L&T
2. MDS
3. G.S.
4. CG SNEIDER

3.8 ELCB & RCCB**(A) CATEGORY-I**

1. S.G.
2. SIGMA

(B) CATEGORY-II

1. STANDARD
2. ANCHOR
3. SUPER
4. INDO-ASIAN
5. AECO-MEFA
6. HPL
7. ELECON-CLIPSAL

(C) CATEGORY-III

1. L&T
2. MDS
3. HAVELLS
4. G.E.
5. C.G. SNEIDER

3.9 TIME SWITCHES

1. L&T
2. MDS
3. INDO-ASIAN
4. C&S

3.10 ENERGY METER

1. HPL
2. L&T
3. G.E.
4. C&S
5. ANCHOR
6. HAVELLS
7. INDO-ASIAN

**CHAPTER-IV
CABLES & WIRES**

4.1 ALLUMINIUM & COPPER XLPE CABLES (ALL Type)

1. UPTO 35 SQ.MM ANY MARKED

4.2 ALLUMINIUM & COPPER XLPS CABLES (ALL Type)**ABOVE 35 SQ.MM UP TO 185 SQ.MM**

1. CAPCAB
2. DICABX
3. FINOLEX
4. RR CABLE
5. POPULAR
6. POLYCAB
7. AVOCAB
8. HMT
9. LOOKMAN
10. POWERCAB

4.3 ALLUMINIUM & COPPER XLPS CABLE (ALL Type)**ABOVE 185 SQ.MM**

1. DICABS
2. AVOCAB
3. POLYCAB
4. CCI
5. INCAB
6. HMT
7. RR CABLE

**CHAPTER-V
FANS**

5.1 CELING FANS & TABLE FANS

1. LAZER
2. ANCHOR
3. POWERPACK
4. CROMPTON
5. BAJAJ
6. ORIENT
7. ALMONDARD
8. KHAITAN
9. INOVA
10. CINNI
11. USHA
12. GEC
13. REMI
14. ORIENTS
15. KEDIA

5.2 EXHAUST FANS, BRACKET FANS & PEDESTAL FANS**(A) CATEGORY-I**

1. LAZER
2. POWERPACK
3. ANSU
4. EPC
5. NOVA
6. REMI
7. KHAITAN
8. ORIENT
9. USHA

(B) CATEGORY-II

1. CROMPTON
2. G.EC.
3. BAJAJ
4. ALMONARD

CHAPTER-VIII**AIRCONDITIONERS, WATER COLLERS & WATER HEATERS****8.1 SERVO CONTROLLED VOLTAGE STABILIZER & ELECTRONICS POWER CONDITIONERS**

1. SUVIK
2. KELTRON
3. KEPREJ
4. GELCO
5. RIDER
6. TOCONSI

8.2 ON LINE UPS

1. SUVIK
2. KELTRON
3. KEPREJ

8.3 WATER HEATERS**A. CATEGORY-I**

1. LAZER
2. POWERPACK
3. BAJAJ
4. USHA

B. CATEGORY-II

1. SPHEREHOT
2. RECOLD
3. VENUS

CHAPTER-IX**MOTOR PUMPS****9.1 MOTOR PUMP STARTERS & STARTER ACCESSORIES****A. CATEGORY-II**

1. CROMPTON
2. JYOTI
3. HAVELLS
4. ANCHOR
5. PECO

B. CATEGORY-III

1. L&T
2. SIEMENS
3. BHARITA CUTTLER HAMMER
4. ALSTHOM
5. C&S

9.2 PANNELACCESSORIES

1. STANDARD
2. L & T
3. MEW
4. KAYCG
5. ANCHOR
6. UNIVERSAL
7. IMP

9.3 SINGLE PHASE MONO BLOCK PUMPS**(A) CATEGORY-II**

1. LUBI
2. PRIME

3. TULLU
4. HARSHA
5. AUE
6. SAGA

(B) CATEGORY-III

1. CROMPTON
2. KIRLOSKAR
3. SIEMENS

9.4 OPEN WELL TYPE HORIZONTAL MONO BLOCK PUMPS**(A) CATEGORY-I**

1. TOPLAND
2. PRIME
3. SABAR

(B) CATEGORY-II

1. UNEEL
2. LUBI
3. KIRLOSKAR
4. CROMPTON
5. PRIMA

9.5 STARTER PANELS

1. L&T
2. SUECO
3. SAMUDRA
4. SUN
5. LUBI
6. BCH

9.6 SUBMERSIBLE PUMPS**(A) CATEGORY-I**

1. TOPLAND
2. AROMA
3. JASCO
4. SABAR
5. PRIMA

(B) CATEGORY-II

1. CROMPTON
2. CALAMA
3. AMRUT

(C) CATEGORY-III

1. KSB
2. UNEEL
3. KIRLOSKAR
4. LUBI

CHAPTER-X**SUBSTATION EQUIPMENTS****10.1 (A) CATEGORY-II**

1. VOLTAMP
2. SKP
3. YULE

(B) CATEGORY-III

1. ALSTOM
2. CROMPTON
3. KIRLOSKAR
4. L&T

TECHNICAL SPECIFICATIONS – ELECTRICAL WORKS

INDEX

GENERAL TECHNICAL SPECIFICATIONS FOR ELECTRIC WORKS

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2. APPLICABLE IS STANDARDS AND VARIOUS CODES FOR ELECTRICAL WORKS

A. APPLICABLE IS STANDARDS VARIOUS CODES

- | | | |
|-----|--|--------------------|
| 1. | METERS (MEASURING) FOR ANALOG METERS | IS:1248-1986 |
| 2. | INSTALLATION AND MAINTENANCE OF SWITCH GEARS | IS:3072-1975 |
| 3. | CODE OF PRACTICE FOR EARTHING | IS:3043 |
| 4. | H.D. AIR BREAKER, SWITCH GEARS AND FUSES FOR
VOLTAGE NOT EXCEEDING 1000 VOLTS | IS:4047-1977 |
| 5. | SELECTION, INSTALLATION AND MAINTENANCE OF FUSES
UP TO 650 VOLTS | IS:8106-1966 |
| 6. | GENERAL REQUIREMENTS FOR SWITCH GEAR AND
GEAR FOR VOLTAGE NOT EXCEEDING 1000 VOLTS | IS:4237-1967 |
| 7. | DEGREE OF PROTECTION PROVIDED BY
ENCLOSURES FOR LV S/GEARS | IS:2147-1962 |
| 8. | INSULATED CONDUCTOR RATING | IS:8084-1972 |
| 9. | ENCLOSED DISTRIBUTION FUSE BOARDS AND CUT-OUTS
FOR VOLTAGE NOT EXCEEDING 1000 VOLTS | IS:2675-1983 |
| 10. | MINIATURE CIRCUIT BREAKER | IS:8828-1978 |
| 11. | FUSE WIRE USED IN RE-WEARABLE TYPE ELECTRIC FUSES
UP TO 650 VOLTS | IS:9926-1981 |
| 12. | PVC INSULATED ELECTRIC CABLES HEAVY DUTY
I) | IS:1554 (PART |
| 13. | RECOMMENDED CURRENT RATING FOR CABLES
II) | IS:3961(PART |
| 14. | COPPER CONDUCTOR IN INSULATED CABLES AND CORES | IS:2982 |
| 15. | CONDUCTOR FOR INSULATED ELECTRIC CABLES AND
FLEXIBLE CORDS | IS:8130 |
| 16. | MILD STEEL WIRES, STRIPS AND TAPES FOR ARMOURING
CABLES | IS:3975 |
| 17. | PVC INSULATION AND SHEATH OF ELECTRIC CABLES | IS:5831 |
| 18. | ALUMINIUM CONDUCTOR FOR INSULATED CABLES
PVC INSULATED AND PVC SHEATHED SOLID ALUMINIUM
CONDUCTOR CABLES OF VOLTAGE RATING NOT
EXCEEDING 1100 VOLTS | IS:1753
IS:4288 |
| 20. | RECOMMENDED CURRENT RATING FOR CABLE | IS: 961 |
| 21. | CODE OF PRACTICE FOR ELECTRICAL WIRING
INSTALLATION SYSTEM VOLTAGE NOT EXCEEDING 650
VOLTS | IS: 732 |
| 22. | CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS
GENERAL)ELECTRICAL INSTALLATION | IS: 1646 |
| 23. | RIGID STEEL CONDUITS FOR ELECTRICAL WIRING | IS:1653 |
| 24. | FITTINGS FOR RIGID STEEL CONDUITS FOR ELECTRICAL
WIRING | IS:2667 |
| 25. | FLEXIBLE STEEL CONDUIT FOR ELECTRICAL WIRING | IS:3480 |
| 26. | ACCESSORIES FOR RIGID STEEL CONDUITS FOR
ELECTRICAL WIRING | IS:3837 |

27.	PVC INSULATED CABLES (WIRES)	IS:694
28.	RIGID NON-METALLIC CONDUITS FOR ELECTRICAL WIRING	IS:2509
	FLEXIBLE (PLAYABLE) NON-METALLIC CONDUITS FOR ELECTRICAL INSTALLATION	IS:6946
30.	THREE PIN PLUGS AND SOCKETS	IS:1293
	CONDUCTORS FOR INSULATED ELECTRICAL CABLES AND FLEXIBLE CODES	IS:8180
32.	SPECIFICATION FOR CONDUIT FOR ELECTRICAL INSTALLATION	IS:9537-1980
33.	ACCESSORIES FOR NON-METALLIC CONDUITS FOR ELECTRICAL WIRING	IS:3419
34.	SWITCHES	IS:3854
35.	PLUGS	IS:6538
36.	SHUNT CAPACITORS FOR POWER SYSTEMS	IS:2834-1954
37.	HRC CARTRIDGE FUSES AND LINKS UP TO 660 VOLTS	IS:2208
38.	GENERAL AND SAFETY REQUIREMENT FOR LIGHTING FITTINGS	IS:1913-1969
39.	CODE OF PRACTICE FOR LIGHTING PUBLIC THOROUGHFARES	IS:2944-1981
40.	WATERPROOF ELECTRIC LIGHTING FITTINGS	IS:3528
41.	WATER TIGHT ELECTRIC LIGHTING FITTING	IS:3553-1966
42.	MILD STEEL TUBULAR AND OTHER WROUGHT STEEL PIPE FITTING	IS:1239-1958
43.	LUMINARIES FOR STREET LIGHT	IS:2149-1970
44.	HRC FUSES HAVING RUPTURING CAPACITY OF 90 KA	IS:9224
45.	EXHAUST FAN	IS:2312-1967
46.	CLASS I CEILING FAN	IS:374-1979
47.	DANGER NOTICE BOARDS	IS: 2551

NOTE :

All codes and standards means the latest where not specified otherwise the installation shall generally follow the Indian Standard codes of practice or relevant British Standard Codes of Practice in the absence of corresponding Indian Standards.

PLEASE FOLLOW :

- a. Indian Electricity Act of 1910 and rules issued there under revised up to date.
- b. Special Attention should be given to Rule No. 50.
- c. Regulations for electrical equipment in building issued by The Bombay Regional Council of insurance Association of India.

GENERAL TECHNICAL SPECIFICATIONS FOR ELECTRIC WORKS

3.1. CABLE LAYING IN TRENCH

(A). MATERIALS:

All cables shall be of approved make and ISI marked. The brick shall be modular well burnt clay bricks of compressive strength not less than 25kg / sq.cm. Only fine shall be used.

(B). STORAGE AND HANDLING OF CABLE:

The cable drums shall be stored on, hard and well drained surface, to avoid sinking of drums in the ground causing damage to the cable drums. For long term storage of all types of cable, paved surface is preferred and protection from rain and sun is to be provided.

The drums shall always be stored on their flanges, and not on their flat sides. Both ends of the cable should be properly sealed to prevent ingress/absorption of moisture.

Ventilation should be there between cable drums. Damaged battens of drums etc. should be replaced at the earliest. Handling: when the cable drums have to be moved over short distance, they should be rolled in the direction of the arrow marked on the drum.

For transportation of cable drums over long distance suitable mechanical transport should be used. If manual transportation is compulsion, the drum should be mounted on the cable drum wheels, strong enough to carry the weight of the drum, and pulled by means of ropes.

For loading and unloading from vehicles, suitable capacity crane or a lifting tackle should be used. Small size cable drums as can also be rolled down carefully on a suitable ramp for unloading, provided no damage is likely to be caused to the cable or the drums.

(B). ROUTE OF CABLE:

Be for cable laying, the route of the cable shall be decided by the engineering-in-charge considering the following.

The shortest practicable route shall be preferred, the cable route shall generally follow fixed developments. Such as roads, foot paths etc. with proper offsets so that future maintenance, identification etc. are rendered easy. Cross country run merely to shorten the route length shall not be adopted.

Cable route shall be planned away from drains and near the property, especially in the case of LV/MV cables. Cable route should be avoided from corrosive soils, ground surrounding sewage effluent etc.

Present and likely future requirement of the other services should be taken in to consideration, while deciding the alignment of the cable.

Whenever cables are laid along roads, the LV/MV cable shall be laid further from the kerb line than HV cables.

Where available space is restricted LV/MV cable shall be laid above HV cable in vertical formation.

Cables of different voltages, and also power and control cable shall be kept in different trenches with adequate separation. Where cables cross one another, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.

Power and communication cables shall as far as possible cross each other at right angles. The horizontal and vertical clearances between them shall not be less than 60 cm.

Necessary way leave for the cable route shall be obtained from appropriate authorities, such as, Municipal authorities, Department of telecommunication, Gas works, railways, Civil Aviation authorities, Owners of properties (in case of private property) etc. and section 12/51 of the Indian Electricity Act shall be complied with.

(C). LAYING OF CABLE:

GENERAL

Cables with kinks, straightened kinks or any other apparent defects like defective armouring etc. shall not be laid.

Cable shall not be bent sharp to a small radius, while handling or laying. The minimum safe bending radius for PVC/XLPE (MV) cables shall be 12 times the overall diameter of the cable.

If cable is cut, the ends of cable shall be sealed with suitable sealing compound/ tape/ heat shrinkable caps immediately.

The cables shall be tested for continuity and insulation resistance.

The cables shall be laid direct in ground, pipe, closed or open ducts, cables trays or on surface of wall etc. as specified.

UNCOILING OF CABLE BEFORE LAYING

The cable drum shall be properly mounted on jacks, or on a cable wheel of suitable capacity. The spindle should be horizontal in the bearings to prevent creeping of drum to one side while rotating.

PVC/XLPE cables less than 120 sqmm size may be removed by "flaking" i.e. by making one long loop in the reverse direction.

The cable shall be pulled over on rollers in the trench steadily and uniformly without jerks and strain. The entire cable length shall as far as possible be laid off in one stretch.

For short runs and sizes upto 50 sqmm of MV cables, any other suitable method of direct handling and lying can be adapted without strain or excess bending of the cables.

LAYING DIRECT IN GROUND

For laying a single cable the minimum width of the trench shall be 35 cm and the depth shall not be less than 75cm. The bottom of the trench shall be level and smooth.

Where more than one cable is to be laid in the same trench in horizontal formation, the width of the trench shall be increased such that the inter-axial spacing between the cables shall be at least 20 cm.

In case of vertical formation of cable laying, the depth of the trench shall be increase by 30 cm for each additional vertical tier.

There shall be a clearance of at least 15 cm between axis of the end cables and the sides of the trench

The trenches shall be excavated in reasonably straight lines. While changing direction of trench, suitable curvature shall be adopted.

The changes in gradients or in depth shall be gradual.

While excavating trench, the excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.

Adequate precautions should be taken not to damage any existing cable(s), pipes or any other such installations in the route during excavation.

Wherever bricks, tiles or protective covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer-in-charge.

Existing property, if any, exposed during trenching shall be temporarily supported adequately as directed by the Engineer-in-Charge. The trenching in such cases shall be done in short lengths and necessary pipes shall be laid for passing cables therein and then the trench shall be refilled.

Excavation through lawns shall be done in consultation with the Department concerned.

SAND CUSHIONING

The trench shall then be provided with a layer of clean dry sand cushion of not less than 8 cm in depth, before laying the cables therein.

Cables laid in trenches in a single tier formation shall have a covering of dry sand of not less than 17 cm above the base cushion of sand before the protective cover is laid.

In the case of vertical multi -tier formation, after the first cable has been laid, a sand cushion of 30 cm shall be provided over the base cushion before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30 cm as started above. Cables in the top most tiers shall have final sand covering not less than 17 cm before the protective cover is laid.

LOOPS

At the time of original installation, approximately 3m of surplus cable shall be left on each terminal end of the cable and on each side of the underground joints. The surplus cable shall be left in the form of a loop. Where there are long runs of cables such loose cable may be left at suitable intervals as specified by the Engineer-in-Charge.

Where it may not be practically possible to provide separation between cables when forming loops of a number of cables, measurement shall be made only to the extent of actual volume of excavation, sand filling etc. and paid for accordingly.

PROTECTIVE COVERING:

Unless otherwise specified, the cables shall be protected by brick of specified size or 20cmx10cmx10cm or locally available size, placed on top of the sand. The bricks shall be placed breadth-wise for the full length of the cable. Where more than one cable is to be laid in the same trench, one row of bricks shall be used for each cable.

Where bricks are not easily available, or are comparatively costly, there is no objection to use locally available material such as stone tiles or slates or stone/ cement concrete slabs. Where such an alternative is acceptable, the same shall be clearly specified in the tender specifications.

BACK FILLING:

The cable cores shall be tested for continuity, absence of cross phasing, and insulation resistance from conductors to earth / armour and between conductors.

Insulation resistance shall be tested with a 500V megger for cables of 1.1 KV grade, or with a 2500/ 5000V megger of cables of higher voltage. Unless the insulation resistance values are satisfactory, the trench shall not be covered or filled.

The trenches shall be then back-filled with excavated earth, free from stones or other sharp edged debris and shall be rammed and watered, if necessary in successive layer not exceeding 30cm depth.

A crown of earth not less than 50 mm and not exceeding 100mm in the centre and tapering towards the sides of the trench shall be left to allow for subsidence unless otherwise specified. The crown of the trench however, should not exceed 10 cms so as not to be a hazard to vehicular traffic.

The temporary re-statement of roadways should be inspected at regular intervals, particularly during wet weather and settlement should be made good by further filling as may be required.

Where it is necessary to cut road berms or displace kerb stones, the same shall be repaired and made good, except for turning/ asphaltting, to the satisfaction of the Engineer-in-Charge, and all the surplus earth or rock shall be removed to places as specified.

LAYING OF CABLE IN PIPE:

In locations such as road crossing, entry in to building, paved areas etc., cables shall be laid in pipes or closed ducts. Metallic pipe shall be used as protection pipe for cables fixed on poles of overhead lines

GI, CL or spun reinforced concrete pipes shall be used for cables in ground, however only GI pipe shall be used as protection pipe on poles.

The size of the pipe shall not be less than 50mm dia for a single cable and not less than 150mm for more than one cable.

Where steel pipes are used for protection of single core cables feeding AC load, both cables in the case of single phase system and all cables in the case of poly phase system should be drawn in single pipe of sufficient dia.

Pipes for MV and HV cables shall be independent.

In the case of new construction, pipes for present and anticipated future requirements shall be laid alongwith the civil works.

Pipes shall be continuous and clear of debris or concrete. Sharp edges if any, at ends shall be smoothened to prevent damage to cable sheathing.

The top surface of pipes shall be at a minimum depth of 1m from the pavement level when laid under roads, pavement etc.

The pipes shall be laid preferable skew to reduce the angle of bend as the cable enters and leaves the crossing.

When pipes are laid by cutting and existing road, after laying the pipes the soil filled up is rammed well in layers with watering to ensure proper compaction. A crown of earth not exceeding 10cm should be left at the top.

The temporary re-instatements of roadways should be inspected at regular at regular intervals upto 10days and any settlement should be made good by further filling as may be required.

After the subsidence has ceased, the top of the filled up trenches in roadways or other paved areas shall be restored. To the same density and material as the surrounding area in accordance with the relevant CPWD Building specifications and to the satisfaction of the Engineer-in-Charge. Suitable size manholes may be provided to facilitate feeding/ drawing in of cables with sufficient working space. Manhole shall be covered by suitable sizes and specified type of manhole.

Pipes for cables entries to the building shall slope downwards from the building. The pipes at the building end shall be suitably sealed to avoid entry of water, after the cables are laid.

Cable-grip / draw-wires, winches etc. may be employed for drawing cables through pipes/ closed ducts.

The size and interval of metal saddle / clamp used for fixing the cables shall be as per table given below.

SR NO	SIZE OF CABLE	CLAMPING BY	FIXING INTERVALS
1	Upto 25 sq mm	Saddle 1mm thick	45 cm
2	35 sqmm to 120 sqmm	Clamp 3mm thick and 25mm wide	60 cm
3	150 sqmm and above	Clamp 3mm thick and 40mm wide	60 cm

Saddles shall be secured with screws to suitable approved plugs. Clamps shall be secured with nuts on to the bolts. Grouted in the supporting structure in an approved manner.

In the case of single core cable, the clamps shall be of non-magnetic material.

Unarmoured cables shall be clamped with suitable non-corrosive packing to prevent damage of the cable sheath.

Cable shall be fixed neatly without undue sag or kinks.

The arrangement of laying the cables in cradles is permitted only in the case of cables of 1.1KV grade of size exceeding 120 sqmm. In such cases, the cables may be suspended on MS flat cradles of size 50mm x 5mm which in turn shall be fixed on the wall by bolts grouted into the wall in an approved manner at a spacing of not less than 60 cm.

All MS components used in fixing the cables shall be either galvanized or given a coat of red oxide primer and finished with 2 coats of approved paint.

(C) JOINTING OF CABLES:

SAFETY PRECAUTION BEFORE JOINTING

A caution board displaying message "CAUTION CABLE JOINTING WORK IN PROGRESS" shall be displayed to warn the public and traffic where necessary.

Before jointing is commenced, all safety precautions like isolation, discharging, earthing, display of caution board on the controlling switchgear etc. shall be taken to ensure that the cable would not be inadvertently charged from live supply.

Metallic armor and external metallic bonding shall be connected to earth.

Where "permit to work" system is in vogue, safety procedures prescribed shall be complied with

LOCATION:

Before laying a cable, most suitable locations for proposed cable joints, if any shall be decided, the water logged locations, carriage ways, pavement. Proximity to telephone cables, gas or water mains, inaccessible places, ducts, pipes, racks etc. shall be avoided for location the cable joints.

Joints shall be staggered by 2m to 3m when joints are to be done for two or more cables laid together in the same trench.

Joints pits shall be of sufficient dimension as to allow easy and comfortable working. The sides of the pit shall be well protected from loose earth falling into it. It shall also be covered by a tarpaulin/ PVC sheet to prevent dust and other foreign matter being blown on the exposed joint and jointing materials.

Sufficient ventilation shall be provided during jointing operation.

JOINTING MATERIALS AND PROCEDURE:

Only approved make and specified type of cable jointing kit shall be used.

The clamps for the armour shall be clean and tight.

Jointing as well as storing shall be done strictly as per the instructions of the manufacturer of jointing kit.

About 3m long surplus cable shall be left on each side of joints.

Jointing work shall be carried out by a licensed / experienced cable jointer. The sequence of cores should be so arranged as to avoid crossing of cores.

Before jointing cable cores shall be tested for continuity, absence of cross phasing, insulating resistance from conductors to earth / armour and between conductors.

Insulation resistance shall be tested with a 500V megger for cables of 1.1 KV grade, or with a 2500 / 5000V megger of cables of higher voltage. Unless the insulation resistance values are satisfactory, jointing shall not be done.

If oxide film is formed on aluminium conductor, it should be removed by using appropriate type of flux.

TESTING AFTER LAYING :

After laying and jointing, the cable shall be subjected to a 15 minutes pressure test with 2 KV AC or 3 KV DC pressure. DC pressure testing may normally be preferred to SC pressure testing.

Alternatively pressure test for one minute with 1000V megger for cables of 1.1 KV grade and with 2500 / 5000V megger for cables of higher voltages shall be sufficient.

(D). ROUTE MARKERS:

Route markers shall be provided along the runs of cables at locations approved by the Engineer-in-Charge and generally at intervals not exceeding 100m.

Markers shall also be provided to identify change in the direction of the cable route and at locations of underground joints.

Route markers shall be made out of 100mm x 5mm GI plate welded / bolted on 35mm x 35mm x 6mm angle iron, 60cm long. Such plate markers shall be mounted parallel to and at about 0.5 m away from the edge of the trench.

C.C route marker made of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20mm in size) shall be laid flat and centered over the cable. The concrete markers, unless otherwise instructed by the Engineer-in-Charge, shall project over the surrounding surface so as to make the cable route easily identifiable.

The works PWD-MV/HV CABLE as the case may, shall be inscribed on the marker.

(E). MEASUREMENT :

Cable laid direct in ground, duct and surface / cable tray shall be measured in running metre straight along trench (excluding ramble length) in running metre correct to 1cm.

Cable laid pipes / closed duct shall be measured in running metre correct to 1 cm taking actual length of the pipe / duct for each run of the cable (excluding ramble length), irrespective of the length of cable drawn through it.

Cable length used in connections shall be measured as item of cable layed in open duct. Jointing and route marker shall be counted in number.

(F). RATE :

Cost of all material, labour and machinery used in execution of work of shall be in the cost of item.

3.2. LT CABLES AND CABLE TERMINATION:

A. SPECIFICATIONS

GENERAL:

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

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

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

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

Materials: All cables shall be of approved make and ISI marked only. The brick shall be modular well burnt clay brick of compressive strength not less than 25kg /sq.cm. Only fine sand shall be used.

Bending of Cable : Cable shall not be bend sharp to a small radius either while handling or in laying. The minimum safe banding radius for PILCA/XLPE,33KV cable shall be 20 times the overall diameter of the cable.

CONDUCTOR :

Uncoated, annealed copper / aluminium, of high conductivity, upto 4 mm² size the conductor shall be solid and above 4 mm² the conductors shall be concentrically stranded as per IEC : 228.

INSULATION :

Cross link polyethylene (XLPE) extruded insulation rated at 70°C.

CORE IDENTIFICATION :

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

Black shall always be used for neutral.

ASSEMBLY :

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

ARMOUR :

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

For cable size upto 10 sq mm : Armour of 1.4 mm dia G.I. round wire

For cable size above 10 sq mm : Armour of 4 mm wide 0.8 mm thick GI strip

SHEATH :

ST -2 PVC along with polypropylene fillers to be provided.

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

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

Sequential length marking along with size and other standard parameters shall be required at every 1.0 mtr on the outer sheath.

TESTING :

Finished cable tests at manufacturers works : The finished cables shall be tested at manufacturer's works for all the routine tests for all the length and size of cables to be delivered at site and the certificate for the same shall be furnished to client. If required the cables shall be tested in presence of the client's representative.

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

Conductor resistance test : The D.C. resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20°C to check the compliance with the values specified in the IS 8130 – 1976.

Cable tests before and after laying cables at site :

Insulation resistance test between phases, phase to neutral and phase to earth.

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

Earth resistance test of all the phases and neutral.

All the tests shall be carried out in accordance with the relevant IS code of practice and Indian Electricity Rules. The vendor shall provide necessary instruments, equipments and labour for conducting the above tests and shall bear all the expenses in connection with such tests. All tests shall be carried out in the presence of client and the results shall be prescribed in forms and submitted.

All specification for HV cable laying shall be same as that of MV cable laying.

Testing of 11KV HT cable :

Insulation resistance shall be tested with 2500/5000 megger, Pressure testing shall be done for 15 minutes with 20KV AC pressure between conductors and with 11.5KV AC pressure between conductor and earth. If facility for pressure testing is not available then testing for one minute with 2500/5000V megger shall be sufficient.

CABLE MARKING :

The outer sheath shall be legibly embossed at every meter with following legend :

ELECTRIC CABLE : 1100 V, SIZE : ____C X ____ MM² with Manufacturers name, year of manufacturing and ISI symbol.

SEALING DRUMMING AND PACKING :

After tests at manufacturer's works, both ends of the cables shall be sealed to prevent the ingress of moisture during transportation and storage.

Cable shall be supplied in length of 500 mtrs or as required in non-returnable drums of sufficiently sturdy construction.

Cables of more than 250 meters shall also be supplied in non-returnable drums.

The spindle hole shall be minimum 110 mm in diameter.

Each drum shall bear on the outside flange, legibly and indelibly in the English literature, a distinguishing number, the manufacturer's name and particulars of the cable i.e. voltage grade, length, conductor size, cable type, insulation type, and gross weight shall also be clearly visible. The direction for rolling shall be indicated by an arrow. The drum flange shall also be marked with manufacturer's name and year of manufacturing etc.

CABLE TERMINATION:

Cable terminations shall be made with aluminium crimped type solder less lugs for all aluminium cables and stud type terminals. For copper cables copper crimped solder less lugs shall be used. Crimping shall be done with the help of hydraulically operated crimping tool.

For joints where by cable is with aluminium conductor and busbars are aluminium, bimetallic lugs shall be used with compound. CUPAL type of washers shall be used.

Crimping tool shall be used for crimping any size of cable.

CABLE GLANDS:

Cable glands shall be of brass single compression type. Generally single compression type cable glands shall be used for indoor protected locations and double compression type shall be used for outdoor locations.

FERRULES:

Ferrules shall be of self-sticking type and shall be employed to designate the various cores of the control cable by the terminal numbers to which the cores are connected, for ease in identification and maintenance.

CABLE JOINTS:

Kit type joint shall be done and filled with insulating compound. The joint should be for 1.1 KV grade insulation.

B. WORKMANSHIP

Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the Contractor shall mark it out on the drawings and also on the site and obtain the approval of the CLIENT AND/OR ITS ARCHITECT before laying the cable. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only.

Cables shall be laid on walls, cable trays, inside shafts or trenches. Saddling or support for the cable shall not be more than 500 mm apart. Plastic identification tags shall be provided at every 30 m.

Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or in accordance with the manufacturer's recommendations whichever is higher.

In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc unless marked on drawing by architect / consultant. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion. Cables shall be protected with brick or cement tiles on all the three sides as shown on drawings. Width of excavated trenches shall be as per drawings. Back fill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall be provided with cables markers at every 10 meters and at all loop points.

All cables shall be full runs from panel to panel without any joints or splices. Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid. Cable termination for conductors up to 4 sq.mm. may be insertion type and all higher sizes shall have compression type lugs. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armouring shall be earthed at both ends.

In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall be laid in slant position, so that no rainwater may enter the building. After the cables are tested the pipes shall be sealed with M. seal & then tarpaulin, shall be wrapped around the cable for making the entry watertight.

Testing : MV cables shall be tested upon installation with a 500 V Meggar and the following readings established:

Continuity on all phases.

Insulation Resistance.

between conductors.

all conductors and ground.

All test readings shall be recorded and shall form part of the completion documentation.

Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool. Proper insulation tape shall be applied at the cable and lug joint.

Format for cable testing certificate :

- a. Drum no. from which cable is taken :
- b. Cable from _____ to _____
- c. Length of run of this cable _____ mtr
- d. Insulation resistance test
 - between core 1 to earth _____ mega-ohm
 - between core 2 to earth _____ mega-ohm
 - between core 3 to earth _____ mega-ohm
 - between core 1 to core 2 _____ mega-ohm
 - between core 2 to core 3 _____ mega-ohm
 - between core 1 to core 3 _____ mega-ohm
 - duration used :
- e. High voltage test : Voltage Duration between core and earth
 - between individual cores

C. MODE OF MEASUREMENT

The cables shall be measured in rmt and terminations on unit basis.

3.3. DISTRIBUTION BOARDS:

A. SPECIFICATIONS

Distribution boards shall be fabricated from 14 gauge M.S. sheet or shall be readymade as specified in the make of material list. It shall be of double door type with hinged (lockable if required) door suitable for recessed mounting in wall. Distribution boards shall be powder coated with 7-tank process application.

The distribution boards shall be provided with phase barriers, wiring channels to accommodate wires and individual per phase neutral links. There shall be separate or individual earth link as per requirement. Proper arrangement shall be made for mounting of MCB's and other accessories.

Distribution boards shall meet with the requirements of IS 2675 and marking arrangement of bus bars shall be in accordance with I.S. standards.

Bus bars shall be suitable for the incoming switch rating and sized for a temperature rise of 35° C over the ambient. Each board shall have two separate earthing terminals. Circuit diagram indicating the load distribution shall be pasted on the inside of the DB as instructed. One earthing terminal for single phase and two terminals for 3 phase DB's shall be provided with an earth strip connecting the studs and the outgoing ECU earth bar.

The top and the bottom faces of the D.B. shall be provided for conduit entry of minimum 1" dia. The faces if asked shall be kept detachable.

All outgoing feeders shall terminate on a terminal strip which in turn is interconnected to the MCB/Fuse base by means of insulated single conductor copper wires as follows:-

Up to 15 A	2.5 sq.mm.	40 A	10 sq.mm.
25 A	4.0 sq.mm.	63 A	16 sq.mm.
32 A	6.0 sq.mm.		

Each DB shall have indicating lamps preferably neon type denoting power availability in the board after the switch indicating lamps shall be complete with fuses.

MINIATURE CIRCUIT BREAKERS (MCB):

MCB's shall have quick make and break non-welding self-wiping silver alloy contacts for 10 KA short circuit both on the manual and automatic operation. Each pole of the breaker shall be provided with inverse time thermal over load and instantaneous over current tripping elements, with trip-free mechanism. In case of multi-pole breakers, the tripping must be on all the poles and operating handle shall be common. Breakers must confirm to BS 3871 with facility for locking in OFF position. Pressure clamp terminals for stranded/solid conductor insertion are acceptable up to 4 sq.mm. aluminium or 2.5 sq.mm. copper and for higher ratings, the terminals shall be suitably shrouded. Wherever MCB isolators are specified they are without the tripping elements.

RCCB / ELCB

The RCCB should suffice all the requirements of IS as per code IS - 12640 - 1988. The RCA should be current operated and not on line voltage.

The RCCB should ensure mainly the following functions:

- i) Measurement of the fault current value.
- ii) Comparison of the fault current with a reference value.
- iii) The RCCB should have a toroid transformer which has the main conductors of primary (P - N) which check the sum of the current close to zero.
- iv) All metal parts should be inherently resistant to corrosion and treated to make them corrosion resistant.
- v) It should be truly current operated.
- vi) It should operate on core balance toroid transformer.
- vii) Its accuracy should be $\pm 5\%$.
- viii) It should operate even in case of neutral failure.
- ix) It should trip at a present leakage current within 100 mA
- x) Its enclosure should be as per IP 30.
- xi) Its mechanical operation life should be more than 20,000 operations.
- xii) It should provide full protection as envisaged by IE rules - 61-A, 71 - ee, 73 - ee, 1985 and also rule 50 of IE rule 1956.
- xiii) It should conform to all national and international standards like IS: 8828-1993, IS: 12640-1988, BS 4293 - 1983, CEE 27 (International commission Rules for the approved of electrical equipment).

B. WORKMANSHIP

The D.B. shall be properly grouted in the wall in concealed manner taking care that the powder coating is not scratched and dents are not formed on the D.B. The MCBs and ELCBs. In the distribution boards shall be fixed as per the circuit details provided. All the wires terminating in the MCBs and the ELCBs shall be lugged for proper contact and ferrules depicting the circuit nos shall be provided. D.B.s mounted in concealed manner shall have a groove around it so as to save the finish of the plaster and colour during future opening of the door. The distribution boards shall have circuit chart tagged on the door for future maintenance. Danger notice plates shall be fitted to the distribution boards with screws and not stuck so as to assure its presence for a longer duration.

C. MODE OF MEASUREMENT

The distribution boards shall be measured in nos and the MCBs and ELCBs shall be measured in nos separately.

3.4. INTERNAL WIRING

A. SPECIFICATIONS

RIGID PVC AND FLEXIBLE PVC FRLS LHSFT CONDUITS:

All conduits shall be rigid PVC alloy low in halogens pipe having minimum wall thickness of medium gauge 1.6 to 2.0 approved by F.I.A. & I.S.I. and shall confirm to IS 9537 part 3 and complying with fire safety standards classification V-0. The temperature stability shall be from – 20°C - +80°C and also shall be UV stabilised.

Up to 38 mm diameter in slab - minimum 1.8 mm wall thickness.

Up to 38 mm diameter in floor - minimum 2.0 mm Wall thickness.

Above 40 mm. diameter - minimum 2.2 mm. wall thickness.

Flexible conduits shall be formed from a continuous length of spirally wound interlocked steel strip with a fused zinc coating on both sides. The conduit shall be terminated in brass adapters.

ACCESSORIES:

PVC conduit fittings such as bends, elbows, reducers, chase nipples, split couplings, plugs etc. shall be specifically designed and manufactured for their particular application. All conduit fittings shall conform to IS: 2667-1964 and IS: 3857-1966. All fitting associated with galvanized conduit shall also be galvanized.

WIRES:

All wires shall be single core multi-strand/ flexible copper or single strand Copper (if specified in BOQ), PVC insulated **FRLS** grade as per IS: 694 and shall be 660 V/1100 V.

All wires shall be colour coded as follows:

<u>Phase</u>	<u>Colour of wire</u>
R	Red
Y	Yellow
B	Blue
N	Black
Earth	Green (insulated)
Control (If any)	Grey
All off wires	Same as Phase wire

SWITCHES & SOCKETS:

Switches shall be modular type with silver-coated contacts. Sockets shall be 5 pins with switch and plate type cover. Combination of multiple switch units and sockets should be used to minimize the switch boxes.

For heavy duty, metal clad sockets with M.C.B / Isolator mounted in a galvanized steel box shall be provided.

SWITCH PLATE AND BOX:

Plates of the same make, as that of switches shall be used with the modular range. Also M.S. boxes shall be taken as switch boxes.

B. WORKMANSHIP

The size of conduit shall be selected in accordance with the number of wires permitted under table given below. The minimum size of the conduit shall be 25 mm diameter unless otherwise indicated or approved. Size of wires shall not be less than 1.5 sq.mm. Copper.

Nominal Dia of wires (mm)	Nominal Cross sec. Area (mm ²)	20 mm		25 mm		32 mm		38 mm	
		S	B	S	B	S	B	S	B
1/2.40	1.50	4	3	8	6	15	9	--	--
1/1.80	2.50	4	2	6	4	10	8	--	--
1/2.24	4.00	2	2	4	3	8	6	--	--
1/2.80	6.00	1	--	4	3	6	6	--	--
1/3.55	10.00	1	--	3	2	5	4	6	5

S - runs of conduits which have distance not exceeding 4.25 m. between draw boxes & which do not deflect from the straight by an angle more than 15 degree.

B - runs of conduits, which deflect, from the straight by more than 15°.

Conduits shall be kept at a minimum distance of 100 mm. from the pipes of other non-electrical services. And maintain minimum 200-300 mm distance between telephones, TV & Computer piping.

Separate conduits/raceways shall be used for :

Normal lights and 5 A 3 pin sockets on lighting circuit.

Separate conduit shall be laid from D.B. to switch board.

Power outlets - 15 A 3 pin 20 A/30 A, 2 pin scraping earth metal clad sockets.

Emergency lighting.

Telephones.

Fire alarm system.

Public address system & Music system.

For all other voltages higher or lower than 230 V.

T.V. Antenna.

Water level guard.

Computer Wiring

Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc., shall be installed in flexible conduits. Otherwise rigid conduits shall be used. No flexible extension shall exceed 1.25 m.

Conduits run on surfaces shall be supported on metal 12 mm. thick G.I. pressure saddles which in turn are properly screwed to the wall or ceiling. Saddles shall be at intervals of not more than 500 mm. Fixing screws shall be with round or cheese head and of rust-proof materials. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building. Unseemly conduit bends and offsets shall be avoided by using fabricated mild steel junction/pull through boxes for better appearances. No cross-over of conduits shall be allowed unless it is necessary and entire conduit installation shall be clean and neat in appearance.

Conduits embedded into the walls shall be fixed by means of staples at not more than 500 mm. intervals. Chases in the walls shall be neatly made and refilled after laying the conduit and brought to the finish of the wall but the building Contractor will do final finish.

Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the CLIENT AND/OR ITS ARCHITECT, before the concrete is poured. Proper care shall be taken to ensure that the conduits are neither dislocated nor choked at the time of pouring the concrete suitable fish wires shall be drawn in all conduits before they are embedded.

Where conduit passes through expansion joints in the building, adequate expansion fittings shall be used to take care of any relative movement.

Inspection boxes shall be provided for periodical inspection to facilitate withdrawal and removal of wires. Such inspection boxes shall be flush with the wall or ceiling in the case of concealed conduits. Inspection boxes shall be spaced at not more than 12 meters apart or two 90° solid bends or equal. All junction and switch boxes shall be covered by 6 mm clear plate. These junction boxes shall form part of point wiring or conduit wiring as the case may be including the cost of removing the cover for painting and re-fixing. No separate charges shall be allowed except where specially mentioned.

Conduits shall be free from sharp edges and burrs and the threading free from grease or oil. The entire system of conduits must be completely installed and rendered electrically continuous before the conductors are pulled in. Conduits should terminate in junction boxes of not less than 32 mm. deep.

An insulated earth wire of copper rated capacity shall be run in each conduit.

Lighting & Power Wiring:

All final branch circuits for lighting and appliances shall be single conductor/ stranded/ flexible wires run inside conduits. The conduit shall be properly connected or jointed into sockets, bends, and junction boxes.

Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.

All circuits shall preferably be kept in a separate conduit up to the Distribution Board. No other wiring shall be bunched in the same conduit except those belonging to the same phase. Each lighting branch circuit shall not have more than ten outlets or 800 watts whichever is lower. Each conduit shall not hold more than three branch circuits.

Flexible cords for connection to appliances, fans and pendants shall be 650/1100 V grade (three or four cores i.e. with insulated neutral wire of same size) with tinned stranded copper wires, insulated,

twisted and sheathed with strengthening cord. Colour of sheath shall be subject to the CLIENT AND/OR ITS ARCHITECT'S approval.

Looping system of wiring shall be used. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors. No such joints shall be made unless the length of the sub-circuit, sub-main or main is more than the length of the standard coil.

Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in 3 mm. thick painted or galvanized steel boxes with cover plates as specified. Cadmium plated brass screws shall be used.

Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 25 mm. and wires not less than 2.5 sq.mm. copper shall be used.

Every conductor shall be provided with identification ferrules at both ends matching the drawings.

Testing: the entire installation shall be tested for :

Insulation resistance.

Earth continuity.

Polarity of single pole switches.3

General: All the wiring switch board, outlet points shall be done in a concealed manner in wall & slab in PVC conduit of minimum 25 mm dia. (medium gauge) & with 650v / 1100v grade PVC insulated flexible copper conductor wire. The switches should be modular with moulded cover plates, blank plates for outlet boxes. The accessories, connectors, sockets, should be fixed with brass chrome / cadmium plated machine screw. For fan points the rates should be with hum -free type 300 W regulators as required to complete the point wiring. The wiring shall be as per IS: 732 and IS: 4648. The wiring shall be done in a looping manner so as to avoid junction boxes at any place. All the looping shall be done only in the switchboard and outlet points. The size of the wire shall be as per the specification. Colour code shall be strictly followed.

The size of wires shall as follow :

25-32 Amp. metal clad points:

Phase / Neutral 6.0 mm²

Earth 4.0 m m²

20 Amp. out let points :

Phase / Neutral 4.0 m m²

Earth 2.5 m m²

Two nos. of 15 Amps. Socket out let connected in parallel
from DB to first outlet

Phase / Neutral 4.0 m m²

Earth 2.5 m m²

from first outlet to second outlet.

Phase / Neutral 2.5 m m²

Earth 2.5 m m²

Light, fans, exhaust fan, 5 Amp. On board plug point, two way light points, bell point etc from switch to outlet.

Phase / Neutral 1.5 m m²

Earth 1.5 m m²

From D.B. to switch board – lighting / 5 A socket etc – i.e. circuit mains part of point wiring

Phase / Neutral 2.5 m m²

Earth 2.5 m m²

15/20 Amps. Socket outlet for AC (Single Phase/Three Phase) / Geyser

Phase / Neutral 4.0 m m²

Earth 2.5 m m²

15/20 Amps. Socket outlet for appliances or looped from sockets with 4 sq mm ckt.

Phase / Neutral 2.5 m m²

Earth 2.5 m m²

Separate pipes shall be laid for off wires and circuit mains.

Circuit mains of same phase shall be drawn in one pipe with prior permission/discussion with the consultant.

Separate phase, neutral and earthing wire of sizes recommended by consultant shall be drawn for each and every circuit mains.

Mains for lighting and on board plug points shall be of one-size higher wires than those used in off.

The point definition shall be conducting and wiring from D.B. to S.B. and there from to final outlet point including switches and accessories, junction boxes, fan boxes, zarri work with cement –sand etc of Proposed make.

C. MODE OF MEASUREMENT

The items shall be measured on unit basis or on mtr basis as per BOQ.

3.6. LIGHT FIXTURES

A. SPECIFICATIONS

Light fixtures as mentioned in the BOQ with the catalogue nos and makes shall be installed. The fixtures shall be complete with ballast and shall be prewired by the manufacturer.

B. WORKMANSHIP

The fixture shall be installed on wall / ceiling as directed and as per manufacturer's instruction, with necessary accessories for surface, concealed, suspended from ceiling, bracket mounting etc. The job also includes connection of fixture with respective outlet point with heat resistant wires through heat resistance sleeve and PVC connector. The exhaust fan shall be installed complete with M.S. angle iron mounting frame/ ring, G.I. louvers, wire mesh and plug at the end of the cord including wiring & earthing etc. Proper earthing shall be provided to the fixtures

C. MODE OF MEASUREMENT

The unit rate shall be considered for fitting one fixture. The rate shall include following

All fixing accessories, mounting bracket, ballast condensers and control gear wherever applicable. Supplying and fixing Ball and socket joints wherever required.

Earthing of fittings.

Electrical connections to fittings/fans from the junction box/ceiling rose.

Installation and interconnection of Electronic regulators for ceiling fans.

Supplying and fixing 300 mm. GI down rod for ceiling fans.

3.6. EARTHING

A. SPECIFICATION

PLATE ELECTRODE EARTH STATION:

The earth station shall be as shown on the drawing and shall be used for equipment earth grid and/or street light pole earthing and shall be as per IS 3043.

The earth electrode shall plate of copper / GI as per BOQ of size in BOQ with copper or GI strip of required size as per BOQ coming out to ground level .

The earth resistance shall be maintained with a suitable soil treatment as shown on the drawing. The resistance of each earth station should not exceed 5 ohms.

The earth lead shall be fixed to the pipe with a nut and safety set screws. The clamp shall be permanently accessible.

The earthing grid and the earthing conductor shall be hot dip galvanized iron strips of the size as shown in the drawing.

G.I. pipe with funnel of approved quality shall be used for watering the earth electrode \ station.

The block masonry chamber with Cast Iron hinged cover shall be provided for housing the above referred funnel and pipe.

The hardware and other consumable for earthing installation shall be brass or hot dip galvanized iron material as shown on the drawing.

EARTH LEADS AND CONNECTIONS:

Earth lead shall be galvanized steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. Galvanized steel buried in the ground shall be protected with bitumen and Hessian wrap or polythene faced Hessian and bitumen coating. At road crossing necessary Hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface.

The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

B. WORKMANSHIP

Following activities shall be carried out for the earthing station

- Excavation in hard murrum.
- Laying Watering pipe.
- Brick masonry with hinged covers.
- Charcoal and Salt fill.
- Earth station should be 1 mt. away from building.
- Keep minimum 2 mt. distance between two earth pits.
- The pit should be minimum 10ft deep.
- The earth resistance should not exceed 1- 5 ohm. (As per IS)
- All earth pits of same category shall be interlinked with strip.
-

Following points shall be followed strictly.

The plate electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 2.5 M below finished ground level.

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

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

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

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

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

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

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

The earth conductors (Hot dip G.I. strips) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

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

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

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

Additional equipment earthing shall be done with Cu strip / Bare Cu Wire as per size indicated in drawing.

Lightening arrestors shall be installed at topmost point of the building. The quantity for the same shall be designed & specification in BOQ to cover total building area. Finial type arrestor shall be used with Cu pipe & Cu base plate. The arrestor / base plate shall be connected to separate earth pit with Cu Strip.

Following tests shall be carried out:

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

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

Each earthing station

Earthing system as a whole

Earth continuity conductor

Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 5 Ohm in each case.

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

C. MODE OF MEASUREMENT

Earthing stations shall be measured in units whereas earthing strips and wires shall be measured in rmt.

3.7. EXTERNAL LIGHT POLES

A. SPECIFICATIONS

Street light poles, M.S. poles / Octagonal poles shall be as per the drawing given. The sections for the pipe shall be as shown in the drawing. The poles shall be welded properly and grinding shall be perfect to show smooth surface and stability shall be maintained. The light fixtures to be mounted above the poles shall be as specified in the BOQ. All the poles shall be treated with 2 coats of red oxide and after the putty and other works shall be spray painted with automotive category paints only. In case of powder coating 7 tank process shall be adopted. The painting or the powder coating option shall be as per the BOQ.

MATERIALS :

Support shall be any of the following types as specified :

- (i) Steel tubular poles, Casting Material
- (ii) Octagonal pole with base plate foundation type.

Support shall be adequate strength and conform to rule 76 of the Indian Electricity rules. The size of pole sections shall be selected in accordance with relevant IS specifications to suit the requirements of Loading.

Length of supports shall be specified, so as to satisfy the relevant functional requirements like the ground clearance of lines when installed, street lighting etc.

Steel tubular poles :

- (i) Steel tubular poles shall conform to IS: 2713 (part 1 to 3) These shall be of seamless / swage and welded type in three stepped sections as specified.
- (ii) The pole shall be complete with cap and base plate.
- (iii) Unless otherwise specified, One six of length of the pole plus 30cm from its base shall be coated with black bituminous paint, both internally and externally. The remaining portion of the pole shall be painted with one coat of red oxide primer on its external surface.

Fabricated poles : Fabricated pole shall be made from Galvanised Iron (GI) pipes or Mild steel (MS) Pipes (seamless or ERW) or fabricated from structural steel or steel sheet as specified.

Paint :

ISI marked paint of approved make and shade shall be used. Primer coats shall be with zinc chromate red oxide paint.

Location of support:

- (i) Pole shall be located strictly as per drawing and / or modified drawings or as directed by the engineer-in-charge. Any modifications, if required due to site conditions, the modified proposal shall be submitted to the engineer in charge for approval of the engineer-in-charge.
- (ii) Pole shall be located along side roads, on road beam, a little away from the road edge and drain.
- (iii) Pole shall not be located in front of entrance to building.
- (iv) Street lighting poles in group housing residential colonies as far as possible, shall be located such that the entrance of the blocks are lit up.
- (v) For street light poles the footpath between main road and a service lane shall be preferred. At each road junction one pole shall be located.

Erection of support :
Excavation supports :

- (i) Normally $\frac{1}{6}$ th length of the pole is buried in the ground, the depth of pit shall be in accordance to pole height. The size of the pit shall be suitable for the foundation of the supports. The pits should be excavated in the direction of the lines.
- (ii) The pit for struts shall be located at a distance of not less than 1.8m from the pole.
- (iii) The depth of the pit for struts shall be such that at least 1.2m of the strut is buried in the ground and the size of the pit shall be suitable for the foundation of the struts.
- (iv) Care shall be taken to see that the minimum amount of soil is disturbed so as to take advantage of the bearing capacity of the virgin ground, (and that the pits are not oversize).
- (v) Pits shall not be left unfilled for unduly long periods so as to avoid accidents. If pits are kept open for any reason, suitable provided near the pits (s) to warn the public, pedestrians, vehicular traffic, till the pit is back filled and levelled.

ERECTION :

- (i) The support shall be correctly before concreting of the back filling of the pit, as the case may be.
- (ii) All supports shall be erected over a bed of thickness 15cm and of are 0.35 sqm of cement concrete 1:3:6 (1cement : 3 coarse sand : 6 grade stone aggregate of 40mm nominal size) laid in the excavated pit, irrespective of the provision of a base plate.
- (iii) Steel poles shall be fixed in cement concrete 1:3:6 (1cement : 3 coarse sand : 6 grade stone aggregate of 40mm nominal size) foundation from bed and upto 15cm above ground level tapered suitably to from collar with not less than 20cm thick all-round the support.
- (iv) After concreting, the excavated earth shall be back filled and consolidated in layer not exceeding 20cm.
- (v) Curing of foundation with collar shall be done for at least two weeks by using moist gunny bags etc. before loading the pole.

Numbering of supports:

All support shall be numbered after painting as directed by the engineering-in-charge.

Octagonal pole construction : all steel used in the construction of the pole shall comply with BS EN 10 025 / IS 5986 Gr.Fe.510. welding shall be in accordance with BS EN ISO 1011/IS 10178.

The pole shall be constructed from mild steel plates cut and folded to form a polygonal section, telescopic jointed and fillet welded. With the exception of site joints.

A door shall be provided in the base of the pole to permit clear access to equipment. The door shall be weather and vandal resistance with a heavy duty lock. The base flange welded connection to the pole shall fully develop the strength of the section. in addition, supplementary gussets shall be provided between bolt holes. The pole shall be delivered to site in sections and joined with stressing equipment, thus forming a sleeve joint no site welding or bolted joints will be permitted.

Metal protection : The entire pole shall be hot dip galvanised after fabrication, internally and externally in accordance with BS EN ISO 1461.

B. WORKMANSHIP

All the light poles shall be brought to site and shall be stored in such a place so as to avoid rusting and brazing of the poles. The poles shall be erected as per the drawing and the top level of all the poles shall be similar. The poles shall be at right angle with the ground. Necessary civil works and spiral earthing shall be done as shown in drawing. No additional holes shall be drilled in poles at site for enabling the cable works. Poles with damage in colour or indentations shall be rejected and if engineering in charge approves for damage in colour the same shall be finished at the site.

C. MODE OF MEASUREMENT

The poles shall be measured in nos and the cabling for the same shall be measured in rmt.

Poles or external light fixtures shall be free from dents or flaking of powder coating until hand over. Damaged material shall be rejected / replaced as per consultants / EIC instructions.

5. FACTORY ACCEPTANCE TEST FOR ALL BOUGHT OUT ITEMS

Client, his consultant and their authorized representative shall have the right to inspect and test or get inspected and tested the goods at the works of the Seller or its sub suppliers any time during manufacture and prior to dispatch and to inspect within a reasonable time after arrival of goods at the ultimate destination and during and after erection, testing and commissioning. The goods shall not be deemed accepted until after the said inspection, testing and commissioning and signing of the Acceptance Certificate. Failure to make any inspection of or payment for or acceptance of goods shall in no way impair client right to reject non-conforming goods or to avail itself of any other remedies to which client may be entitled, notwithstanding client knowledge of the nonconformity, its substantiality in the case of its discovery. In the event of failure of Seller to remove the rejected goods within the time allowed, client shall have the right to dispose of the same at the seller's risk and cost. During the time the rejected goods lie with client awaiting removal by the seller, they will so lie at the seller's risk. All goods rejected by client after receipt at the destination shall be removed by the seller within a reasonable time allowed by client, not exceeding 30 (thirty) days at seller's expense and risk.

The Seller will permit client Inspectors, Consultant and their authorized representatives free access during normal working hours to his works, godown, storage or loading spot etc. and will give them all necessary assistance to perform their task including free use of all accessories, testing and control instruments. The seller shall ensure that the same facilities are granted by his sub-suppliers.

Unless specifically stated to the contrary in the order, all expenses relevant to the preparation and performance of testing, inspection and preparation of any test reports or certificates shall be borne by the Seller EXCEPT for the salaries, fees, traveling, lodging and boarding expense of the Consultant's / client's representatives. However, if the visit duration of D&D / client's representatives is extended for the reasons not attributable to D&D/ client, the cost of the extended period of visit shall be borne by the seller.

The sellers shall carry out tests related to performance tests as described in the specifications and specified in the order. All such performance tests shall be at supplier costs. Supplier shall also provide all the tests certificates and documents as demanded by the Inspector for his satisfaction that the order has been executed as per PO specifications. All such certificates, documents in original shall be submitted to the Client before dispatch of material. The goods shall be dispatched from suppliers shop only after written confirmation from clients / or its authorized representative.

The contractor shall consider all cost towards inspection of goods by consultant / EIC at factory / manufacturers works prior to shipping for 2 persons. (Travelling (Air / 1st AC) / stay etc complete)

6. SAFETY CODE

1. Suitable scaffolds shall be provided for workmen for all work that cannot safely be done from the ground, or from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra labour shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and handhold shall be provided on the Ladder and the ladder shall be given an inclination not steeper than 1/4 to 1 (1/4 horizontal and 1 vertical).
2. Safe means of access shall be provided to all working platform and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length. Width between side rails in a rung ladder shall in no case be less than 30 cm. for ladders upto and including 3 meters in length. For longer ladders this width shall be increased atleast 6 mm. for each additional 30 cm. of length. Uniform step spacing shall not exceed 30 cm.
Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites shall so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lightest to protect public from accidents and shall be bound to bear expenses of defense of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person.
3. Demolition : Before any demolition work is commenced and also during the process of the work:-
 - a) All roads and open areas adjacent to the work site shall either be closed or suitably protected.
 - b) No electric cable or apparatus, which is liable to be a source of danger over a cable or apparatus used by operator, shall remain electrically charged.
 - c) All practical steps shall be taken to prevent danger to persons employed, from risk or fire or explosion or flooding. No floor, roof, or other part of a building shall be so overloaded with debris or any materials as to render it unsafe.
4. All necessary personal safety equipment as considered adequate by the Engineer-in-charge shall be available for use of persons employed on the site and maintained in a condition suitable for immediate use; and the contractor shall take adequate steps to ensure proper use of equipment by those concerned.
 - a) Those engaged in handling any material, which is injurious to eyes, shall be provided with protective goggles.
 - b) Those engaged in welding works shall be provided with welder's protective-shields.
 - c) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
 - d) The contractor shall not employ male or female labour below the age of 18 years.
5. When work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

6. Use of hoisting machines and tackle including their attachments, anchorage and supports shall confirm to the following:
 - a)
 - i. These shall be of good mechanical construction, sound material and adequate strength and free from patent defects and shall be kept in good repair and in good working order.
 - ii. Every rope used in hoisting or lowering materials or as a means suspension shall be of durable quality and adequate strength, and free from patent defects.
 - b) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in charge of any hoisting machine including any scaffold winch or give signals to operator.
 - c) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension, safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with safe working load. In case of a hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond safe working load except for the purpose of testing.
 - d) In case of a departmental machine, safe working load shall be notified by the Engineer-in-charge. As regards contractor's machines the contractor shall notify safe working load of each machine to the Engineer-in-charge whenever he brings it to site work and get it verified by the Engineer-in-charge.
7. Motors gearing, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards; hoisting appliances shall be provided with such means as will reduce to the minimum risk of accidental descent of load adequate precautions shall be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations, which are already energized, insulating mats working apparel such as gloves, sleeves and boots as may be necessary, shall be provided. Workers shall not wear any rings, watches and carry keys or other materials, which are good conductors of electricity.
8. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities shall be provided at or near places of work.
9. These safety provisions shall be brought to the notice of all concerned by display on a notice board at a prominent place at the work spot. Persons responsible for ensuring compliance with the safety code shall be named therein by the contractor.
10. To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the contractor shall be open to inspection by the Engineer-in-charge or his representatives and the Inspecting Officers.
11. Notwithstanding the above conditions 1 to 14 the contractor is not exempted from the operation of any other Act or Rule in force.
12. If the height at which the contractor is working is more than 12 feet then the staff should wear safety helmet and tie himself with softy belt, client/ architect have all right to ask the contractor to stop work if the safety condition are not fulfilled.

7.0 TESTING OF INSTALLATION

1.0 SCOPE

This chapter describes the details of tests to be conducted in the completed internal electrical installations, before commissioning.

1.1 GENERAL

Tests

On completion of installation, the following tests shall be carried out:-

- 1)** Insulation resistance test.
- 2)** Polarity test of switch.
- 3)** Earth continuity test.
- 4)** Earth electrode resistance test.

Witnessing of tests

Testing shall be carried out for the completed installations, in the presence of and to the satisfaction of the Engineer-in-charge by the contractor. All test results shall be recorded and submitted to the Department.

Test instruments

All necessary test instruments for the tests shall be arranged by the contractor if so required by the Engineer-in-charge.

1.2 INSULATION RESISTANCE

- 1.2.1** The insulation resistance shall be measured by applying between earth and the whole system of conductors, or any section thereof with all fuses in place, and all switches closed, and except in earthed concentric wiring, all lamps in position, or both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure, provided it need not exceed 500 volts for medium voltage circuits. Where the supply is derived from a three wire D.C, or a polyphase A.C. system, the neutral pole of which is connected to earth either directly or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral.
- 1.2.2** The insulation resistance shall also be measured between all the conductors connected to one pole, or phase conductor of the supply, and all the conductors connected to the neutral, or to the other pole, or phase conductors of the supply with all the lamps in position and switches in "off" position, and its value shall be not less than that specified in sub-clause 16.2.3.
- 1.2.3** The insulation resistance in mega ohms measured as above shall not be less than 12.5 mega ohms for the wiring with PYC insulated cables, subject to a minimum of 1 mega ohm.
- 1.2.4** Where a whole installation is being tested, a lower value than that given by the formula, subject to a minimum of 1 mega ohm, is acceptable.
- 1.2.5** A preliminary and similar test may be made before the lamps etc. are installed, and in this event the insulation resistance to earth should not be less than 25 mega ohms for the wiring with PYC insulated cables, subject to a minimum of 2 mega ohms.

- 1.2.6** The term "outlet" includes every point along with every switch, except that a switch combined with a socket outlet, appliance or lighting fitting is regarded as one outlet.
- 1.2.7** Control rheostats, heating and power appliances and electric signs may, if required, be disconnected from the circuit during the test, but in that event the insulation resistance between the case or frame work, and all live parts of each rheostat, appliance and sign, shall be not less than that specified in the relevant Indian Standard Specifications, or where there is no such Specification, shall be not less than one mega ohm.

1.3 POLARITY TEST OF SWITCH

- 1.3.1** In a two wire installation, a test shall be made to verify that all the switches in every circuit have been fitted in the same conductor throughout, and such conductor shall be labeled or marked for connection to the phase conductor, or to the non-earthed conductors of the supply.
- 1.3.2** In a three wire or a four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted in a conductor which is labeled, or marked for connection to one of the phase conductors of the supply.
- 1.3.3** The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp, one lead of which is connected to the earth. Glowing of test lamp to its full brilliance, when the switch is in "on" position irrespective of appliance in position or not, shall indicate that the switch is connected to the right polarity.

1.4 TESTING OF EARTH CONTINUITY PATH

The earth continuity conductor, including metal conduits and metallic envelopes of cables in all cases, shall be tested for electric continuity. The electrical resistance of the same along with the earthing lead, but excluding any added resistance, or earth leakage circuit breaker, measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

1.5 MEASUREMENT OF EARTH ELECTRODE RESISTANCE

- 1.5.1** Two auxiliary earth electrode, besides the test electrode, are placed at suitable distance from the test electrode (see figure 14). A measure current is passed between the electrode 'A' to be tested and an auxiliary current electrode 'C', and the potential difference between the electrode 'A' and auxiliary potential 'B' is measured. The resistance of the test electrode 'A' is then given by:

$$R=V/I$$

Where,

- | | | |
|---|---|---|
| R | - | Resistance of the test electrode in ohms, |
| V | - | Reading of the voltmeter in volts. |
| I | - | Reading of the ammeter in amps. |

- 1.5.2** (i) Stray currents flowing in the soil may produce serious errors in the measurement of earth resistance. To eliminate this, hand driven generator is used.
- (ii) If the frequency of the supply of hand driven generator coincides with the frequency of stray current, there will be wandering of instrument pointer. An increase or decrease of generator speed will cause this to disappear.

- 1.5.3. At the time of test, the test electrode shall be separated from the earthing system.
- 1.5.4 The auxiliary electrodes shall be of 13 mm diameter mild steel rod driven upto 1 m into the ground.
- 1.5.5 All the three electrodes shall be so placed that they are independent of the resistance area of each other. If the test electrode is in the form of a rod, pipe or plate, the auxiliary current electrode 'c' shall be placed at least 30 m away from it, and the auxiliary potential electrode 'B' shall be placed mid-way between them.
- 1.5.6 Unless three consecutive readings of test electrode resistance agree, the test shall be repeated by increasing the distance between electrodes A and C upto 50 m, and each time placing the electrode B midway between them.
- 1.5.7 On these principles, "Megger Earth Tester", containing a direct reading ohm-meter, a hand driven generator and auxiliary electrodes are manufactured for direct reading of earth resistance of electrodes.

1.6 TEST CERTIFICATE

On completion of an electrical installation (or an extension to an installation), a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as given in Appendix 'E' in addition to the test certificate required by the local Electric Supply Authorities.

9. SPECIAL CONDITIONS OF CONTRACT

1. GENERAL

The complete Electrical Installation shall be carried out in strict accordance with the regulations of the electricity supply authority, Institution of Electrical Engineers, ISI Standards, fire Insurance Company insuring the building and national code of practice.

The standard conditions of contract are meant to amplify the specifications, schedule of quantities and drawings and the more stringent of the above shall apply should there be any ambiguity or inconsistency. The contractor should report the same to the Architect/Consultant and obtain clarification before submitting his tender.

All Equipments, cables etc. shall be adequately rated to suit the climatic conditions experienced in this country.

Clause in this specification shall apply equally throughout.

2. ORDERING

As soon as possible after the contractor receives written notification of the acceptance of his tender he shall order all the materials and equipment required to complete the contract. He shall submit to the consultant the detailed summary of all the orders placed, providing the details about the name of Supplier/Vendor, make of equipment, date of order and forecast of delivery date at site.

3 STANDARD OF MATERIALS

When the material and equipment is specifically described named in the specifications, it is so named or described for the purpose of establishing a standard of materials and workmanship to which the contractor must adhere. The Contractor must quote with the material as listed in the make of materials list attached later in the document. The Contractor may submit with his tender a list indicating any alternative make of material that he proposes to install. Before installing such a make the contractor shall take permission from the consultant. All materials condemned by the consultant as not approved for use are to be removed from the premises and suitable material shall be delivered and installed in their place at the expense of the Contractor. If alternatives are not offered during the tender stage then the contractor will be deemed to have submitted his tender based on all materials and equipment specified or shown on the drawings and therefore no alternative manufacturer or supplier of such material and equipment specified or shown will be considered after the contract is awarded if however the material or equipment specified or shown on the drawing is not available due to any genuine reason. The contractor shall prior to order get the written approval of the consultant for the particular material/equipment.

The Contractor shall be responsible for the safe custody of all material and shall insure them against theft damage by fire earthquake etc. A list of materials and equipment together with a sample of each shall be submitted to the consultant as directed by him within 30 days of the award of the contract.

All materials required for the works shall be new and the best of their respective kinds and shall be of uniform pattern. All materials shall be suitable for use in temperatures of 50°C with comparative humidity.

The protective finishes detailed as follows must be provided on all materials and apparatus used on this contract to ensure that no deterioration is caused by the local climatic conditions.

All materials shall be inspected by the Contractor to ensure that finishes are in accordance with this specifications.

- A. The interior fittings in all distribution boards and control units shall be properly painted.
- B. All holes in distribution boards and similar equipment shall be blanked off to protect from dust and vermin where ventilation is necessary holes are to be neatly covered.
- C. All cable entry holes on switchgears and similar equipment shall be fitted with PVC/Rubber Bushings.

The material supplied by the client or other agencies shall be properly inspected by the contractor before accepting so that any damage thereafter is the liability of the contractor.

4. WORKMANSHIP

The workmanship and method of installation shall confirm to the best standard practice. All work shall be performed by skilled tradesman to the satisfaction of the Consultant/Architects. Helpers shall have qualified supervision.

Any work that in the opinion of the consultant does not confirm to the best standard practice shall be removed and reinstated at the Contractor's expense permits certificates and licenses must be held by all tradesman for the type of work in which they are involved where such permits certificates and licenses exist under government legislation.

5. PROCEDURE

Throughout all stages of work the contractor shall maintain a close liaison with the consultant and with all other contractors involved in the work.

Site work shall commence immediately with the start of building work and shall proceed expeditiously in harmony with the building work so as not to delay the latter in any way. All plant to be supplied and work to be done under this specification shall be manufactured and executed in the manner set out in this specification or where not so set out the reasonable satisfaction of the consultant and all the contractors works on site shall be carried out in accordance with the such reasonable directions as the consultant may give.

The contractor in the interest of the work shall furnish a bar chart based on the chart furnished by the civil contractor stating all the starting and completion dates clearly in the format that consultant approves or in the format of the civil bar chart.

The contractor shall also furnish the time chart showing the material procurement marking the ordering date and the delivery date of the material on site. In case of delay in delivery of material at site the contractor may be asked to furnish proper reason for the delay.

The contractor if at all feels necessary shall attach the drawing schedule requirements with the tender documents.

6. PERMITS

The Contractor shall obtain all necessary permits prior to work commencement for the excavation of cable trenches etc. in the areas where it is suspected that existing services are present the contractor shall carry out excavation work by hand. He shall also obtain the necessary permits from the respective authorities prior to working on major items of the switchgear. All application permits shall be made in writing with a copy to the consultant.

7. TEMPORARY AND TRIAL USAGE

It shall be understood and agreed that temporary and trial usage by the employer of any device, machinery, apparatus, equipment or any other work or materials supplied under this contract before final completion and written acceptance of the item by the employer it is further understood and agreed that the employer shall have privilege of such temporary and trial usage as soon as the contractor shall claim that the said work is completed and in accordance with the drawings and specifications and to the manufacturer's instructions and for such reasonable length of time as the consultant shall deem suitable for making a complete and thorough test of the apparatus or system under test.

No claim for the damage will be made by the contractor for the injury to or breaking of any parts of the works which have been placed under test whether this damage has been caused by weakness, flaw or inaccuracy of structural parts or by defective material or workmanship of any kind whatsoever.

8. CLEANING

Before operating any of the systems the contractor shall clean out all rubbish and dirt upon completion of the contract the contractor shall ensure that all items of plant are left in a clean and tidy condition.

9. SETTING OUT OF WORKS

The specification and schedule of rates shall be considered as part of this contract and any work materials shown on the schedule and not called for in the specifications or vice-versa shall be executed as if specifically called for in both.

The Contractor at his own expense shall set out all his hard works and take all his measurements and dimensions required for the erection of his materials on site making and modifications in detail to the consultant before proceeding and must allow in his tender for all such modifications and for the provision of any sketches or drawings related there to.

The position of all DB's Panels, Cable routes, fixtures, Wiring Systems, Service Outlets and control Switches shown on the drawings are to be assumed as being correct for the purpose of tendering final positions of these must be agreed with the consultant before installation.

The data given here in and on the drawings is as exact as could be secured but its complete accuracy is not guaranteed. The drawings are for the guidance of the contractor, exact locations, distances and levels will be governed by the site conditions.

10. AS BUILT DRAWINGS / SHOP DRAWINGS

Contractor shall make all necessary shop drawings indicating conduit / cable tray routes / qtys / sizes; cable schedule, circuiting details etc complete before starting the works and get approval of consultant / EIC.

At the completion of the works and before issue of the certificate of virtual completion, the contractor shall submit to the consultant 4 sets (HARD AND SOFT FORMAT) of layout drawings drawn at approved scale indicating the complete wiring system as installed. These drawings must provide the following minimum information:

- A. Run and size of conduits, inspections, junction and pull boxes.
- B. Size of conductors in the conduits.
- C. Location and rating of sockets and switches controlling the light and power outlets.
- D. Location and details of distribution boards, mains, switches, switchgear, main panel and other particulars.
- E. A complete wiring diagram, as installed and schematic drawings showing all connections in the complete electrical system.
- F. Location of outlets, junction boxes, sizes of various conduits for telephones.
- G. Location of all earthing stations, routes, sizes of all earthing conductors, manholes, layout of earth link strips, etc.
- H. Layout and particulars of all cables.
- I. Necessary drawings with prints for approvals from local / govt. authorities.

Above indicates the general requirement. However, contractor must include all information desired by the client and Architects/Consultants in the final as built documents. Guidance for the preparation of as built document shall be had from the consultant.

11. MANUFACTURER'S INSTRUCTIONS

Where manufacturer's have furnished specific instructions, relating to the materials used in this job for covering, paints etc which are not specifically mentioned in this documents, manufacturer's instructions shall be followed.

12. GUARANTEE

At the close of the work and before issue of the final certificate of virtual completion. The contractor shall furnish written guarantee indemnifying the Architect/Consultant against defective materials and workmanship for a period as mentioned in the schedule of fiscal aspects. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to client the following :

- A. Any defective work or material supplied by the Contractor.
- B. Any material or equipment damage or destroyed as a result of defective workmanship by the Contractor.

13. SAFETY OF MATERIAL

The Contractor shall provide proper and adequate storage facilities to protect all materials and equipment, including those issued by the owner against damage from any cause whatsoever.

14. COMPLETION CERTIFICATE

On completion of the Electrical Installation a certificate shall be furnished by the Contractor counter signed by the licensed supervisor, under whose direct supervision the installation was carried out. The certificate shall be in the prescribed form as required by the local authority.

The contractor shall be responsible for getting the Electrical installation inspected and approved by the local authorities connected.

15. ENGINEER AND FOREMAN

The Contractor shall employ a competent fully licensed, qualified full time electrical Engineer and foreman to direct the work of Electrical Installation in accordance with drawings and specification. The foreman shall be available full time on site to receive instruction from Architect/Consultant or his nominee in the day to day activities throughout the duration of the contract the foreman shall correlate the progress of work in connection with all relevant requirements of the supply authorities.

16. LIASIONING WITH LOCAL SUPPLY COMPANY

The contractor shall be responsible for all the liaisoning work with the supply company. However, all the technical assistance required for the same may be furnished by the consultant. The contractor has to fill the necessary forms and submit test reports so as to ensure that the supply is available in time. The contractor shall prepare necessary drawings for the approval of the concern government departments and has to get the necessary permissions for supply and D.G. sets etc.

17. SPECIFICATIONS AND SCHEDULE

The specification and schedule of rates shall be considered as part of this contract and any work or materials shown on schedule and not called for in this specifications or vice versa shall be executed as if specially called for in both. The drawings indicate the extent and general arrangement of the fixtures, controlling switches, wiring system etc. and are essentially diagrammatic. The drawing indicates the points of termination of conduit runs and are suggestive of the routes to be followed.

18. SUPERVISION

Supervision shall be by a competent person experienced in the nature of the work to be undertaken. This person shall be available on site for the full period of works. The Engineer may demand at any time during the contract the replacement of the contractors personnel who fails to satisfy this requirement of competent.

19. TOOLS AND EQUIPMENTS

The Contractor shall provide all necessary Jointing Equipment, tools, Portable power tools, test equipment etc which will be required to carry out the Electrical work. All the zarri work, except in unavoidable circumstances, shall be done with a zarri cutter.

This includes all heavy duty equipments such as Cranes, lorries, etc. for site delivery and fixing. The contractor must have minimum following instruments :

- 1) 1000 / 500 V Meggar.
- 2) Clip on meter.
- 3) Earth tester.
- 4) Lux meter.
- 5) Zarri Cutter.
- 6) Multi Meter.
- 7) Drill machine upto 25 mm dia.
- 8) Ladders suitable for 30 ft. and above.
- 9) All safety equipments like helmet, safety rope etc.
- 10) Complete set of spanners, screw drivers etc.

20. SITE STORAGE

The contractor shall be responsible for the safe storage of materials on site. This includes ensuring that all equipment is handed to the client in sound undamaged order.

The Contractor shall be responsible for safe storage of materials on site, and liable for their replacement. The Contractor would be required to maintain a watch man on site and this shall remain Contractors Choice.

21. SPARES

The Contractor shall prepare a schedule of manufactures recommended for spares for one year maintenance.

22. OPERATING AND MAINTENANCE MANUALS

The Contractor shall furnish two sets of operating manuals which shall include services maintenance instructions and circuit diagram for each item of equipment.

23. SITE CONDITIONS

The Contractor shall take all necessary action to acquaint himself fully with site conditions. Any conditions at tendering stage will not be accepted.

After the contract is awarded the Contractor shall acquaint himself fully with existing services and obtain all necessary information to avoid any damage to the services during excavation etc.

24. LABELS AND NOTICES

On all switchgear identification name plates shall be fitted these will identify the substation and/ or out going ways. The labels shall be made on indestructible non deteriorating material with lettering engraved in black or white background except where otherwise specified. Fixing shall be by means of rivets or screws in addition to any adhesive. all labels shall be English/Hindi /mother language as directed by the Consultant. All pillars and mini feeder pillars in addition to identification labels shall have each way identified by a label to the same specification fitted in the feeder pillar. An indestructible "Danger 415 volts" plates should be fitted externally with a double flush danger signal. The letters to be 12 MM height minimum in signal red.

In addition each distribution board shall have a typed chart detailing particulars of the circuits controlled which shall be fixed to the inside of the door. The details shall include the circuit load, description, the type and rating of the protection device, and the cable size. A sheet of transparent rigid plastic shall be used to completely cover the chart to prevent damage.

25. PACKING AND RECEIPT OF MATERIAL

The contractor shall take every possible measure including appropriately strong packing, proper supervision of loading and off loading and proper transportation by the most suitable route to ensure the safe delivery to site of plant and equipment. The Contractor shall keep at site up-to-date record of all materials received and fully annotated with details of the carrier and condition of equipment on arrival.

26. RECORDING OF WORK

The contractor shall keep a diary and a set of drawing recording the progress of the works and details of all instruction received. These shall be available for the consultant upon request. The contractor's site representative will submit a written report every two weeks outlining the progress of the work including work completed to date. The review of the work completed and the barchart submitted shall be done weekly and the difference in the two shall be submitted to be Consultant specifying the reasons for the difference.

On completion of work the contractor has to submit detailed reconciliation statement of all electrical materials. The loss of material shall be recovered at prevailing market rate for the material supplied by the client or other agency.

The contractor shall take permission from the employer before he takes all the unused material from the site on completion of work.

27. MARKING OUT

Routes and positions of systems, and positions of all electrical equipment shall be marked out by the contractor and approved by the Engineer before such items are installed.

These items shall be installed in the positions shown on the drawings, but reasonable variations may be made on site with the consent of Engineer.

28. FIXING

Screws fixing brick concrete or similar materials which necessitates plugging shall be made using steel woodscrews into plugs in rotary drilled holes.

Items of switch fuse gear, cable racks and trays etc. shall be fixed using corrosion resistant steel bolts fitted with expanding collars, e.g. 'Anchor Fastner' set into rotary drilled holes of the correct size all such bolts shall be provided with one number wide flange washer and one heavy spring washer.

29. CONTRACTORS RATES

The Contractors rates must be included the cost of transportation of materials to the site. All taxes such as sales tax, Excise and Octroi etc. and the fixing or placing in position for which the items of work is intended to be operated.

The contractor shall quote in English, in words and figures, the amount tendered by him in the Form of Schedule of rates forming part of the tender document in such a way that interpolation is not possible. The amount for each item shall be worked out and entered and requisite totals given for all items. The tendered amount for the work shall be entered in the Tender and duly signed by the tenderer.

The contractor shall include in rates quoted all expenses (travelling / lodging / boarding) for inspection of goods at manufacturers workshop for two persons from client / consultants office.

If some discrepancies are found between the rates in words and figures or the amounts shown in the tender following procedure shall be followed :

- a) When there is difference between the rates in figures and words, the rate in words shall be taken as correct.

- b) When the rate quoted by the tenderer in figures and words, tallies, but the amount is incorrect, the rate quoted by the tenderer shall be taken as correct.
- c) When it is not possible to ascertain the correct rate, in the manner prescribed above, the rate as quoted in the words shall be adopted.

The contractor shall be liable to furnish the rate analysis for the rates quoted by them, if the architect/consultants find the rates to be non workable and ask for the analysis.

Labour rates not quoted for the items / or rates for extra items shall be decided 15 days prior to the start of the work as per the procedure listed in schedule of fiscal aspects. However, looking to the urgency of the work, if it is required to execute the item without the settlement of rate, then the rate for the same item will be finalised before making the payment.

30 ARCHITECTS / CONSULTANTS DECISIONS

Matters not covered by the specification given in the contract as a whole shall be covered in the relevant ISI codes. If such codes for a particular subject have not been framed, the decision of the Architect/Consultant shall be final.

The work shall be carried out under the direction and supervision of the architect / consultant or their representative at site who shall guide the representative of contractor from time to time. On acceptance of the tender, the contractor shall intimate the name of the representative who would be supervising the construction and would be responsible for taking instructions for carrying out the work.

The Architects / consultants or their representative at site shall have access to the workshops of the successful tenderer so as to ensure themselves of the quality of material and workmanship.

The Architects / Consultants decision with regard to the quality of material and workmanship will be final and binding. Any material rejected by the Architect / Consultant shall be immediately removed by the contractor.

31 DEFECTS LIABILITY PERIOD

This period of 12 months, shall be in force from the date of "Virtual completion" and minor defects if any shall be corrected / rectified within 24 hours and major defects within 3 days which shall develop during this period. However, if the same are not rectified by the Contractor within the period mentioned above the clients with the concurrence of the Architects shall get the work done at the risk and the cost of the Contractor.

32. OCCUPYING PART AREAS

If the owner wants to occupy areas in part, the Contractor shall have to complete the work of these areas in consultation with the owner and handover the same to the employer without affecting any of the clause of the contract agreement.

33. TEMPORARY WIRING

Whenever any temporary wiring is done, it has to be done so that all precaution for safety is taken and temporary wiring shall be done so that, it is not hazardous to any body. Any accident due to temporary or permanent wiring or installation shall be the responsibility of the contractor and compensation shall be paid by the contractor to all the concerned.