

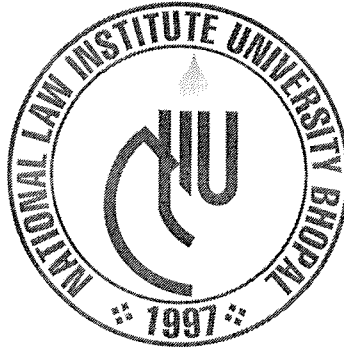
**NATIONAL LAW INSTITUTE UNIVERSITY,
BHOPAL**

**VOLUME-I
(TECHINICAL BID)**

**TENDER DOCUMENT FOR
CIVIL & ELECTRICAL WORKS**

OF

CONSTRUCTION OF PG BOYS HOSTEL.



ARCHITECT

VASTUKALP PROJECTS PRIVATE LTD

Kerwa Dam Road, Bhopal – 462 044

Telephone No.: - 0755-2696965/971/972/980 Ext - 109



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NATIONAL LAW INSTITUTE UNIVERSITY, BHOPAL

Tender Notice – 01/DEC-2022/NLIU

Online item rate tenders in separate three Bids System i.e. A,B & C are invited from Registered Contractors in appropriate class, with CPWD/Railway/MES/P&T/ State PWD/Central Govt. & State Govt. Department, MPLUN OR their Public Sector undertaking(s) in appropriate class for the Civil, Plumbing & Electrical works for Construction of PG Girls Hostel building at NLIU, Bhopal.

Description of works	Estimated Cost of the Project	Period of Completion	EMD	Cost of tender documents	Duration of sale of tender	Last Date & time of submission of tender	Date of opening of Bid
Construction of PG Boys Hostel (Civil & Electrical works) in the premises of NLIU, Bhopal	Rs 16,16,57,853/- Cr. AS PER CPWD DSR – 2022 INCLUSIVE GST@18%	09 Months	Rs. 32.0 lacs	Rs. 25,000/+ (Non Refundable)	19/12/2022 to 09/01/2023 upto 5.0 pm	Upto 10/01/2023	11/01/2023

The tender forms can be downloaded from the university website: www.nliu.ac.in or mptenders.gov.in through online payment of Rs. 25,000/-. The tender form can also be downloaded from website: www.nliu.ac.in or mptenders.gov.in. However, the downloaded filled in tender form should be submitted along with a tender cost of Rs. 25,000/-. Without the said tender cost the tender of such agency shall be rejected.

Online tenders shall be received on 10/01/2023 and the bid shall be opened on the 11/01/2023. The financial bid of only those bidders would be opened who would find successful in the technical bid as per criteria given in the evaluation chart.

In the event of withdrawing offer by any of the tenderers within the validity period, the EMD of such tenderers shall be forfeited and they would be debarred from future tendering for works in the University.

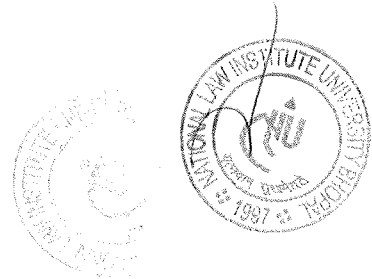
The Contractors who fulfill the following requirements and as stipulated in the Technical Bid form shall be eligible to apply and should submit duly stamped and certified copies of relevant document in support of the same with the Technical Bid (failing which the tender shall be rejected). If any of the certificates is found forged/fabricated or false, the tenderer would stand disqualified and his EMD would be forfeited without prejudice to any legal action. If the contractor would fail to submit the required documents as stated above the tender of the contractor shall be rejected without any discussion further in the matter.

(ENVELOP– A) given below.

1. Should have satisfactorily completed similar nature of work in last 05 years under single work order at least one of them should be in Central / State Government, Central / State Autonomous Bodies / Undertakings one work costing not less than Rs 11.0 crores or two works costing not less than Rs. 7.0 crores and three works costing not less than Rs. 5.50 crores each.
2. Should have average annual financial turnover of Rs. 20.0 crores of Civil & Electrical Work during the last five years ending 31.03.2017.
3. Agency should have registration in Central Govt. or State Govt. (Under new centralized systems) in appropriate class.
4. The agencies should have PAN No.
5. The I.T.C.C for the immediate last 05 financial years shall be furnished or the copies of I.T returns filed for the immediate last 05 financial years shall be submitted.
6. The agencies should have PF Registration and GST Registration.
7. Cost Tender and EMD

Note: Non Association / Relation: Should a contractor or a tenderer have a relative employed in NLIU (or in any way connected with the agency involved in the execution of this work) or in case of partnership firm or company incorporated under the Indian Companies Act, 2013, should a partner or relative of the partner or a share holder be employed in a responsible capacity in NLIU (or in any way connected with the agency involved in the execution of this work), the authority inviting the tender should be informed of the fact at the time of submission of tender, failing which the tender may be rejected. If such fact is suppressed at the time of tendering and come to light at any time after acceptance of tender, the contract may be rescinded.

The NLIU reserve the right to reject any or all tenders or split the work in between more than one party without assigning reasons whatsoever.



TECHNICAL BID EVALUATION
(ENVELOP – B)

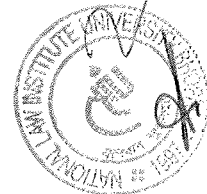
JOB : Civil and Electrical works.

PROJECT: Construction of PG Boys Hostel at National Law Institute University Campus, Bhopal.

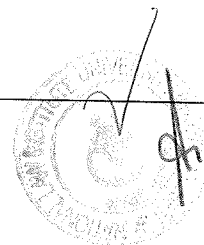
The evaluation committee will carry out its technical evaluation applying the evaluation criteria & point system below. Each criterion shall be marked on a scale of 1 to 10 and then the marks shall be weighted to become scores. The weights given to different evaluation criteria shall be: -

INFORMATION TO BE FURNISHED BY THE TENDERERS

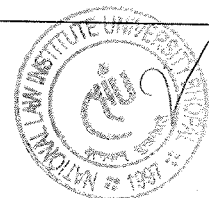
1	Name of the organization	
2	Address	
3	Year of establishment	
4	Status of the firm (whether Company/ Firm/Proprietary concern 1. Limited - 5 marks 2. Private Limited - 4 marks 3. Firm - 3 marks 4. Proprietary - 2 marks	5
5	Names of Directors/ Partners/ Proprietor	



6	Whether registered with the Registrar of Companies/Registrar of Firms. If so, mention the number and date	5
7	Name(s) and address of Bankers. Enclose Solvency Certificate from Bankers for an amount of Rs. 15,00,00,000/- . It is mandatory .	10
8	Whether registered for GST. If so, mention number and date. Furnish also copies of latest return.	5
9	Whether an assess of Income Tax. If so, mention Permanent Account Number and date. Furnish also copies of latest Income Tax Clearance Certificate.	
10	Registration with PF/ESI Authorities	5
11	Whether registered under new centralized registration system as Class 1 CPWD/MPPWD Contractor. If so, furnish the details.	
12	Detailed description and value of works done in the last Seven Years. Only works costing more than Rs.20.0 crores <ol style="list-style-type: none"> 1. Upto 20 crores or above – 5 marks 2. Between 15.0 crores to 18.0 crores - 4 marks 3. Below 13.0 crores – 3 marks 4. Upto 10.0 crores – 2 marks 	Please attach separate sheet 5



13	Specify the maximum value of work executed in a year	5
14	List of Major Construction machinery & equipments in possession of the firm which could be available for the works.	5
15	Particulars of Managerial / Engineering Personnel and Technicians along with their experience.	Please attach separate sheet 5
16	Particulars of existing works in hand and their value.	Please attach separate sheet 5
17	Furnish the names of three responsible persons along with their designation and addresses, who will be in a position to Certify about the quality as well as past performance of your organization	
	1	
	2	
	3	
18 (a)	Specific experience of firm exactly similar to the work for which tenders are being invited 1. Hostel Building (100 students)- 10 marks. 2. Civil & Electrical Work of same value - 5 marks	10
(b) (i)	Details of any new Technology being adopted by the firm.	10
(ii)	The approach & methodology	5
(iii)	Proven record of successfully completed projects without time and cost over runs with the above approach and methodology.	10



(c)	Qualification & competence of key personnel, who will be involved/ engaged in the execution of the project.	10
		<u>100 Points</u>

The Tenderer should score atleast 75 points out of 100 in the technical proposal to be considered for financial evaluation.

- FINANCIAL EVALUATION

The financial bids of the bidders, who would be found **successful** by obtaining at least **75** marks in technical evaluation, shall be opened publicly in the presence of the representatives of the firms who choose to attend on the date and time decided by Building Committee of NLIU, Bhopal. The Successful bidder would be informed the date and the time through e-mail and/or telephonically etc.

For the purpose of evaluation 'COST' shall be inclusive of all taxes. The lowest bid will be given a financial score of 100 and other bids will be given financial scores that are inversely proportional to their prices.

(ENVELOP – C) – FINANCIAL BID



VERIFICATION STATEMENT

Applicants are to verify that the information contained in this completed Questionnaire, any annex thereto and all supporting and explanatory information is true, to their best knowledge and belief and that nothing material has been concealed.

By virtue of my signature below, I confirm to my best knowledge and belief that the information contained in this questionnaire and sections, annexed thereto and all supporting and explanatory information is truthful and exact.

Signed:
(Same signatory as on letter of application)

Witness:

Name

Address



I. NOTICE INVITING TENDER

- 1.1a) Online item rate tenders are invited by the Registrar on behalf of NATIONAL LAW INSTITUTE UNIVERSITY for the proposed Construction of PG Boys Hostel in its campus at Bhopal.
- b) Online tenders are required to be submitted in three parts as A, B and C due date and time as mentioned in the tender notice.
- c) These three separate covers i.e. A (as specified in NIT page no. 1) and B (as specified in NIT page no. 4) and C (Financial Bid as specified in NIT page no.7) due date and time and shall be submitted on or before 10/01/2023. The tender received after due date and time will not be considered.
- d) Tenders will be opened on 11/01/2023.
- e) Financial Bids shall be opened who qualify on the Technical Evaluation.
- 1.2 Tenders not properly complying with the conditions shall be rejected.
- 1.3 Tenderers should quote their rates both **in figures and in words**. The schedule of quantities must be fully priced and the total of each page along with carried over figures of the previous page shall be given in ink and signed by the tenderers. No blank space shall be left.
- 1.4 Online tenders will be received on or before 10/01/2023.
- 1.5 If the tender is made by or on behalf of a company incorporated under the Companies Act (of 1956), it shall be signed by their Managing Director or one of the Directors duly authorized on that behalf by the Company. If it is made by a partnership firm, it shall be signed with the co-partnership name by a member of the firm who shall sign his own name and give the name and address of each partner of the firm and attach a copy of Power of Attorney with the Tender authorizing him to sign on behalf of the other partners. A certified copy of the registered partnership deed shall also be submitted along with the tender.

1.6 ACCEPTANCE PERIOD

The tender shall remain valid for acceptance for a period of 90 days from the date of opening of tender which period is extendable by tenderer. If desired by the University.

1.7 SITE INSPECTION

Every tenderer is expected to inspect the site of the proposed work before quoting his rates. He must also go through all the drawings and documents. It will be construed that the contractor has inspected the site and satisfied himself, at his own cost, and the quoted rates shall hold good and will be binding in all conditions.

1.8 SCHEDULE OF QUANTITIES

A schedule of approximate quantities for various items accompanies this tender. It shall be definitely understood that the Employer / Consultant do not accept any responsibility for the correctness or completeness of the schedule, in respect of items and quantities and this schedule is liable to alterations by omissions, deductions or additions at the discretion of the Employer / Consultant without affecting the terms of the contract. The consultant with the approval of Employer reserves the right to completely delete any item from the scope of the work without affecting the terms of the contract for which tenderer would not be entitled for any compensation at any stage of the work.



1.9 CONTRACTORS' RATES

The contractors' rates must include the cost of transportation of material to the site, all taxes such as Sales Tax, Excise and Octroi and royalties etc. and the fixing and placing in position for which the items of work is intended to be operated.

The Employer will be under no obligation to provide Form 31 or Form 'C' to the Contractor.

1.10 INTERPRETATION

In interpreting the specifications, the following order of decreasing importance shall be followed:

- (a) Drawings.
- (b) Schedule of quantities
- (c) General, Particular & Special Specifications

Matters not covered by the specifications given in the contract as a whole, shall be covered by the relevant Indian Standard Codes. If such codes for a particular subject have not been framed, the decision of the Architect with the approval of the Employer shall be final and binding.

1.11 No conditional tender shall be accepted.

1.12 ALTERATIONS IN N.I.T.

No alterations shall be made by the tenderer in the Notice Inviting Tenders. Instructions to the contractors, Contract Form, Conditions of the Contract, Drawings and Specifications, and if any such alterations are made or any special condition attached, the tender shall liable to be rejected.

1.13 ACCEPTANCE OF TENDER

The acceptance of the tender will rest with the Employer, who does not bind himself to accept the lower tender and reserves to himself the authority to reject any or all of the tenders received and split the work conveying more than one tender, without assigning any reasons.

The Employer reserves the right of accepting the whole or any part of the tenders received and the tenderers shall be bound to perform the same at their quoted rates.

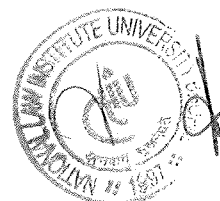
The tenders received would be scrutinized and approved within a period of one month and the successful contractor would be intimated immediately to enable him to execute all the required documents. The execution of all the documents would be required to be completed maximum within a period of one week from the date to the tender conveying acceptance of the tender.

1.14 SITE SUPERVISION

The work shall be carried out under the direction and supervision of the Employer/Architect at site. On accepting the tender, the contractor shall intimate the name of his accredited representative who would be supervising the construction and would be responsible for taking instructions for carrying out the work on day to day basis.

The Employer/Architect at site shall have access to the workshops of the successful tenderers so as to ensure themselves of the quality of material and workmanship.

1.15 QUALITY



The Employer/Architect decision with regard to the quality of the material and workmanship will be final and binding, any material rejected by the Employer shall be immediately removed by the contractor from the site.

1.16 COMMENCEMENT OF WORK/PERIOD OF COMPLETION

The Contractor shall commence work on site within 07 days from the date of issue of the work order. This date shall be considered as the date of Commencement of the said work.

Time is the essence of the contract. All works as per this tender shall be completed within **09 (nine) Calendar months** from the date of commencement in a manner as decided by the Employer. Completion period includes Monsoon period as well as festival period. Time Schedule of construction would be immediately submitted by the tenderer which will be strictly observed by them.

1.17 INCOME TAX

Every tenderer shall furnish along with the tender the latest Income Tax Clearance Certificate valid on date without which his tender will be rejected. Employer will deduct amount towards Tax Deduction at sources (TDS) as per the latest Income Tax Act and Rules, from all payments made to the Contractor.

1.18 DEFECTS LIABILITY PERIOD

Any defects developed within 'Defect Liability Period' of 12 months from the actual date of completion, will have to be rectified by the contractor. In case of failure to do so, the Employer with the concurrence of the Architect shall get the rectification work done by other agency at the risk and cost of the contractor. The rectification of such defects shall be taken by the Contractor immediately on receipt of written notice from the Employer/Architect and such defects may extend "liability period".

1.19 PART OCCUPATION

If Employers want to occupy areas in part, the contractor shall have to complete the work of the areas in conjunction with the Employer and hand over the same to the Employer without affecting any of the Clauses of the contract agreement.

1.20 CONTRACT SIGNING

After acceptance of the tender, the tenderer shall sign the necessary contract papers within 10 days of the intimation, expenses for the agreement including cost of stamp papers etc. shall be borne by the contractor. In case of delay the 'Earnest Money' shall be forfeited and the tender cancelled or the contract enforced as per terms of the tender and the tenderer shall thus be bound even though the formal agreement has not been executed and signed by the tenderer.

1.21 EMD

- (a) EMD of **Rs. 32,00,000/- (Rupees Thirty Two Lacs only)** to be submitted at the time of submission of Tender. The tender received without EMD or EMD is not in prescribed form as specified in NIT shall be rejected. The EMD shall be refunded to the unsuccessful tenderer within one month of the opening of the tender. The EMD of successful tenderer shall be adjoined against Retention Money.
- (b) **Retention Money:** Retention money @ 5% shall be deducted from each running account payment.
- (c) **Performance Guarantee (Security Deposit):** Within 15 days of the award of the contract, the contractor shall deposit with the Employer a sum equivalent to 5% of contract value as **Performance Guarantee (Security Deposit)** in the form of a Bank Guarantee, from any **NATIONALISED BANK**



valid for the duration of the contract period until the end of date of completion of defects liability period. The Performance Guarantee from the bidder who has quoted the value of work less from the estimated value of work by a margin of **10% or more** shall have to deposit the sum equivalent to 10% of contract value as **PERFORMANCE GUARANTEE**.

- (d) The Retention Money/EMD/Performance guarantee amount shall not bear any interest.

1.22 REFUND OF DEPOSIT

- (a) Retention money shall be refunded after the defects liability period of 12 months from the actual date of completion.

Any money payable by the contractor under the terms of the contract may be deducted from the above deposits.

1.23 SUPPLY OF MATERIALS

Employer does not bind himself to supply any materials whatsoever required for the work. The quality/make of material to be purchased by the contractor shall have the approval of the Employer before incorporation within the works. For the purpose of compensation, actually recorded quantities shall be taken into consideration.

Rejected material shall be removed at once from the site of work at contractor's cost.

1.24 INSURANCE:

The successful contractor shall take out Contractor's All Risk (CAR) insurance policy, in the name of the contractor beneficiary -----, and the original policy shall be deposited with the Employer. The policy shall cover Clauses as under.

- (i) The contractor shall at all times indemnify and keep indemnified the Employer and its officers, servants, agents and any other guest or person moving in the Campus Area premises from and against all third party claims whatsoever (including but not limited to property loss and damage, personal accident, injury or death of/to property or person of any Sub-contractor and/or the servants or agents of the contractor, any Sub-contractor(s) and/or the Employer) and the contractor shall at his own cost and initiative at all times up to the successful conclusion of the defect liability period specified in Clause 1.16 hereof take out and maintain all insurable liabilities under this Clause, including but not limited to third party insurance and liabilities under this clause, including but not limited to third party insurance and liabilities under the Motor Vehicles Act, Workmen's Compensation Act, Fatal Accidents Act, Personal Injuries Insurance Act, Emergency Risk Insurance Act and/or other Industrial Legislation from time to time in force in India with insurance company(ies) approved by the Employer, and such policy(ies) shall be of not lesser limit than the limits hereunder specified with reference to the matters hereunder specified, namely.
- (a) Workmen's Compensation Insurance - to the limit to which compensation may be payable under the laws of the Republic of India.
- (b) Third Party Insurance - body injury and property damage to the limit of not less than **Rs.1,00,000/- (Rupees One Lac only)** in each accident at each job site and to a limit of not less than **Rs.5,00,000/- (Rupees Five Lacs only)** in case of serious injury and not less than **Rs. 10,00,000.00 (Rupees Ten lakhs only)** in case of death, for all accidents at all job sites



Provided that the limits specified above shall operate only as a specification of minimum limits for insurance purposes, but shall not in any way limit the contractor's liability in terms of this Clause to the limit(s) specified.

- (ii) Should the Contractor fail to take out and/or keep afoot insurance as provided for in the foregoing Sub-Clause, the Employer shall be entitled (but without obligation to do so) to take out and/or keep afoot such insurance at the cost and expense of the Contractor, and without prejudice to any other rights or remedies of the Employer in this behalf, to deduct the sum(s) incurred, from the dues of the Contractor.
- (iii) Period of Policies: All insurance covers mentioned above shall be kept alive during the completion period of contract and defects liability period.

1.25 PAYMENTS

Only One running bill shall be prepared and produced by the contractor every 45 days, based on the measurement by the Contractor, which would be verified by the Employers Engineer and the Architect / Consultant. Contractor shall submit 3 copies of the bill and 3 copies of the measurement sheets along with cement and steel for reinforcement in RCC, consumption statement indicating quantity theoretically required and quantity consumed. Variation of $\pm 2\%$ on the theoretical quantities would be allowed. Coefficient for such purposes would be adopted from the latest C.P.W.D. DSR. The bill to be submitted by the contractors for the work less than **Rs. 1.25 Crore** shall not be accepted by the Client to ensure the timely completion of the work. The Employer will make the payment of the bill within 20 days from the date of receipt of the bill after due verification.

1.26 LIQUIDATED DAMAGES

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the Contractor and shall be deemed to be the essence of the contract on the part of the contract and shall be reckoned from seventh day after the date on which the order to commence the work issue to the contractor. The work shall throughout the stipulated period of the contract be proceeded with all due diligence and the contractors shall pay as compensation calculated at the rates stipulated below or such smaller amount as the Employer whose decision in writing shall be final may decide on the amount of tendered value of the work for every complete day/week (as applicable) that the work remains uncommenced or unfinished after the proper dates.

This will also apply to items or group of items for which a separate period of compensation has been specified.

- i) Completion period (as originally stipulated) not exceeding 3 month @ 1% per day.
- ii) Completion period (as originally stipulate) exceeding 3 month @ 1% per week.

And further to ensure good progress during the execution of work, the Contractor shall be bound in all cases in which the times allowed for any work exceeds, one month (Save for special jobs) to complete one eight of the whole of the work before one fourth of the whole time allowed under the contract has elapsed and three eight of the work before one half of such time has elapsed and three fourth of the work, before three fourth of such time has elapsed. However, for special jobs if a time schedule has been submitted by the Contractor and same has been accepted by the Employer the Contractor shall comply with the said time schedule.

In the event of contract failing to comply with this condition, he shall be liable to pay compensation as stated above in the clause.

Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10% of the group of items of work for which a separate period of completion is originally given.



The amount of compensation may be adjusted or set-off against any sum payable to the contractor under this or any other contract with the University.

1.27 WATER AND ELECTRICITY

Water and Electricity shall be arranged by the Contractor at his own expense. If arranged by the Employer the same shall be supplied at one point only, and contractor shall make his own arrangements for distribution lines required for the work. Recovery for the same shall be made at 1% (½% for water and ½% for electricity) of the bills. In case of failure of power, the contractor shall have alternate arrangement (DG Set etc.) to keep the work in progress at his own cost and Employer will not take any responsibility for the same.

1.28 ESCALATION

No escalation on labour, material or any other statutory levy/tax will be paid to the contractor during the duration of the project. No alteration in this clause will be acceptable.

1.29 QUALITY OF CONSTRUCTION & BRAND OF MATERIAL

The Employer would be free to get the quality of material/ construction inspected by his own expert(s) from time to time and adverse reports, if any, will be placed before the expert committee appointed by the Employer. In case the samples of the material are proved sub-standard as per specifications, the penalty whatsoever is proposed to be imposed by the expert committee should be acceptable to the contractor.

All 'Brand/Quality' material will be used by the Contractor and it will be specified by the Contractor in his tender.

In case specified Branded material is not available in market temporarily any time during the construction, alternatively equally good quality of branded material proposed as per relevant to be BIS Code to be used will be got approved by the Employer/Architect before the same is used.

1.30 RECEIPT OF TENDERS

Tenders along with all the copies, drawings etc. in sealed envelope will be received as stated on the cover of this Volume.

1.31 E.S.I. (EMPLOYEES STATE INSURANCE) & PROVIDENT FUND

ESI charges & Provident fund charges, if applicable, shall be borne by the Contractor.

1.32 WORK TAX AND LABOUR CESS ETC.

Payment of works contract tax/ labour cess etc., to the relevant Authority shall be the responsibility of the Contractor. If the Contractor fails, the amount at the approved rate will be deducted by the Employer from the payments to be made to the Contractor from time to time and will be duly deposited by the Employer with the concerned department.

1.33 GST

The amount of GST shall not be reimbursed to the Contractor by the Client and it would be assumed that as per instructions given in the tender the contractors must have quoted their rates inclusive of GST.

1.34 SUPPLIER / LABOUR PAYMENT



The Contractor shall pay to its Suppliers/ Labourers within reasonable time fixed with them. The Employer shall not be responsible during the period of Contract or after completion of Project for Contractors liabilities towards Suppliers/Labourers. In case, if Contractor fail to pay to the Suppliers/Labourers, the Employer reserve the right to pay the same said amount to the Suppliers/Labourers after due verification and recover the same from the amount due/payable to the Contractor.

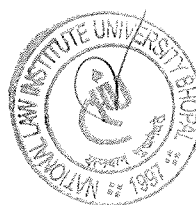
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APPENDIX

SUMMARY OF VARIOUS CLAUSES

1. Defects Liability period (1.18) : 12 months.
2. Period of final measurements and Valuation : 3 months.
3. Date of commencement (1.16) : 07 days from the date of issue of work order.
4. Period of completion (1.16) : 09 (Nine) calendar months as per Bar Chart.
5. Liquidated damages : As per Clause 1.26
6. Running Bill Payments (1.25) : As per Clause 1.25.
7. Earnest Money Deposit (1.21a) : **Rs. 32,00,000/- (Rupees Thirty Two Lacs only)**
8. Retention Money (1.21b) : 5% of the certified gross value from each R.A Bill.
9. Performance Bond (1.21c)
(Security Deposit) : as specified in NIT in clause no. 1.21(c)



II. TENDER FORM :

Dear Sir,

SUB : _____

With reference to the tender invited by you for the Construction of the PG Boys Hostel, I/we write this after having:

- a) examined the designs, drawings, details, specifications, schedule of quantities, instructions to tenderers, draft agreement and the conditions of contract annexed thereto (here-in-after called the Contract Documents) relating to construction.
- b) visited and examined the site of the proposed work and,
- c) acquired the requisite information as affection the tender.

I/We undersigned, hereby offer to construct the proposed work in strict accordance with the contract documents for the consideration to be calculated in terms of the priced schedule of quantities.

I/We undertake to complete the whole of the works as per the attached schedule from the date of issue of intimation by you that our tender has been accepted and upon receiving possession of the site. I/We further undertake that on failure subject to the conditions of the contract relating to extension of time, I/We shall pay the agreed 'Liquidated Damages' to the Employer the sum named in the Appendix to the conditions of contract, as 'Liquidated Damages' for the period during which the work shall remain incomplete.

I/We hereby deposit with you as 'Earnest Money' of Rs.-----/- (**Rupees** ---- Only) carrying no interest and I/We do hereby agree that this sum shall be forfeited in the event of the Employer accepting my/our tender and I/We fail to take up the contract when called upon to do so.

I/We further agree to the deposit of 5% of contract value as **PERFORMANCE GUARANTEE** (Security Deposit) Within 15 days of the award of the contract in the form of a Bank Guarantee form any **NATIONALISED BANK** valid for the duration of the contract period until the end of date of completion of defects liability period.

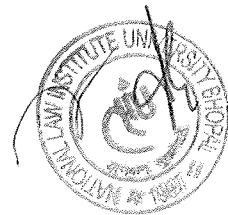
I/We further agree to the deduction of 5% from the 'Interim Payment' towards the 'Retention Money' which will be returned as per the relevant Clauses in the agreement.

Yours faithfully,

Name of the partners of the firm

OR

Name of the persons having Power-of-
Attorney to sign the contract.



III. DRAFT AGREEMENT :

ARTICLES OF AGREEMENT

Made the _____ day of _____ 2022
Between _____

(Hereinafter called 'The Employer') on the one part and

M/s _____

(Hereinafter called 'the Contractor' on the other part

WHEREAS the Employer is desirous for the Construction of the PG Boys Hostel.

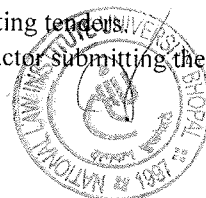
(Hereinafter called 'the Work).

And has caused Drawings and Schedule of Quantities showing and describing the works to be done to be prepared by or under the direction of **M/s VASTUKALP PROJECTS Pvt. Ltd.**

AND WHEREAS the Contractor has supplied the Employer with a fully priced copy of the said Schedule of Quantities (which copy is hereinafter referred to as 'The Contract Bills') AND WHEREAS the said Drawings (hereinafter referred to as the 'the Contract Drawings') and the contract bills have been signed by or on of the Parties hereto: AND WHEREAS the contractor has deposited the sum of Rs. _____ (Rupees _____) with the Employer for the due performance of this Agreement.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them under section 'Definitions in the General Conditions of Tender Document issued by the Employer and accepted by the Contractor while submitting his bid dated _____.
- 2.a) The following documents included in the tender bid shall be deemed to form and be read and construed as part of this Agreement along with amendments negotiated and confirmed in various subsequent letters exchanged as mentioned herein after:
 - i) Notice Inviting Tender
 - ii) Tender Form
 - iii) Contract agreement and General Conditions of Contract
 - iv) Special Conditions
 - v) Specifications
 - vi) Schedule of Quantities and Rates
 - vii) Tender drawings
 - viii) Construction Programme
- b) The following documents shall also be deemed to form and to be read and construed as part of this Agreement and shall be complimentary to one another.
 - i) Letter No. _____ Dated _____ inviting tenders
 - ii) Letter No. _____ Dated _____ of Contractor submitting the tender bid.



Handwritten signature

iii) _____
iv) Work Order No. _____ Dated _____ .

NOW IT IS HEREBY AGREED AS FOLLOWS:

1. For the consideration hereinafter mentioned, the contractor will upon and subject to the conditions annexed carry out and complete the work shown upon the contract drawings and described by or referred to in the Contract's Bills and in the said conditions.
2. The Employer will pay the contractor the sum of Rs. _____ (Rupees _____) (hereinafter referred to as the contract sum) or such other sum as shall become payable hereunder at the times and in the manner specified in the said conditions.
3. The terms "The Architect" the said conditions shall mean the said **M/s VASTUKALP PROJECTS Pvt. Ltd., Shop No. 39, Gali No. 1, Shalapur Khara, Bijwasan South West Delhi-110061** or in the event of its dissolution or ceasing to be the Architect for the purpose of this contract, such other person as the Employer shall nominate for that purpose provided always that no person subsequently appointed be the Architect under this contract shall be entitled to disregard or overrule any certificate or opinion or decision or approval or instruction duly given or expressed by the Architect for the time being and approved by the Employer.
4. The said conditions and appendix thereto shall be read and construed as forming part of this Agreement, and the parties hereto shall respectively abide by, submit themselves to the conditions and perform the agreements on their parts respectively in such conditions contained.

As witness our hands this _____ day of _____ 2022

Signed by the said _____ Employer
in the presence of _____

Witness:

Name _____ :

Address :

Signed by the said _____ Contractor
in the presence of _____

Witness

Name _____ :

Address :



IV. DEFINITIONS AND INTERPRETATIONS

1.0 DEFINITIONS

The following terms shall have the meaning hereby assigned to them except where the context otherwise requires:

- a) Employer means **NATIONAL LAW INSTITUTE UNIVERSITY**, or his/her Authorized Representative.
- b) Architect, shall be the person for the time being or from time to time duly appointed by the Employer to act as 'Architect' for the purpose of the contract. In some part of the document, the word **Architect** shall also mean the said "Architect".
- c) Contractor shall mean the successful tenderers to whom the contract has been awarded.
- d) Contract, shall mean and include the following:
 - i) Notice Inviting Tender
 - ii) Tender Form
 - iii) General Conditions of Contract
 - iv) Specifications
 - v) Schedule of Quantities
 - vi) Drawings
- e) Site, shall mean the actual place of work in, over or under which work is to be done, allotted by the Employer for materials or labour or both.
- f) Work, of the contractor shall mean and include materials or labour or both.
- g) Contract Price, shall mean the sums referred to in the formal agreement, if any or the work order.

2.0 ASSIGNMENT AND SUB-LETTING

2.1 Assignment

The contractor shall not assign the contract or any part thereof or any benefit or therein or there under.

2.2 Sub-letting

The Contractor shall not sub-let the whole of the contract. The contractor shall not sub-let any part of the works, if given, shall not relieve the contractor from any liability or obligation under the contract and the contractor from any shall responsible for the acts, defaults and neglects of the sub-contractor, his agents, employees or workmen as fully as if they were the acts defaults or neglects of the contractor or his agents, servants, or workmen.



3.0 DRAWINGS

3.1 ISSUE OF DRAWINGS

Drawings approved for construction will be issued to the contractor progressively during the contract period and the contractor shall arrange for the execution of the works and the procurement of materials accordingly. The contractor shall give adequate notice in writing to the Architect or his Representative of any further drawings or specification that may be required for the execution of the works or otherwise under the contract.

3.2 COPIES OF DRAWINGS TO BE KEPT AT SITE

One copy of the drawings furnished to the contractor as aforesaid shall be kept at the site and the same shall at all reasonable times be available for inspection and use by the Architect in writing. The contractor may request for additional copies on payment of Rs.50/- per drawing.

3.3 ISSUE OF FURTHER DRAWINGS AND INSTRUCTIONS

Employer/Architect shall have full power and authority to supply to the contractor from time to time through his representative, during the progress of the works such further drawings and instructions as shall be necessary for the purpose of proper and adequate execution and maintenance of the works and the contractor shall carry out and be bound by the same.

3.4 OWNERSHIP OF DRAWINGS

All drawings supplied to the contractor are deemed to be the property of the Employer/Architect. The contractor agrees both on behalf of himself and his employees, whether during or after completion of the contract not to divulge or use, except for the purpose of this contract, any information contained in the drawings.

3.5 EXECUTION AS PER DRAWINGS

The contractor must not vary or deviate from the drawings in any respect while executing the work or executing any extra works of any kind whatsoever unless advised by the Employer/Architect.

3.6 PLANS AND DRAWINGS TO BE SUBMITTED BY THE CONTRACTOR

The contractor shall submit the following information in triplicate to Architect for approval within the time stipulated against each item below:

- a) A general tentative layout plan of construction plant and equipment for the execution of work within time period stipulated in schedule.
- b) Drawings or prints showing the location of major plants and other facilities which he proposes to put up at the site, including any changes in the general layout, at least 7 days prior to the commencement of the respective work.
- c) Layout and details of temporary works that the contractor wants to carry out to fulfil his obligation under the contract.

Within 7 days the Architect will give their approval/comments sufficient to proceed with the work or objections/instructions to the contractor based on which the drawings shall be revised and re-submitted for approval by the Architect.



All these plans and drawings submitted by the contractor and approved by the Architect shall become part of the contract.

4.0 GENERAL OBLIGATIONS

4.1 INSPECTION OF SITE ETC. BEFORE SUBMISSION OF TENDER

The contractor shall inspect and examine the site and its surroundings, and shall satisfy himself before submitting his tender, as to the nature of the ground, form and nature of the site, the quantities and nature of work and materials required for the completion of the works, the means of access to the site, the local labour conditions, the accommodation he may require and in general shall obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his tender. Contractor would make all arrangements for access to the site for transportation of building material up to the required place. University will not take any responsibility in this regard.

4.2 SUFFICIENCY OF TENDER

The contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices stated in the priced Schedule of quantities and the Schedule of rates and prices, if any. The tender rates and prices shall cover all his obligations under the contract and all matters and things necessary, or the proper completion and maintenance of the works.

4.3 CLARIFICATION BEFORE SUBMITTING TENDERS

Should the contractor notice any discrepancy or error in the statement made, or quantities or units shown against items, he shall immediately bring to the notice of the authorities and obtain the clarification before submitting the tender. The tender shall be based on such clarifications received and shall be recorded as such in the covering letter to the tender, failing which the Employer shall have the right to ask the contractor to execute the work according to the statement made or quantities or units shown in the tender, without any compensation.

4.4 RATES QUOTED FOR FINISHED WORK

The rates quoted in the tender by the contractor must be for the finished work as per the drawings and specifications.

4.5 LOCATION OF WORK

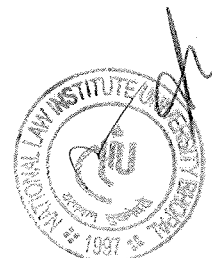
Unless specifically mentioned in the item, the work described therein may be at any location or elevation.

4.6 The tender shall remain open for acceptance for a period of 90 days from the date of opening of the tender.

4.7 COMMENCEMENT OF WORK

The contractor shall commence the work at the site, immediately as being advised by the Employer of the acceptance of the tender and shall proceed with the same with due expedition. It is again mentioned that time is the essence of a contract, which has to be adhered to strictly.

4.8 PROGRAMME OF WORK



Soon after the award of contract, the Contractor shall submit to the Employer for his approval a programme to match with the planned completion of the whole job showing the order of procedure and method in which he proposes to carry out the works and shall whenever required by the Employer representative furnish further detailed programme and particulars in writing of the contractor's arrangements for carrying out the works and of the construction plant and temporary works which the contractor intends to supply, use or construct as the case may be. The submission to and approval, if any, by the Architect or his Representative of such programs or particulars shall not relieve the contractor of any of his duties or responsibilities under the contract.

4.9 **CONTRACTORS' EMPLOYEES (FOR BUILDING WORKS)**

The contractor shall provide and employ at site in connection with the execution and maintenance works:

FOR BUILDING WORKS

The contractor shall employ the following technical staff during the execution of this work.

One Civil Graduate Engineer with Minimum 10 years of practical experience.

Three qualified Diploma Holder (Overseer) in Civil Engineering. & having experience of not less than 10 years for supervision and billing purpose.

The technical staff shall be available at the site whenever required by Employer to take instructions.

In case the contractor fails to employ the technical staff as aforesaid, he shall be liable to pay a reasonable amount not exceeding Rs.75,000/- for each month of default in the case of the Graduate Engineer and Rs.40,000/- for each month of default in the case of qualified Diploma Holder (Overseer)

The decision of the Employer as to period for which the required technical staff is not employed by the Contractor and as to the reasonableness of the amount to be deducted on this account shall be final and binding on the contractor's as to the amount and the contractor's liability to pay the said amount.

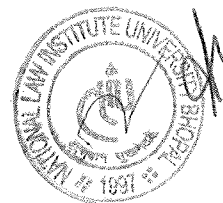
4.10 **REMOVAL OF WORKMEN**

The Employer/Architect shall be at liberty to and require the contractor to remove forthwith from the work any person employed by the Contractor in or about the execution or maintenance of the works who in the opinion of the Employer misconduct himself or is incompetent or negligent in the proper performance of his duties or whose employment is otherwise considered by the Employer to be undesirable and such person shall not be again employed upon the work without the written permission of the Architect. Any person so removed from the works shall be replaced by the contractor without delay by a competent substitute approved by the Architect. Misconduct of Employee of the contractor /poor workmanship shall be a valid reason for suspension of the contract by **NATIONAL LAW INSTITUTE UNIVERSITY** and in that case, no compensation of whatsoever nature shall be paid to the contractor.

4.11 **COMMUNICATIONS TO BE IN WRITING**

All references, communications, correspondences made by the Employer, the Architect, and their representative or the contractor concerning the works shall be in writing and no reference, communication, or complaint which is not in writing, shall be recognized.

4.12 **OCCUPATION AND USE OF LAND**



No land, or building belonging to or in the possession of the Employer shall be occupied by the contractor. The contractor shall not use or allow to be used, the site for any purpose other than that of executing the works.

4.13 CONSTRUCTION OF SITE SHED

Any site shed proposed to be temporarily constructed by the contractor for his office work, storage of materials etc. shall conform to the standard sketch, or to the plan approved by the Employer. Permission for the construction of such shed shall be obtained in writing.

4.14 MATERIALS, TOOLS AND PLANT

All materials required for the execution of the works other than those mentioned in the Notice Inviting Tender shall be supplied by the contractor. Materials so supplied shall have the approval of the Employer before using on the works. All the rejected materials shall be removed at once from the site of work at the contractors' own cost. The contractor shall supply all tools, tackles, and equipment like compressors, concrete mixers, vibrators, pumps, welding or pneumatic tools, tar boilers etc. required for the execution of the works.

4.15 TOLLAGES ETC.

The contractor shall pay all tollages and other royalties, rent and other payments or compensations, if any, for getting stone, gravel, sand, clay and all other materials required for the works. Contractors would settle all such payments with the local authorities. In case any demand is raised for such non-payment by any of the state authorities it would be recovered from their dues and paid to the authorities concerned.

4.16 SETTING OUT

The contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position, levels, dimensions, and alignment of all parts of the works and for the provision of all necessary instruments, appliances, and labour in connection therewith. If any time during the progress of the works any error shall appear or arise in the position, level, dimensions or alignment of any part of the works, the contractor on being required so to do by the Employer shall at his own cost rectify such error to the satisfaction of the Employer. The checking of any setting out or of any line or level by the Architect or his representative shall not in any way relieve the contractor of his responsibility for the correctness thereof. The contractor shall provide all necessary instruments, appliances, and labour required by the Architect or his representative for checking, if any, of the setting out. The contractor shall carefully protect and preserve all benchmarks, site levels, pegs and other things used in setting out the works. The rates quoted for the work shall also include the cost of all reference and level pillars and their dismantling when no longer required.

4.17 DAMAGE TO PERSONS AND PROPERTY

The contractor shall indemnify and keep indemnified the Employer against all losses and claims for injuries or damages to any person or property whatsoever which may arise out of or in consequence of the construction and maintenance of works and against all claims, demands, proceedings, damages, costs, charges, expenses, whatsoever in respect thereof in relation thereto.

4.18 CO-OPERATION WITH OTHER AGENCIES

The contractor shall co-operate with the work of other agencies or contractors that may be employed or engaged by the Employer and as far as it relates to the contractors' work. The sequence of work shall be so arranged that the work of other agencies is also in progress simultaneously.



4.19 BARRICADING AROUND EXCAVATED TRENCHES ETC.

The contractor shall at his own cost provide around the excavation, temporary barricading with bullies and bamboo's with warning signals during day and night and shall maintain it so long the trenches are not filled up. Similar barricades shall also be provided at all dismantling work, erection of structural, sheeting work etc. No extra claim shall be entertained for providing, maintaining and removing such barricades.

4.20 PROTECTION OF UNDERGROUND SERVICES

The contractor must take all precautionary measures to protect the underground and other services lines, viz. cables, water and sewer lines etc. and observe any specific instructions which may be given in this regard by the Employer.

4.21 DE-WATERING TRENCHES AND PITS

The tendered rates shall always be deemed to have taken into account the cost of removal of silt and materials that may slip in the trench and pit and de-watering the trenches or pits of water accumulated or collected through seepage or subsoil water or rainwater. The contractor shall in no case be entitled to claim any extra amount for the above work. The contractor shall remain prepared with necessary pumps and equipment for de-watering the trenches or pits so as to avoid unnecessary delay and possible damage to the property etc.

4.22 WORK IN OR AROUND OPERATING PLANT OR OFFICES ETC.

Where the work is being carried out in or around an operating plant where the plant must run uninterrupted, the contractor shall work only at specified places and times as mutually arranged between the contractor and the Employer, similar arrangement must be made while executing works inside the offices, buildings etc. without causing disturbance to the office work. For this the work may be required to be done during off-hours and Sundays. No extra will be allowed beyond the rates quoted for doing work in the manner described above.

4.23 WORK IN SHIFTS AND OFF-DAYS

The contractor shall work in one or more shifts as also on Sundays and off days to complete the work in time if so, required by the Employer for which the Employer shall not be liable to pay any extra.

4.24 SITE ORDER BOOK

A site orders book must be maintained and always be available at site to record the instructions by the Employer or their representative. The contractor must see that the instructions noted therein are properly carried out and compliance verified by the Employer or their representative.

4.25 DELAYS IN OBTAINING MATERIALS SUPPLIED BY THE EMPLOYER

If the Employer has undertaken to supply any material specified in the special conditions at rates and conditions cited therein, the contractor shall keep himself in touch with day to day position regarding the supply of materials from the Employer and so adjust the progress of the works that labour may not remain idle nor there be any other claim due to or arising from delay in obtaining the materials.

4.26 RECORD OF MATERIALS SUPPLIED BY THE EMPLOYER



The contractor shall maintain an account of different materials obtained from the Employer for executing the works under the contract. The Employer shall have the power to check the position of materials at all times and verify stocks as and when desired.

4.27 **SAFE STORAGE OF MATERIALS**

The contractor shall be responsible for the safe storage of materials supplied by the Employer for the execution of the works. Surplus materials or materials lost or damaged or unaccounted for or made unserviceable by the contractor shall be charged at the prevailing market price.

4.28 **TRANSPORT OF MATERIALS**

Unless otherwise specified, all the materials supplied by the Employer shall be transported by the contractor from the employers' store/yard, to the site of work at no extra cost.

4.29 **SITE TO BE KEPT CLEAR**

The surplus spoil and dismantled debris shall be removed to a place as directed by the Employer and stacked, leveled and dressed as directed.

4.30 **CONFLICT IN MEANING BETWEEN SCHEDULE OF RATES AND SPECIFICATIONS**

In case of any inconsistency between the General conditions of the contract and the special conditions, the special conditions of the contract shall have precedence over the General Conditions.

5.0 **LABOUR AND LABOUR RULES**

The contractor shall obtain a valid license under the Contract Labour (R & An Act 1970) and the Contract Labour (Regulation and Abolition) Central Rules, 1971 before the commencement of the work, and continue to have a valid license until the completion of the work.

Any failure to fulfill this requirement shall attract the penal provisions of this contract arising out of the resultant non-execution of the work.

(A) No labourer below the age of fifteen years shall be employed on the work.

(B) **PAYMENT OF WAGES**

- a) The contractor shall pay to labour employed by him either directly or through sub-contractors wages not less than fair wages as defined on the C.P.W.D. Contract Labour Regulations or as per the provisions of the contract Labour (Regulation and Abolition) Act 1970 and the Contract (Regulation and Abolition) Central Rules 1971, wherever applicable.
- b) The contractor shall not withstand the provisions of any contract to the contrary, causes to be paid fair wage to labour indirectly engaged on the work, including any labour engaged by his sub-contractor in connection with the said work as if the labour has directly employed by him.
- c) In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this agreement the contractors' shall comply with or cause to be complied with the C.P.W.D Contractor' Labour regulation made by the Government from time to time in regard to payment of wages, wage period, deductions from wages recovery of wages not paid and deductions un-authorized made, maintenance of wage books or wage slips, publication of scale of wages and



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other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract labour (Regulation and Abolition) Act 1970 and the Contract labour (Regulation and Abolition) Central Rules 1971, wherever applicable.

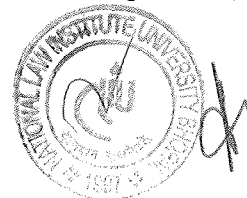
- d) The Employer concerned shall have the right to deduct from the moneys due to the contractor any sum required estimated to be required for making good the loss suffered by a worker or workers by reason of non fulfillment of the conditions of the contract for the benefit of the worker, non-payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non observance of the Regulation.
- e) The Contractor shall comply with provisions of the payment of Wages Act 1936, Minimum Wages Act, 1948 Employees Liability Act 1938, Workmen's Compensation Act 1923, Industrial Disputes Act 1947, Maternity Benefits Act 1961 and the Contract labour (Regulation and Abolition) Act 1970 or the modifications thereof or any other laws relating thereof and the rules made there under from time to time.
- f) The Contractor shall indemnify University against payments to be made under and for the observance of the Laws aforesaid and Central Public work Department contractor's labour regulations without prejudice to his right to claim indemnity from his sub-contractors.
- g) The regulations aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.
- h) Whatever is the minimum wage for the time being or if the wage payable is higher than such wage, shall be paid by the Contractor to the workmen directly without the intervention of Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

The Contractor shall ensure that no amount by way of commission or otherwise is deducted/ recovered by the Jamadar from the workmen.

- (C) In respect of all labour directly or indirectly employed in the work for the performance of the Contractor's part of this agreement the Contractor shall at his own expense arrange for the safety provisions as per the safety Code framed from time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangements and provide necessary facilities as aforesaid he shall be liable to pay a penalty Rs.50 for each default and in addition the Employer shall be at liberty to make arrangements and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.
- (D) The Contractor shall submit, by the 4th and 19th of every month, to the Employer a true statement showing, in respect of the second half of the preceding month and the first half to the current month respectively.

- [1] The number of labourers employed by him on the work.
- [2] Their working hours.
- [3] The wages paid to them.
- [4] The accident that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and
- [5] The number of female workers who have been allowed Maternity Benefit according to F and the amount paid to them.

Failing which the contractor shall be liable to University a sum not exceeding **Rs.1500** for each default or materially incorrect statement. The decision of the Employer shall be final in deducting from any bill due to the contact amount levied as fine.



(E) In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with all the rules framed by the University from time to time for the protection of health and sanitary arrangement for workers employed by the NATIONAL LAW INSTITUTE UNIVERSITY and its contractors.

(F) **LEAVE AND PAY DURING LEAVE SHALL BE REGULATED AS FOLLOWS:**

1. LEAVE

- i) in case of delivery, maternity leave not exceeding 8 weeks, 4 weeks upto and including the day of delivery and 4 weeks following that day.
- ii) in the of miscarriage – up to 3 weeks from the date of miscarriage.

2. PAY

- i) in the case of delivery leave pay during maternity leave will be at the rate of the women's average daily earning, calculated on the total wages earned on the days when full time work was done during a period of 3 months immediately preceding the date on which she gives notice that she expects to be confined or at the rate of Rupees on a day whichever is greater.
- ii) in the case of miscarriage-leave oat at the rate of average daily earning calculated on the total wage earned on the days when full time work is done during a period of 3 months immediately preceding the date of such miscarriage.

3. CONDITIONS FOR THE GRANT OF MATERNITY LEAVE

No maternity leave benefit shall be admissible to work unless she has been employed for a total period of not less than 6 months immediately preceding the date on which she proceeds on leave.

- 4. The contractor shall maintain a register of Maternity (Benefit) in the Prescribed form as shown below and the same shall be kept at the place of work.



**MINISTRY OF LABOUR
NOTIFICATION**

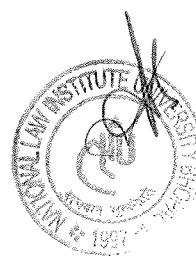
**CENTRAL PUBLIC WORKS DEPARTMENT
Fair wage Schedule of Rate prescribed vide clause 19b**

“SCHEDULE”

These labour wages have been revised by Govt. of India. The Contractors are required to refer latest revised minimum wages schedule before quoting their rates.

Category of work	All Inclusive minimum Rates of wages per day				
	Area A	Area B-1	Area B-2	Area C	Area D

(1)	(2)	(3)	(4)	(5)	(6)
1. Bajri Spreader. 2 Beldar. 3. Beater Women. 4. Bellow man. 5. Boatman. 6. Barryman. 7. Bucket man. 8. Carrier (stone). 9. Carrier (water). 10. Cart man. 11. Caretaker (bridge). 12. Chain man. 13. Cleaner (crane) truck (cinder for ash pit). 14. Chowkidar. 15. Concrete hand mixer. 16. Condenser attendant. 17. Coalman, 18. Daffadar, 19. Driver (bullock) Camel Donkey (Mule) 20. Flagman, 21. Flagman (ballast train). 22. Gateman. 23. Gangman, 24. Gangman (permanent way) 25. Grass Cutter, 26. Handle man. 27. Jamadar, 28. Jumper man. 29. Kamin. 30. Khalasi. 31. Khalasi I/II Bridge, Electrical Marine, Moplan, Shore, Store steam road roller, Survey. 32. Labour (garden). 33. Lampman. 34. Mali, 35. Majdoor (lorry/train). 36. Muchher, 37. Petrol man. 38. Peon, 39. Searcher 40. Signalman, 41. Hunter, 42. Slinger, 43. Striker, 44. Striker (Moplahgang), 45. Sweeper, 46. Tatti boy, 47. Tile turner, 48. Trolly man 49. Valve man, 50. Valve Controller. 51. Watch man 52. Water man, 53. White Washer, 54. Wooden man, Wooden woman. 55. Any other Categories by whatever name called which are of an unskilled nature					



SEMI SKILLED OR UNSKILLE SUPERVIOSOR

7.50

7.00

6.25

5.75

5.25

1. Assistant wire man. 2. Bearer. 3. Belchawala. 4. Bhisti. 5. Bhisti (With mushak), 6. Boat man (head) 7. Brakes man, 8. Breaker, 9. Breakers (rock rock-stone stone metal stone), 10. Caneweaver, 11. Chain man, 12. Charpoy stringer, 13. Checker, 14. Chowkidar (head). 15. Cook, 16. Cracker, 17. Crowbar man. 18. Daftary. 19. Dandee, 20. Doolymany, 21. Driller, 22. Driller (hole rock) 23. Driver (skill), 24. Excavator, 25. Farash, 26. Ferroman, 27. Fireman. 28. Fireman (brick kiln, steam road roller). 29. Fitter, (assistant semi skille), 30. Gate, keeper. 31. Gharami (thatch) 32. Glassman. 33. Greaser cum fireman. 35. Grinder. 36. Hacksaw man 37. Hammer man. 38. Helper to bar binder. 39. Helper to welder. 40. Helper (Loco crane or truck), 41. Helper (artisan), 42. Helper (structural) 45. Kasab. 46. Keymen. 47. Khalsi (head Survey). 48. Laboratory boy. 49. Labourer (rock-cutting). 50. Lascar. 51. Manjee, (boat man) 52. Masalchi. 53. Mali (head) 54. Mate, 55. (Blacksmith) road, carpenter, engineer driver and or feeder, fitter gang, Khalasi, mazdoor, mason permanent way pump driver turner) 56. Mate store 57. Mazdoor (heavy weight, Charge-men, mistry, head), 58. Muccadam, 59. Night guard. 60. Oil man, 61. P.M. Mate, 62. Quarry operator. 66. Runner (post-dak), 67. Storeman. 68. Stocker. 69. Stocker and boiler man. 70. Seacummy, 71. Thatcher, 72. Thoombaman (spade worker). 73. Tindal. 74. Trolley man (head motor), 75. Topaz 76. Topkar (big stone breaker), 77. Trolley Jamadar. 78. Winchman, 79. Any other categories by whatever name called which are of a semi skilled nature.

9.50

8.75

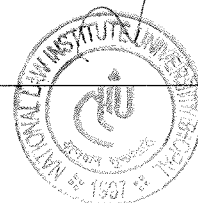
7.75

7.25

6.50

SKILLED

1. Assistant mistry, 2. Armature Winder grad II and III. 3. Barbinder, 4. Bhandari, 5. Blacksmith (selection grade. Grade II, III, class II & III head) 7. Boiler man, 8. Boiler man (Grade II & III), 9. Boiler foreman Grade II, 10. Borer, 11. Boreman, 12. Brick layer, 13. Bricklayer (selection Grade, Class II), 14. Blasterer, 15. Carpenter, 16. Carpenter (selection Grade II & III, class I & III, 17. Cabinet maker, 18. Caneman, 19. Caltak Cutter maker, 20. Chargeman class II, and class III, 21. Carpenter (ordinary), 22. Checker (junior), 23. Chickmaker, 24. Chickman, 25. Chipper, 26. Chipper cum grinder, 27. Concrete to mixture mixer, 28. Concrete mixer operator, 29. Cobbler, 30. Cook (head), 31. Core maker, 32. Driver, 33. Driver (Motor vehicle, Motor vehicle selection grade motor lorry, motor lorry grade II, lorry grade II, diesel/engine diesel engine grade II, mixer mechanical/road I.C. and cement mixer etc. road roller), 34. Driver (road roller grade II), 35. Driver (engine static stone crusher, tractor or bull dozer steam road roller, water pump mechanical assistant road roller, mechanical, steam tractor with bull dozer, mechanical transport engine static and road roller boiler attendant, engine), 36. Driver (loco or truck),



37. Distemperer, 38. Driller, well boring), 39. Electrician, 40. Electrician grade II, Class II and Class III, 41. Electrician (assistant), 42. Fabricator, 43. Fitter, 44. Fitter (selection grade, Grade II and III, Class III assistant pipe, pipe class II pipe line bending bars. For reinforcement-cum mechanic, mechanic and plumber, 45. Gharani (head), 46. Glazier, 47. Hole driller for blasting, 48. Joiner, 49. Joiner (cable grade II), 50. Lineman, 51. Lineman (grade II & III HT. & LT), 52. Mason, 53. Mason (selection grade II & III, class II & III, class B Mistry, stone, stone class II, Brick work, stone work, Brick layer tile flooring B.I.M. macadam, headstone cutter (ordinary), 54. Machinist, 55. Mechanic (class II, air-conditioning, air-conditioning grade II, diesel I, grade II, road roller grade II, road roller grade II, assistant, radio), 57. Mechanic (tube-well), 58. Mason (gharami), 59. Mistry [grade II, air-conditioning grade II permanent way survey santras, works, 61. Mistry [steel tube-well, telephone], 62. Mason class A, 63. Moulder, 64. Metro logical observer, 65. Meter reader, 66. Moulder [brick tile], 67. Navghani, 68. Operator [fitter], 69. Operator [batching plant, cinema projector, clamp/ shelf, compressor, cranes, derrick, diesel engine, dozer, dragline drill, dumber, excavator for lift, generator grader, jack hammer and payment breaker, leader, pump, pile, driving, scrapper, screening plant, shovel, tractor vibrator, weigh batcher, 70. Operator [pneumatic tools], 71. Operator [Stone crusher mechanical], 72. Painter, 73. Painter (selection grade, grade II and III, class II, assistant, letter, & polisher, polisher rough], 74. Painter spray class II, 75. Blasterer, 76. Plaster mason grade II], 77. Plumber, 78. Plumber [selection grade, class II assistant senior, junior mistry grade II], 79. Plumbing mistry, 80. Plumber-cum fitter, 81. Polisher, 82. Polisher {floor}, 83. Pump driver, 84. Pump driver [selection grade, grade II and III] 85. Pump (Engine driver), 86. P.E. driver, 87. Pumpman, 88. Pumpman [assistant], 89. Pumper, 90. Polisher [with spray] grade II, 91. Ratan man, 92. Railways guard, 93. Repairer [battery], 94. Rivet cutter [assistant], 95. Rivetter, 96. Rivetter [cutter], 97. Road inspector grade II, 98. Railway plate layer, 99. road binder, 100. Sawyer, 101. Sawyer [selection grade class II], 102. Serang, 103. Serangpile Driving, pontools with boiler, 104. Snapsman, 105. Sharper or slotter, 106. Sprayer (as phalt), 107. Station Master, 108. Surveyor (silt), 109. Shift In-charge, 110. Sprayman, 111. Sprayman (Road), 112. Stone Cutter, 113. Stone Cutter (selection grade, grade II, class II, 114. Stone chiser, 115. Stone chisler (class II), 116. Stone blasterer, 117. Sub Oversear (unqualified), 118. Surveyor, 119. Surveyor Assistant, 120. Tailor, 121. Tailor (upholstery), 122. Tar Sprayer, 123. Tarman, 124. Tiler (class II, Wall, Floor, Roof), 125. Tiler (selection grade), 126. Tin Smith, 127. Tin smith (selection grade, Grade II and III, and class II), 128. Tinker, 129. Tradesman, 130. Train Examiner, 131. Trailer, 132. Turner Miller, 133. Turner, Tyre vulcaniser, 135. upholsterer, 136. Uphosterr (grade II and III), 137. Wood cutter class II (140).work sircar, 138. Wireman (grade II and III), 139. Welder, 140. Welder Gas, 141. Welder



Class II, 142.Budge Work, 143.Welder (class II), 144.White washer (selection grade, class II), 145.Wire Workman, 146.White Washing and Colour Wasing man, 147.Work Assistant, 148.Any other categories by whatever name called which are of skilled nature.....

12.00 11.00 10.00 9.75 8.25

HIGHLY SKILLED

1.Armature winder, Grade I, 2.Blacksmith grade I and class I, 3.Boilman grade I, 4.Boiler foreman grade I, 5.Brick layer class I, 6.Cable jointer grade I, 7.Decorator, 8. Celotex cutter and Decorator, 9.Chargeman class I, Checker (senior), 11.Ddsigner, 12.Dressor, 13.Driver Lorry Grade I, Motor Lorry Grade I, Motor Vehicle Class I, 14.Electrician Grade I and Diesel Engine grade I, Road roller class I, 15.Fitter grade I, pump grade I, Panel class I, Pipe class I (head), 16.Foreman (Assistant), 17.Grinder (Tool) grade I, Linesman Grade I, 18.Mason skilled grade I class I, 19.Master rigger mechanic class I and class II), 20.Mechanic (head), 21.Mechanic (Diesel grade I Road Roller grade I, Air-conditioning), 22.Mistry grade I, 23.Mistry Air-conditioning grade I, 24.Overseer, 25.Overseer (Senior and Junior), 26.Operator (Batching plant grade I clampshell grade I, compressor grade I, crane grade I, diesel engine grade I, dozer grade I, dragline grade I, drill grade I, dumper grade I excavator grade I, forklift grade I, generator grade I, grinder grade I, loader grade I, pipe driving grade I, scrapper grade I, screening plant grade I, Shovel grade I, Tractor grade I, 27.Painter (Grade I, class I, Vibrator grade I, spray, 28.Plasterer (mason class I,) 29.Plumber (head class I, mistry class I,) 30.Polisher (with spray) grade I, 31.Road inspector grade I, 32.Sawyer class I, 33.Sharper and Slotter grade I, 34.Sizer, 35.Stone Cutter class I, 36.Stone cutter grade I, 37.Stone chisler class I, 38.Stone mason class I, 39.Sub overseer (qualified) 40.Trademan class I, 41.Turner or miler grade I, 42.Tyre vulcanisor grade I, tiler class I, 43.Tilker class I, tinsmith grade I and class I, 44.White washer class I, Woodcutter class I, Any other categories by whatever name called which are of a highly skilled nature.

15.00 13.75 12.50 11.50 10.25

CLERICAL

1. Account clerk, 2.Clerk, 3.Computer Operator, 4.M.C.Clerk, Munshi (matriculate, non matriculate), 6.Store Clerk, (matriculate and non matriculate), & Store issues, 8.Store keeper, 9.Store keeper grade I, II, (matriculate II, non-matriculate), 10.Tally clerk, 11.Time keeper, 12.Time keeper (matriculate non matriculate), 13.Toll keeper, 14.Work munshi, 15.Work munshi (Sub ordinate), 16.Telephone operator, 17.Typist, 18.Any other categories by whatever name called which are of a clerical nature.....

12.00 11.00 10.00 9.00 8.25

Explanation :- For the purpose of this notification :-



1. Area A, B-I, B-II and C, mentioned Annexure to this notification shall respectively comprise all the places specified in the Annexure as such area include all places within a distance of eight Km from the periphery of a Municipality or Cantonment Board or notified area committee of a particular place and Area D shall comprise of all other places not mentioned in the Annexure and to which Minimum Wages Act extends.
2. Employees employed in the employments in the construction or maintenance of roads or in buildings, in stone breaking and stone crushing, in the maintenance of buildings and in the construction and maintenance of runways in D class areas where the minimum rates of wages have been fixed on area wise basis and where the Central Government has sanctioned payment of winter allowance or hill allowance or any other special allowance shall be paid in addition to the minimum rates of wages fixed by this notification an amount equal to 10 percent of the minimum rates of wages fixed.
3. Where in any area the wages fixed under this notification are lower than the fixed under minimum wages Act by the State Government employees in the schedule employments in the construction or maintenance of roads in buildings operation, in stone breaking or stone crushing in the maintenance of buildings and in the construction and maintenance of runways in respect of Government shall in respect of these areas to be the minimum rates of wages payable under this notification.
4.
 - a) "Unskilled" work is one which envelope simple operation requiring little or no skill or experience on the job.
 - b) "Semi skilled work" is one which involves some degree of skill or competence acquired through experience on the job and which is capable of being performed under the supervision or guidance of a skilled employee and includes unskilled supervisory work.
 - c) "Skilled work" is one which involves skill or competence acquired through experience on the job or through training as an apprentice or in a technical or vocational institute and the performance of which call for initiative and judgment.
 - d) "Highly Skilled work" means work which call for a high degree of perfection and full competence in the performance of certain tasks acquire through intensive or professional training or practical work experience for long years and also requires of worker to assume full responsibility for the judgment or decision involved in the execution of these tasks.
5. The minimum rates of wages are applicable to employees employed by contractors also.
6. The minimum rates of wages shall consist of all inclusive rates, and include also the wages for weekly day.
7. The minimum rates of wages payable to young persons below 18 years of age and for disabled persons shall 80% and 70% respectively of the rates fixed by this notification for adult workers of the appropriated category.
8. Workers employed on tunnel working shall be paid 20% extra of the minimum wages fixed under this notification for the appropriate category.



REGISTER OF MATERNITY BENEFIT
[Clause 19F of the Conditions of Contract]

Name and Address of the contract(s) _____

Name and Location of the work _____

Name of the Employee	Father's/Husband's Name	Nature of employment	Period of actual	Date of which notice of confinement given
1	2	3	4	5

Date on which maternity leave commenced and ended

Date of Delivery/ Miscarriage	In case of delivery		In case of miscarriage	
	Commenced	Ended	Commenced	Ended*
6	7	8	9	10

Leave pay paid to the employee

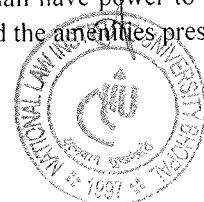
In case of Delivery	In case of miscarriage		Remarks
Rate of leave pay	Amount paid	Rate of leave pay	Amount paid
11	12	13	14



Specimen form of the Register regarding Maternity Benefit admissible to the Contractor's labour in National Law Institute University Works.

	Name of the work	Name of the Contractor
1.	Name of the woman and her husband's name	
2.	Designation	
3.	Date of appointment	
4.	Date with months and year in which 'she is employed'	
5.	Date of discharges/dismissal if any.	
6.	Date of production of certificates in respect of pregnancy.	
7.	Date on which the women informs about the expected delivery.	
8.	Date of delivery/miscarriage/death.	
9.	Date of production of certificate in respect of delivery/miscarriage.	
10.	Date with the amount of maternity/death benefit paid in advance of expected delivery.	
11.	Date with the amount of subsequently payment of maternity benefit.	
12.	Name of the person nominated by the women to receive the payment of the maternity benefit after her death.	
13.	If women die, the date of her death the name of the person to whom maternity benefit amount was paid, the month thereof and the date of payment.	
14.	Signature of the contractor authenticating entries in the register.	
15.	Remarks columns for the use of Inspecting Officer.	
(G)	<p>In the event of the contractor(s) committing a default or breach of any of the provisions of the Central Public Work Department Contractor's Labour Regulation and model rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filling any statement under the provisions of the above regulation and rules which is materially incorrect, he/they shall without prejudice to any other liability pay to the University a sum not exceeding Rs.50 per every default, breach or furnishing, making submitting, filing such materially incorrect statements and in the event of the contractor(s) defaulting continuously in this respect the penalty may be enhanced to Rs.50 per day for each day of default subject to a maximum of 5 percent of the estimated cost of the work put to tender. The decision of the Employer shall be final and binding on the parties.</p>	

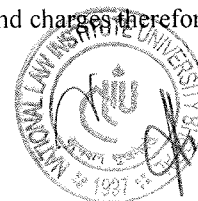
Should it appear to the Employer that the contractor (s) is/are not properly observing and complying with the provisions of C.P.W.D? Contractor's Labour Regulations and Abolition Act 1970 and the Contract Labour (R&A) Central Rules, 1971 for the protection of health and sanitary arrangements for work – people employed by the contractor(s) (hereinafter referred as "the said Rule) the Employed shall have power to give notice in writing to the contractor(s) requiring that the said Rule be a complied with and the amenities prescribed therein



be provided to the work people within a reasonable time to be specified in the notice if the contractor(s) shall fail within the period specified in the notice to comply with and/observe the said Rules and to provide the amenities to the work people as aforesaid the Employed shall have the power to provide the amenities herein before mentioned at the cost of the contractor(s). The contractor(s) shall erect, make mentioned at the cost of the contractor(s). The contractor(s) shall erect, make and maintain at his/their own expense and to approved standards all necessary huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the work and if the same shall not have been erected or constructed according to approved standards within the period specified in the notice the Employer shall have power remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the contractor(s).

(H) The contractor(s) shall at his/their own cost provide his/their labour with a sufficient number of huts (here in after referred to as the camp) of the following specifications on a suitable plot of land to be approved by the Employed.

1. (a) The minimum height of each hut at the eaves shall be 2.10m. (7 ft.) and the floor area to be provided will be at the rate of 2.7 sq.m. (30 sq.ft.) for each member of the member of worker's family staying with the labour.
 - (b) The contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.80m x 1.50m (6'x5') adjacent to the hut for each family.
 - (c) The contractor(s) shall also construct temporary latrines and urinals for the use of the labourers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.
 - (d) The contractor(s) shall construct sufficient number of bathing & washing places one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.
2. (a) All the huts have walls of sun-dried or burnt bricks laid in mud mortar or other suitable local materials as may be approved by the Employed. In case of sun dried brick, the wall should be plastered with mud gobi on both sides. The floor may be katcha but plastered with mud gobi and shall be at least 15 cm (6") above the surrounding ground. The roofs shall be laid with thatched or any other materials as may be approved by the Employed and the contractor shall ensure that throughout the period of their occupation the roofs remains water-tight.
 - (b) The contractor(s) shall provide each hut with proper ventilation.
 - (c) All doors, windows and ventilators shall be provided with suitable locks for security purposes.
 - (d) These shall be kept an open space of at least 7.2m. (8 yards) between the rows of huts which may be reduced to 6m. (20ft) according to the availability of the site with the approval of the Employed. Back to back construction will be allowed.
3. Water Supply – The contractor(s) shall provide adequate supply of water for the use labourers. The Provisions shall not be less than 2 gallons of pure and whole some water per head per day for drinking proposes and 3 gallons of clean water per head per day for bathing and washing purpose. Where piped Water supply is available supply shall be at stand post and where the supply is from wells or river/tanks, which may be of metal or masonry shall be provided. The contractor(s) shall also at his/their own cost make arrangements for laying pipe. Lines or water supply to his/their labour camp from the existing mains wherever available and shall pay all fees and charges therefore.



4. The site selected for the camp shall be high ground, removed from jungle.
5. Disposal of Excreta – The contractor(s) shall make necessary arrangement for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the contract(s) shall make arrangements for the removal of the excreta through the Municipal Committee/authority. All charges on this account shall be borne by the contractor and paid direct by him to the Municipal Committee/authority. The contractor shall provide one sweeper for every 8 seats in case of dry system.
6. Drainage – The Contractor(s) shall provide efficient arrangements for draining away sludge water so as to keep the camp neat and tidy.
7. The contract(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accident to the workers.
8. Sanitation – The contractor(s) make arrangements for conservancy and sanitation in the labour camps according to the rules of the local Public Health and Medical Authorities.

(I) The Employed may require the contractor to dismiss or remove from the site of the work any person or person in the contractors employ upon the work who may be incompetent or misconduct himself and the contractor shall forth with comply with such requirements.

(J) It shall be the responsibility of the contractor to see that the building under construction is not occupied by anybody unauthorized during construction and to hand over the employed vacant possession of complete buildings. If such building though completed, is occupied illegally, then the Employed will have the option to refuse to accept the said building/buildings in that position, and delay a levy up to 5% of the estimated cost put to tender may be imposed by the Employed whose decision shall be final both with regard to justifications and quantum.

However, the Employed may require the contractor through a notice to remove the illegal occupation any time on or before construction and delivery.

5.1 REPORTING ACCIDENT OF LABOUR

The contractor shall be responsible for the safety of all employees and/or workers employed or engaged by him on and in connection with the works and shall forthwith report all cases of accidents to any of them, however caused and whenever occurring to the authorities concerned required as per law and to the Employer/Architect or his representative and shall make every arrangement to render all possible assistance and aid to the victim of the accident.

5.2 PROVISION OF WORKMEN'S COMPENSATION ACT

The contractor shall at all times indemnify and keep indemnified the Employer against all claims for compensation under the provisions of the workmen's compensation act 1923 or any other law for the time being in force by or in respect of any workmen employed by the contractor in carrying out the contract and against all costs and expenses or penalties incurred by the Employer in connection there with. In every case in which, by virtue of the provisions of the said act, the Employer is obliged to pay compensation to a workmen employed by the contractor in executing the works, the Employer shall recover from the contractor the amount of the compensation so paid and without prejudice to the rights of the Employer shall be at liberty of the Employer under the said act. The Employer shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any due by the Employer to the contractor, whether under this contract or otherwise without prejudice to any other remedy that may be available to the Employer in law. The Employer shall not be bound to contest any claim made against it under the said Act, except on the



written request of the contractor and upon his giving to the Employer full security for all costs for which the Employer might become liable in consequence of contesting such claim.

5.3 ACCIDENT OR INJURY TO WORKMEN

The Employer shall not be liable for or in respect of any damages or compensation payable at law in respect or in consequence of any accident or injury to any workmen or other person in the employment or the contractor or his sub-contractors, and the contractor shall indemnify and keep indemnified the Employer against all such damages and compensation and against all claims, demands, proceedings costs, charges and expenses whatsoever in respect thereof or in relation thereto.

5.4 PROVISION OF MINES ACT

The contractor shall observe and perform all the provisions of the Mines Act 1952 where applicable or any statutory modifications thereof and shall indemnify and keep indemnified the Employer from and against any claim under the said Act.

5.5 PRESERVATION OF PEACE

The contractor shall take requisite precautions to prevent any riotous or unlawful behaviour by or amongst his workmen and/or others employed on the works by him, for the preservation of peace and protection of the inhabitants and security of property in the neighborhood of the works.

5.6 AGE LIMIT OF LABOUR

The age limit for employment of labour shall be in strict accordance with the existing labour legislation.

5.7 RETURN OF LABOUR EMPLOYED

The contractor, if required by the Architect, shall submit return in detail in such form and at such interval as the Architect may prescribe showing number of different classes of labour employed on the works from time to time by the contractor.

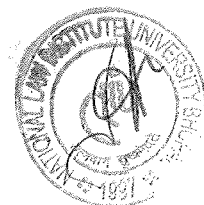
6.0 MATERIAL TESTS AND WORKMANSHIP:

6.1 QUALITY OF MATERIALS, WORKMANSHIP AND TESTS

All materials and workmanship shall be of the respective kinds described in the contract and in accordance with C.P.W.D. specification volume I to III latest version and volume IV to VI latest version for Civil & Electrical work with up to date correction slip and shall be subjected from time to time to such tests as the Employer may direct at the place of manufacturer or fabrication or on the site at all or any of such places. The contractor shall provide such assistance instruments, machines, labour and materials, as are normally required for examining measuring, and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before in University on the works for approval as may be required by the Employer.

Contractor shall arrange for Compression testing machine at site for testing of concrete cubes/bricks etc. However, this provision does not bind the NATIONAL LAW INSTITUTE UNIVERSITY/his representative for getting the testing done from outside at contractor's expense. Cost of materials to be paid for testing would be borne by contractor including transportation etc. to lab. from site.

6.2 CONSTRUCTION OF PROTOTYPES OR SAMPLES OF WORK



- a) The contractor shall construct prototypes or samples of work as laid down in the contract or as instructed by the Architect. Such prototypes or samples of work, after approval by the Employer shall serve as the standards to be achieved in the final construction.
- b) **MOCKUP ROOM:** Contractor has to prepare a mockup room as per the items selected by Employer. The finishing of all items shall be approved, so that desired finishing/quality shall be maintained in other rooms as well.

6.3 COST OF SAMPLES

All samples shall be supplied by the contractor at his own cost. Cost of transportation testing samples will be borne by the contractor from site to Labs.

6.4 COST OF TESTS

The cost of making any test sample shall be borne by the contractor and contractor should arrange for all requirements like cubes etc. to take the samples by Employer/Architect. Testing charges in the Laboratory would be paid by the Contractor.

6.5 INSPECTION OF OPERATION

The Employer or any person authorised by him shall at all times have access to the works and to the site and to all workshops and places where work is being prepared or where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility for and every assistance in or in obtaining the right to such access.

6.6 EXAMINATION OF WORK BEFORE COVERING UP

No work shall be covered up or put out of view without the approval of the Employer/Architect or their representative and the contractor shall afford full opportunity to the Employer/Architect or his representative to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. The contractor shall give due notice to the Employer and Architect wherever any such work or foundations is or are ready or about to be ready for examination and the Employer and Architect shall without unreasonable delay, unless he considers it unnecessary and advises the contractor accordingly, attend for the purpose of examining and measuring such work or of examining such foundations.

6.7 UNCOVERING AND MAKING OPENINGS

The Contractor shall uncover any part or parts of the works or make openings in or through the same as the Architect may not from time to time direct and shall reinstate and make good such part or parts to the satisfaction of the Employer. If any such part or parts have been covered up or put out of view after compliance with the requirements of clause 6.5 hereof and are found to be executed in accordance with the contract the expenses of uncovering making openings in or through, reinstating and making good the same shall be borne by the Employer, but in any other case all such expenses shall be borne by the contractor and shall be recoverable from him by the Employer and deducted by the Employer from any moneys due or which may become due to the contractor, without prejudice to any other remedy that may be available to the Employer in law.

6.8 REMOVAL OF IMPROPER WORK AND MATERIALS



The Employer/Architect or his representative shall during the progress of the works have power to order in writing from time to time.

- a) The removal from the site within such time or times as may be specified in the order of any material, which in the opinion of the Employer/Architect or his representative is not in accordance with the contract.
- b) The substitution of proper and suitable materials.
- c) The removal and proper re-execution (notwithstanding a previous test thereof or interim payment therefore) of a work which in respect of materials or workmanship is not in the opinion of the Architect or his representative in accordance with the contract.

6.9 **SUSPENSION OF WORK**

The contractor shall, on the written order of the Employer/Architect suspend the progress of the works or any part thereof for such time or times and in such manner as the Employer/Architect may consider necessary and shall, during such suspension, properly protect and secure the work, so far as is necessary in the opinion of the Employer/Architect.

7.0 **TIME OF COMPLETION, AND TAKING OVER:**

7.1 **POSSESSION OF SITE**

Save in so far the contract may prescribe the extent of portions of the site of which the contractor is to be given possession from time to time and the order in which such portions will be available to him and subject to any requirement in the contract as to the order in which the work shall be executed, the Employer shall give to the contractor possession of so such of the site as may be required to enable the contractor possession of so such of the site as may be required to enable the contractor to commence and proceed with the construction of the works in accordance with such reasonable proposals of the contractor as he will make in writing to the Employer and shall, from time to time as the work proceeds give the contractor possession of such further portions of the site as may be required to enable the contractor to proceed with construction of the works in accordance with the said programme or proposal.

7.2 **TIME OF COMPLETION**

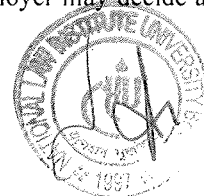
The whole of the works shall be completed within the time stipulated or within such extended time as has been allowed under clause 7.3

7.3 **EXTENSION OF TIME OF COMPLETION**

If the contractor shall desire an extension of time for completion of work on the grounds of his having been unavoidably hindered in its execution or on any other grounds he shall apply in writing to the Employer/Architect within 30 days of the date of hindrance on account of which he desires such extension as aforesaid and the Employer shall if in his opinion (which shall be final) reasonable grounds be shown therefore authorize such extension of time if any as may in his opinion be necessary or proper. The contract shall not claim any extra charges on this account.

7.4 **EXTENSION OF COMPLETION TIME DUE TO STRIKE, FIRE ETC.**

If in the opinion of the Employer/Architect the progress of the work has at any time been delayed by strikes, fire inclement weather, unavoidable casualties etc. beyond the control of the contractor, then the time of completion of the work may be extended for such reasonable time as the Employer may decide and this will be indicated in writing.



7.5 WORK TREATED AS COMPLETE

The works shall not be treated as complete until,

- i) The site is clear from all materials, site shed etc. and the Employer/Architect is satisfied with the job done by the contractor or his representative.
- ii) The contractor has submitted the reconciliation statement regarding the stores received from the Employer, and all the surplus and salvaged materials are returned to the Employers' stores, and the Employer has agreed to the same.
- iii) All equipment, tools plants etc. taken from the Employer has been returned by the contractor.
- iv) Any other material, taken on loan/transfer from other agency has been returned by the contractor.
- v) All power and water supply connections taken for the execution of the works have been disconnected by the contractor.
- vi) Rectification of any damage done by the contractor to the work executed have been satisfactorily done by the contractor.

7.6 TAKING OVER

After completion of works or any substantial part of the works before the completion of the whole of the works, the contractor shall notify the Employer/Architect in writing, who within 15 days of receipt of the said notice shall give such certificate with respect to any substantial part of the works which has been both completed to the satisfaction of the Employer/Architect and occupied or used by the Employer/Architect or refuse to issue the same stating the reasons thereof in writing. When any such certificate is given in respect of a part of the works, such part shall be considered as completed for the purpose of taking over and computation of the period of maintenance of such part, that is, such period shall commence from the date of completion of such part of the works as certified. The works in whole or part shall not, however, be treated as completed for the purpose of other relevant Clauses hereof unless and until the provisions of Clause 7.5 hereof are fully complied with.

7.7 MAINTENANCE

For a period of 12 months commencing immediately after completion of the work accepted by the Employer/Architect, the contractors' liability shall be to replace the defective parts, rectify/reconstruct the defective work that may develop of his own construction or those of his sub-contractors approved by the Employer/Architect (under clause 2.1 & 2.2) arising solely from faulty material or workmanship or for any other reason.

If it is necessary for the contractor to rectify/reconstruct any defective portions of the work under the contract, the provision of this condition shall apply to the portions of work so replaced or renewed until the expiration of three months from the date of such replacement or renewal or until the end of the above mentioned period of 6 months, whichever may be later. If any defects be not remedied within a reasonable time the Employer/Architect may have against the contractor in respect of such defects.

The contractor shall bear the cost of such repairs/rectification carried out on his behalf at site. Immediately upon expiry of the maintenance period the Employer/Architect shall issue a final certificate indicating that the contractor has completed his obligation under the contract.



The decision of NATIONAL LAW INSTITUTE UNIVERSITY/their authorised representative's view regarding workmanship shall be final and binding on the Contractor and Contractor has to abide by the decision.

The deduction of expenditures for rectification shall be made from the deposit of the Contractor, in case Contractor does not attend the problem in a reasonable time.

8.0 TERMINATION OF CONTRACT:

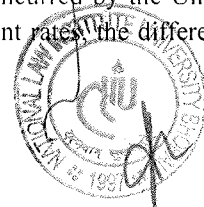
8.1 TERMINATION OF CONTRACT

The Employer may without prejudice to his right against the contractor in respect of any delay or inferior workmanship or otherwise or to any claims of damage in respect of any breach of the contract and without prejudice to any rights or remedies under any of the provisions of this contract or otherwise and whether the date of completion has or has not elapsed by notice in writing absolutely determine the contract in any of the following cases.

- i) If the contractor having been given by the Employer a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in any inefficient or otherwise improper or unworkman like manner, shall omit to comply with the requirements of such notice for period of 7 days thereafter or if the contractor shall delay or suspend the execution of the work so that either in the judgment of the secure completion of the work by date for completion or he has already failed to complete the work by that date.
- ii) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.
- iii) If the contractor commits breach of any of the terms and conditions of this contract.

When the Contractor has made himself liable for action under any of the cases aforesaid the Employer on behalf of the NATIONAL LAW INSTITUTE UNIVERSITY shall have powers.

- a) To determine or rescind the contract as aforesaid (of which termination or rescission notice in writing to the contractor under the hand of Employer shall be conclusive evidence) upon such determination or rescission the security deposit of the contractor shall be liable to be forfeited and shall be absolutely at the disposal of the University.
- b) To employ labour paid by NATIONAL LAW INSTITUTE UNIVERSITY and to supply materials to carry out the works or any part of the work debiting the contractor with cost and price of the labour and the price of the materials (of the amount of which cost and price certified by the Employer shall be final and conclusive against the contractor) and crediting him with the value of the work done in all respect in the same manner and at the rates as if it had been carried out by the contractor under the terms of his contract. The certificate of the Employer as to the value of work done shall be final and conclusive against the contract provided always the action under the sub clause shall only be taken after giving notice in writing to the contractor, provided also that if the expenses incurred by the University are less than the amount payable to the contractor at his agreement rates, the difference should not be paid to the contractor.



- c) After giving notice to the contractor to measure up the work of the contractor and to take such part thereof as shall be unexecuted out of his hands and to give it to another contractor to complete in which case any expenses which may be incurred in excess of sum which would have been paid to the original contractor if the whole work had been executed by him (of the amount of which excess the certificate in writing of the Employer charge shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any money due to him by the University under this contract or on any other account whatsoever or from his security deposit or the proceeds of sales thereof or sufficient part thereof as the case may be.

In the event of any one or more of the above courses being adopted by the Employer the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagements or made advances on account or with a view to the execution of the work or the performances of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or unless and until the Employer has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

8.2 BACK CHARGING THE CONTRACTOR

Extra cost and expenses incurred for completing the work or balance work or carrying out the rectification of any work as mentioned above through another agency or agencies including its own department shall be debited to contractors' account and shall be recovered from any money due or that may become due to the contractor without prejudice to any other remedy that may be available to the Employer in law.

9.0 ALTERATIONS, ADDITIONS, AND OMISSIONS:

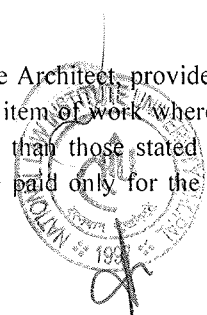
9.1 VARIATION:

The Employer on the accommodation of the Architect shall be entitled to make any variation of the quality or quantity of the works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion be desirable, he shall have power to order the contractor to do and the contractor shall do any of the following:

- a) Increase or decrease the quantity of any work up to 20% plus minus included in the contract.
- b) Omit any such work.
- c) Change the character or quality of kind of any such work.
- d) Change the levels, lines, position and dimensions of any part of the works and,
- e) Execute additional work of any kind necessary for the completion of the works, and no such variation shall in any way initiate or invalidate the contract but the value, if any, of all such variations shall be taken into account in ascertaining the amount of the Contract Price.

9.2 ORDERS FOR VARIATIONS TO BE IN WRITING

No such variation shall be made by the contractor without an order in writing of the Architect, provided that no order in writing shall be required for increase or decrease in the quantity of any item of work where such increase or decrease is the result of the actual quantities exceeding or being less than those stated in the Schedule of quantities which are estimates. In such cases, the contractor shall be paid only for the actual

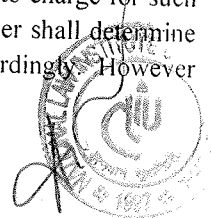


quantity of work done as certified by the Architect at the accepted unit item rates and no compensation shall be allowed. Provided also that if for any reason the Architect shall consider it desirable to give any such order verbally, the contractor shall comply with such order but it must be followed by confirmation in writing of such verbal order given by the Architect, which shall be deemed to be an order in writing within the meaning of this Clause.

9.3 EXTRA ITEMS

The Employer shall have power to make any alteration in, omissions, form additions to or substitution for, the original specifications, drawings, and instructions that may appear to him to be necessary during the progress of the work and the contractor shall carry out the work in accordance with any instructions which may be given to him in writing signed by Employer and such alterations, commissions, additions or substitutions shall not invalidate the contract and any altered, additional or substituted 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 same conditions in all respects in which he agreed to do the main work. The time for the completion of the work shall be extended in the proportion that the altered addition or substituted work bears to the original contract work and the certificate of the Employer shall be conclusive as to such proportion. Over and above this a further period to the extent of 25 percent of such extension shall be allowed to the contractor. The rates for such addition, altered or substituted work under this clause is worked out in accordance with the following provisions in their respective order.

- i) If rates for the additional, altered or substituted work are specified in the contract for the work the contractor is bound to carry out the additional altered or substituted work at the same rates as are specified in the contract for the work.
- ii) If the rates for the additional altered or substituted work are not specifically provided in the contract for the work, the rates will be derived from the rates for a similar class of work as are specified in the contract for the work.
- iii) If the altered, additional or substituted work include any work for which no rates is specified in the contract or the same cannot be derived from the similar class of work in the contract, then such work shall be carried out as stated below: -
 - a) The Civil work shall be carried out at the rates entered in C.P.W.D., Delhi schedule of rates latest with errata and correction slips as issued minus/plus the percentage worked out on overall schedule basis which the tendered amount for Civil work bears to the estimated cost of work put to tender.
 - b) The Electrical work shall be carried out at the rates in C.P.W.D. schedule of rate Electrical (Part-I internal) latest and C.P.W.D. schedule of rate Electrical (Part-II external) latest with errata and correction slips issued minus/plus the percentage which the tendered amount for Electrical work put to tender.
- iv) If the rate for altered, additional or substituted work cannot be determined in the manner specified in sub-clause (i) to (iii) above then the rates for such work shall be worked out on the basis of the Schedule of rate of the District specified above minus/plus, the percentage which the tendered amount bears to the estimated cost of the Civil/Electrical work put to tender as the case may be. Provided always that if the rate for particular part or parts of the item is not in the District Schedule of rates, the rate for such part or parts will be determined by the Employer on the basis of prevailing market rate when work was done.
- v) If the rates for the altered additional or substituted work cannot be determined in the manner specified in sub-clause (i) to (iv) above, then the contractor shall, within days of the date of receipt of order to carry out the work, inform the Employer of the rate which it is intention to charge for such class of work, supported by analysis of the rate or rates claimed, and the Employer shall determine the rate or rates on the basis of prevailing market rates and pay the contractor accordingly. However



the Employer by notices in writing will 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 advisable. But under no circumstances the contractor shall, suspend the work on the plea of no-settlement of rates of items falling under the clause.

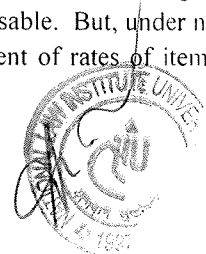
- vi) Except in case of items relating to foundation provisions contained in sub-clause (i) to (v) above shall not apply to contract or substituted item as individually exceed the percentage set out in the tender documents (referred to herein below as "deviation limit") subject to the following restrictions.
- a) The deviation limit referred to above be the net effect (algebraically sum) of all additions and deductions ordered.
 - b) In no case shall the additions/deductions (arithmetical sum) exceed twice the deviation limit.
 - c) The deviation ordered on items of any individual trade included in the contract shall not exceed plus-minus the value of 50% of that trade in the contract as a whole or half the deviation limit, whichever is less.
 - d) The value of addition of items of any individual trade not already included in the contract shall not exceed 10% of the deviation limit.

Note: - "Individual trade" means the trade sections to which a schedule of quantities annexed to the agreement has been divided or, in the absence of any such division the individual sections of the C.P.W.D. Schedule of rates latest specified above such as excavation and earth work, concrete, wood work and joinery etc.

- vii) For the purpose of operation of Clause 9.3, the following works shall be treated as work relating to foundation;
- a) For buildings plinth level or 1.2 meters (4 ft.) above ground level whichever is lower, excluding items above flooring and D.P.C. but including base concrete below the floors.
 - b) For abutments, piers, retaining walls of culverts and bridges, walls of water reservoir the bed of floor level.
 - c) For retaining walls where floor level is not terminate 1.2. Meters above average ground level or bed level.
 - d) For roads all items of excavation and filling including treatment of sub-base and soling works.
 - e) For water supply lines, sewer lines, underground storm water drains and similar work, all items or works below ground level except items of pipe work proper masonry work.
 - f) For open storm water drains all items of work except lining of drains.

"The rates of any such work except the items relating to foundations which in excess of the deviation limit-shall be determined in accordance with the Provisions Contained in Clause 12A".

12A In the case of contract or substituted items which individually exceed the quantity stipulated in contract by more than the deviation limit, except the items relating to foundation work which the contractor is required to do under Clause 9.3 above the contractor shall within 7 days from the receipt of order, claim revision of the rate supported by proper analysis in respect of such items for quantities. In excess of the deviation limit, notwithstanding the fact that rates of such items exist in the tender for the main work or can be derived in accordance with the provisions of sub clause (ii) of Clause 12, and the Employer may revise their rates, having regard to the prevailing market rates and the contractor shall be paid in accordance with the rates so fixed. The Employer shall however, be at liberty to cancel his order to carry out such increased quantities of work by giving notice in writing to the contractor and arrange to carry it out in such manner as he may consider advisable. But, under no circumstance the contractor shall suspend the work on the plea of non-settlement of rates of items falling under this clause.



All the provisions of the preceding paragraph shall equally apply to the decrease in the rates of items for quantities in excess of the deviation limit, notwithstanding the fact that the rates of such items exist in the tender for the main work or can be derived in accordance, with the provisions of sub-clause (ii) of the preceding Clause 12 and the Employer may revise such rates having regard to the prevailing market rates.

9.4 **REBATE/EXTRA OVER ORIGINAL ITEM**

If there is a deviation in the specification of particular item of the tender, rebate/extra over the quoted rate shall be generally derived as follows: -

For items not covered in the schedule, rebate/extra shall be derived based on observation/analysis of labour and materials involved in such items.

9.5 **ITEMS OF AD-HOC NATURE**

The contractor shall procure necessary materials and carry out miscellaneous work of Ad-hoc nature specifically provided with necessary tools and tackles as may arise during execution of the contract. The actual quantum of work shall be certified by the Architect and payment for the same shall be decided by the Employer.

9.6 **CLAIMS**

The contractor shall send to the Employer's representative an account, giving full and detailed particulars with proper analysis, of all claims for any additional expense to which the contractor may consider himself entitled and of all extra items of work, which he has executed, within one month of execution of such work, and no claim for payment for any such work will be considered which has not been included in such particulars. Provided always that the Employer shall be entitled to authorize payment to be made for any such work notwithstanding the contractors' failure to comply with this condition, if the contractor has at the earliest practicable opportunity notified the Employer in writing, that he intends to make a claim for such work.

10.0 **MEASUREMENTS:**

10.1 **QUANTITIES**

The quantities set out in the Schedule of quantities are the estimated quantities of the work. They are not to be taken as the actual and correct quantities, of the works, to be executed by the contractor in fulfillment of his obligation under the contract.

10.2 **WORKS TO BE MEASURED**

The Architect shall, except as otherwise stated, ascertain and determine by measurement the value in terms of the contract. He shall when he requires any part or parts of the works to be measured, give notice to the contractors' authorised agent or representative, who shall forthwith attend or send a qualified agent to assist the Architect or his representative in making such measurement, and shall furnish all particulars required by either of them. Should the contractor not attend or neglect or omit to send such agent, then the measurement made by the Architect or approved by him shall be taken to be the contract measurement of the work. If the contractor does not so attend to examine and agree such records and drawings they shall be taken to be correct. If, after examination of such records and drawings, the contractor does not agree to the same or does not sign the same as agreed, they shall nevertheless be taken to be such examination, lodge with the Architects'



representative for decision by the Architect, notice in writing of the respects in which such records and drawings are claimed by him to be incorrect.

10.3 **METHOD OF MEASUREMENT**

The works shall be measured net in accordance to IS: 1200 (all parts), notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the contract.

11.0 **SPECIFICATIONS**

Work shall be carried out according to latest C.P.W.D. specifications.

12.0 **SETTLEMENT OF DISPUTES:**

Except where otherwise provided in the contract all questions and disputes relating to meaning of the specifications, designs, drawings and instructions herein before mentioned and as to the quality of workmanship of materials used on the work or as to any other question, claim right matter or things whatsoever, in any way arising out of or relating to the contract design, drawings, specifications, estimates, instructions orders or these conditions or otherwise concerning the works, or the executions, or the failure to execute the same whether arising during or progress of the work or same whether arising during or progress of the work or after the completion or abandonment thereof shall be referred to the sole Arbitrator of the person appointed by the DIRECTOR, NATIONAL LAW INSTITUTE UNIVERSITY at the time of dispute or if there be no DIRECTOR, NATIONAL LAW INSTITUTE UNIVERSITY at that time, there will be no objection to any such appointment that the arbitrator so appoint is University employee, that he had to deal with the matters to which the contract relates and that in the course of his duties as University employee he had expressed views on all or any of the matters in dispute or difference. The arbitration to which the matter is originally referred being transferred or vacating his office or being unable to act for any reason such Director as aforesaid at the time of such transfer, vacating office or inability to act shall appoint another person to act as arbitrator in accordance with the terms of the contract. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor. It also a term, of his contract that no person other than person appointed by NATIONAL LAW INSTITUTE UNIVERSITY as aforesaid should act as arbitrator and if for any reason that is not possible the matter is not to be referred to arbitration is not possible the matter is not to be referred to arbitration at all. The arbitrator shall give reasons for the award.

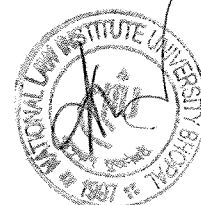
Subject aforesaid the provisions of the Arbitration and conciliation Act 1996 or any statutory modification or re-enactment thereof and the rules made there under and for the time being in force shall apply to the Arbitration proceeding under this Clause.

It is also a term of the contract that the party invoking arbitration shall specify the dispute or disputes to be referred to arbitration under this Clause together with the amount or amounts claimed in respect of each such dispute.

It is also a term of the contract that if the contractor (s) does do not make any demand for arbitration in respect of any claim(s) in writing within 90 days of receiving the intimation from University that the bill is ready for payment, the claim of the contractor(s) will be deemed to have been waived and absolutely barred and the University shall be discharged and released of all liabilities under the contractor in respect of these claims.

The arbitrator(s) may from time to time with consent of the parties enlarge the time for making and publishing the award.

13.0 **NOTICES:**

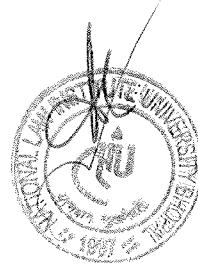


13.1 SERVICE OF NOTICE ON CONTRACTOR

All certificates, notices or written orders to be given by the Employer or by the Architect to the Contractor under the terms of the contract shall be served by sending by Registered Post or delivering the same to the contractor's place of business or such other address as the contractor shall nominate for this purpose.

13.2 SERVICE OF NOTICE ON EMPLOYER

All notices to be given to the Employer under the terms of the contract shall be served by sending by post or delivering the same to the Employers' address.



TECHNICAL SPECIFICATIONS

PLUMBING WORKS

CONTENTS

<u>SECTION</u>	<u>ITEM</u>
	GENERAL TECHNICAL CONDITIONS
I	SANITARY FIXTURES
II	SOIL, WASTE AND VENT PIPES
III	EXCAVATION FOR PIPE LINE
IV	WATER SUPPLY
V	SEWERAGE / DRAINAGE SYSTEM
VI	LIST OF APPROVED MAKES OF MATERIALS

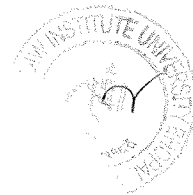


TECHNICAL SPECIFICATIONS

(PLUMBING WORKS INTERNAL & EXTERNAL)

GENERAL TECHNICAL CONDITIONS

1. **SCOPE OF WORK**
 - 1.1 Work under this contract shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely furnish all the plumbing and other specialized services as described hereinafter and as specified in the schedule of quantities and/or shown on the plumbing drawings.
 - 1.2 Without restricting to the generally of the foregoing sanitary installations shall include the following:
 - a). Sanitary Fixtures.
 - b). Soil, Waste, Rainwater and vent pipes.
 - c). Water supply (Internal & External)
 - d). External Sewerage system.
 - f). Sewage disposal.
 - 1.3 Services rendered under sub-section 1.4 shall be done without any extra charge.
 - 1.4 The contractor must get acquainted with the proposed site for the works and study specifications and conditions carefully before tendering. The work shall be executed as per programme approved by the Architect. If part of site is not available for any reason or there is some unavoidable delay in supply of materials stipulated by the Institute, the programme of construction shall be modified accordingly and the contractor shall have no claim for any extras or compensation on this account.
 - 1.5 Works area shall be the area shown in the plan attached.
2. **SPECIFICATIONS**
 - 2.1 Work under this contract shall be carried out strictly in accordance with specifications attached with the tender.
 - 2.2 Item not covered under these specifications due to any ambiguity or misprints, or additional works, the work shall be carried out as per specifications of the latest central public works department with latest amendments as applicable in the contract.
 - 1.3 Works not covered under Para 2.1 and 2.2 shall be carried out as per relevant Indian standards specifications or codes of practice and, if not available, as per British Standards specifications or codes of practice or unified plumbing code of U.S.A.



3. EXECUTION OF WORK

- 3.1 The work shall be carried out in conformity with the plumbing drawings and within the requirements of architectural, HVAC, Electrical, Structural and other specialized services drawings.
- 3.2 The contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction programme.
- 3.3 On award of the work, contractor shall submit a programme of construction in the form of a pert chart or bar chart for approval of the Architect. All dates and time schedule agreed upon shall be strictly adhered to, within the stipulated time of completion/commissioning along with the specified phasing, if any.

4. DRAWINGS

- 4.1 Plumbing drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the architectural and other services drawings.
- 4.2 Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.
- 4.3 Contractor shall verify all dimensions at site and bring to the notice of the architects all discrepancies or deviations noticed. Architects decision shall be final.
- 4.4 Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small-scale drawings.
- 4.5 Any drawings supplied with the tender shall be returned in good conditions along with the tender.
- 4.6 Any drawings issued by the Architects for the works are the property of the Architects and shall not be lent, reproduced or used on any works other than intended without the written permission of the Architects.

5. INSPECTION AND TESTING OF MATERIALS

- 5.1 Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Indian standards.
- 5.2 For examination and testing of materials and works at the site contractor shall provide all testing and gauging equipment necessary but not limited to the followings:
- a) Theodolite
 - b) Dumpy level
 - c) Steel tapes
 - d) Weighing machine
 - e) Plumb bobs, spirit levels, Hammers
 - f) Micrometers
 - g) Thermometers, Stoves
 - h) Hydraulic test machine
 - i) Smoke test machine



- 5.3 All such equipment shall be tested for calibration at any approved laboratory, if required by the Architect.

- 5.4 All testing equipment shall be preferably located in special room meant for the purpose.

6. METRIC CONVERSION

- 6.1 All dimensions and sizes of materials and equipment given in the tender document are commercial metric sizes.
- 6.2 Any weights, or sizes given in the tender having changed due to metric conversion, the nearest equivalent sizes accepted by Indian standards shall be acceptable without any additional cost.

7. REFERENCE POINTS

7.1 Contractor shall provide permanent bench marks, flag tops and other reference points for the proper execution of work and these shall be preserved till the end of the work.

7.2 All such reference points shall be in relation to the levels and locations given in the architectural and plumbing drawings.

8. REFERENCE DRAWINGS

8.1 The contractor shall maintain one set of all drawings issued to him as reference drawings. These shall not be used on site.

All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings. All changes to be made shall be initialed by the Architect.

9. SHOP DRAWINGS

9.1 The contractor shall submit to the Architect four copies of the shop drawings.

9.2 Shop drawings shall be submitted under following conditions:

- a). Showing any changes in layout in the plumbing drawings.
- b). Equipment layout and piping, wiring diagram.
- c). Manufacturer's or contractor's fabrication drawings for any materials or equipment supplied by him.

9.3 The contractor shall submit four copies catalogues, manufacturers drawings, equipment characteristic data or performance charts as required by the Architect.

10. COMPLETION DRAWINGS

10.1 On completion of work, contractor shall submit one complete set of original tracings and two prints of 'as built' drawings to the Architect. These drawings shall have the following information:

- a). Run of all piping & diameters on all floors and vertical stacks.
- b). Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall.
- c). Run of all water supply lines with diameters, locations, of control valves, access panels.
- d). Location of all mechanical equipment with layout and piping connections.

10.2 Contractor shall provide four sets of catalogues, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.

10.3 All 'warranty cards' given by the manufacturers shall be handed over to the Architect.

11. CONTRACTORS RATES

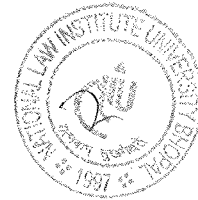
11.1 Rates quoted in this tender shall be inclusive of cost of materials, labour, supervision, erection, tools, plant, scaffolding, service connections, transport to site, taxes, octroi and levies, breakage, wastage and all such expenses as may be necessary and required to completely do all the items of work and put them in a working condition.

11.2 Rates quoted are for all heights and depths required for this work.

11.3 All rates quoted must be for complete items inclusive of all such accessories, fixtures and fixing arrangements, nuts, bolts, hangers as are a standard part of the particular item except where specially mentioned otherwise.

11.4 All rates quoted are inclusive of cutting holes and chases in walls and floors and making good the same with cement mortar/concrete of appropriate mix and strength as directed by Architect. Contractor shall provide holes, sleeves, recesses in the concrete and masonry work as the work proceeds.

11.5 Rates quoted shall be inclusive of cost incurred in testing, commissioning of works and materials.



12. TESTING

- 12.1 Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.
- 12.2 Tests shall be performed in the presence of the Architect.
- 12.3 All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.
- 12.4 Contractor shall perform all such tests as may be necessary and required by the local authorities to meet Municipal or other bye-laws in force.
- 12.5 Contractor shall provide all labour, equipment and materials for the performance of the test.

13. SITE CLEARANCE AND CLEANUP

- 13.1 The contractor shall, from time to time clear away all debris and excess materials accumulated at the site.
- 13.2 After the fixtures, equipment and appliances have been installed and commissioned, contractor shall clean-up the same and remove all plaster, paints stains, stickers and other foreign matter of discoloration leaving the same in a ready to use condition.
- 13.3 On completion of all works, contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done at contractors risk and cost.

14. LICENSE AND PERMITS

- 14.1 Contractor must hold a valid plumbing license issued by the Municipal authority or other competent authority under whose jurisdiction the work falls.
- 14.2 Contractor must keep constant liaison with the Municipal authority and obtain approval of all drainage and water supply works carried out by him.
- 14.3 Contractor shall obtain, from the municipal authority, completion certificate with respect to his work as required for occupation of the building.
- 14.4 All inspection fees or submission fees paid by the contractor shall be reimbursed by the Institute on production of valid official receipts.

15. RECOVERY OF COST FOR MATERIALS ISSUED TO CONTRACTORS FREE OF COST

- 15.1 If any materials issued to the contractor, free of cost, are damaged or pilfered, the cost of the same shall be recovered from the contractor on the basis of actual cost to owner which shall include all freight and transportation, excise duty, sales tax, octroi, import duty etc. plus 100% the deduction or the actual cost given by the Institute shall be final and binding on the contractor.

16. CUTTING & MAKING GOOD.

No structural member shall be chased or cut without the written permission of the Architect.

17. MATERIALS SUPPLYING BY INSTITUTE.

- 17.1 The contractor shall verify that all materials supplied by the Institute conform to the specifications of the relevant item in the tender. Any discrepancy found shall be brought to the notice of the Architect.
- 17.2 After receipt of materials, it shall be the responsibility of the contractor for any damage found and he shall be liable to pay the actual cost of the material as per market rate at the time.

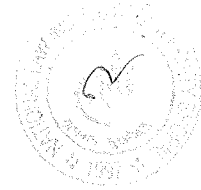
18. MATERIALS

- 18.1 All materials used in the works shall conform to the tender specifications.
- 18.2 As far as possible materials bearing I.S. certification marks shall be used with the approval of the Architect.
- 18.3 Unless otherwise specified and expressly approved in writing by the Architect, materials of makes and specifications mentioned with tender shall be used.

19. MOCK UP

The contractor shall install all pipes, fixtures, clamps and accessories and fixing devices in mock-up shaft and room so constructed as directed by Architect without any cost. The materials used in the mock-up may be reused in the works if found undamaged.

Any tiles or finished surfaces or floors damaged by the contractor while doing his work shall be made good with new tiles or other finishing material. No payment shall be admissible for such repairs. The Architect may, at his discretion get the damaged work repairs to the contractor.



SECTION-I

SANITARY FIXTURES

1. SCOPE OF WORK

- 1.1 Work under this section shall consist of furnishing all material and labour as necessary and required to completely install all sanitary fixtures, brass and chromium plated fittings and accessories as required by the drawings and specified hereinafter or given in the schedule of quantities.
- 1.2 Without restricting to the generally of the foregoing the sanitary fixtures shall include all sanitary fixtures, C.P. fittings and accessories etc. necessary and required for the building.
- 1.3 Whether specifically mentioned or not all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required.

2. GENERAL REQUIREMENTS

- 2.1 All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the schedule of quantities, specifications, drawings or not.
- 2.2 All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per architectural/interior designer's requirements. Wherever necessary the fittings shall centered to dimensions and pattern desired.
- 2.3 Fixing screws shall be half round head chromium plated brass with C.P. washers wherever required as per directions of Architect.
- 2.4 All fittings and fixtures shall be fixed in a neat workmanlike manner true to levels and heights shows on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good at contractors cost.
- 2.5 When directed, contractor shall install fixtures and accessories in a mock-up room for the approval of the Architect. Sample room fixtures may be reused on the works if undamaged, but no additional payment for fixing or dismantling shall be admissible.

3. INDIAN W.C.

- 3.1 Indian W.C. pan shall be Orissa pattern of size as specified in the schedule of quantities. Each W.C. shall be provided with a 100mm dia cast iron or porcelain P or S trap with or without vent horn.
- 3.2 W.C. shall be flushed by means of a C.I. high level flushing cistern or low level cistern of polyethylene body complete with accessories on an exposed or concealed type flush valve or as specified in bill of quantities.
- 3.3 The W.C. shall be fixed in level in a neat workmanlike manner. The W.C. and trap shall be set in cement concrete 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20mm nominal size). Joints between W.C. and flush pipe shall be made with a putty or white lead and linseed oil and caulked well or with an approved rubber joint.



4.0 ANGLO INDIAN W.C.

- 4.1 Anglo Indian W.C. shall be wash down type 'P' or 'S' Trap set.
- 4.2 Each Anglo Indian W.C. set shall be provided with a solid plastic seat with cover of colour given in the schedule of quantities, rubber buffers and chromium plated hinges.
- 4.3 Plastic seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C.
- 4.4 Each Anglo Indian W.C. shall be flushed with a porcelain flushing cistern or an exposed or concealed type flush valve. Flush pipe/bend shall be connected to the W.C. by means of a suitable rubber adapter.

5.0 EUROPEAN W.C.

- 5.1 European W.C. shall be wash down, single or double siphonic type, floor or wall mounted set, flushed by means of porcelain low level flushing cistern, or an exposed or concealed type flush valve, as specified in schedule of quantities. Flush pipe/bend shall be connected to the W.C. by means of suitable rubber adapter. Wall hung w.c. shall be supported by C.I. floor mounted chair.
- 5.2 Each W.C. seat shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C.

6.0 URINALS

- 6.1 Urinals shall be lipid type half shall white glazed vitreous China of approx. size 630x420x380mm size or as specified in bill of quantities.
- 6.2 Half stall Urinals shall be provided with 15mm dia C.P. spreader, 32mm dia C.P. domical waste and C.P. cast brass bottle trap with pipe and wall flange, and shall be fixed to wall by one C.I. bracket and two C.I. wall clips as recommended by manufacturers complete as directed by Architect.
- 6.3 Half stall urinals shall be fixed with C.P. brass screws and shall be provided with 32mm dia domical waste leading to urinals trap.
- 6.4 Urinals shall be flushed by means of automatic porcelain flushing cistern or exposed or concealed type urinal flush valve, as specified in schedule of quantities.
- 6.5 Flushing cistern for urinals shall be automatic type cast iron or vitreous china as given in the schedule of quantities. Each flushing cistern shall have a copper siphon and inlet noose cock to control the flow. Flushing cistern shall be fixed to wall with R.S. or C.I. brackets. Cast iron cistern and brackets shall be painted with two coats of white enamel paint. Cistern may be concealed in pipe shafts or false ceilings where required as directed by Architect.
- 6.6 Sensor for urinals shall be as given in the schedule of quantities.



- 6.7 Flush pipes of flushing cistern with sizes of main and branch flush pipes shall be as follows:

No. of Urinals in range	Capacity of cistern litres	Size of pipe	Size of main flush pipe	Size of branch flush pipe	Size of Connection to urinal
One	5	--	--	--	15
Two	10	20	--	--	15
Three	10	25	--	--	15

6.8 Alternatively, urinals may be flush with flush valves, exposed or concealed type.

6.9 Waste pipes for urinals shall be any one of the following:

- a). G.I. pipes
- b). Rigid P.V.C.
- c). Lead pipes.

Waste pipes may be exposed on wall or concealed in chase as directed by the Architect. Specifications for waste pipes shall be same as given in sub-section 8.0 to 10.0 section-II of Volume-II.

7.0 LAVATORY BASIN

7.1 Lavatory basins shall be white glazed vitreous china or polymarble of size, shape and type specified in the bill of quantities.

7.2 Each basin shall be provided with R.S. or C.I. brackets and clips and the basin securely fixed to wall. Placing of basins over the brackets without secure fixing shall not be accepted.

7.3 Each basin shall be provided with 32mm dia C.P. waste with overflow, pop-up waste or rubber plug and chain as given in the bill of quantities, 32mm dia C.P. Brass bottle trap with C.P. pipe to wall and flange.

7.4 Each basin shall be provided with fittings or mixing fitting as specified in the bill of quantities.

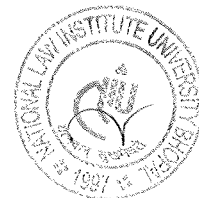
7.5 Basins shall be fixed at proper heights as shown on drawings. If height is not specified, the rim level shall be 79 cms above the floor or as directed by Architect.

8.0 SINKS

8.1 Sinks shall be of precast Terrazzo marble, or white glazed fireclay or vitreous china or stainless steel or any other material as specified in the schedule of quantities.

8.2 Each sink shall be provided with R.S. or C.I. brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable angle iron clips or brackets as recommended by the manufacturer. Each sink shall be provided with 40mm dia C.P. waste with chain and plug or P.V.C. waste. Fixing shall be done as directed by Architect.

8.3 Supply fittings for sinks shall be mixing fittings or C.P. taps as specified in the bill of quantities.



9.0 MIRRORS

- 9.1 Mirrors shall be electro coated copper 5.5mm thick of guaranteed reputed make. The size shall be as specified in the bill of quantities or shown on the drawings. The image shall be clear and without waviness at all angles of vision.
- 9.2 Mirrors shall be provided with backing of 12mm thick marine plywood sheet fixed with C.P. brass semi-round headed screws and cup washers or C.P. brass clamps as specified or instructed by Architect.

10.0 SHOWER SET

- 10.1 Shower set shall comprise of one/two C.P.Brass concealed stop cocks with two long body brass/C.P. brass bib cock, or bath spout or as given in the bill of quantities.
- 10.2 Each shower set shall also be provided with C.P. Shower arm with wall flange and shower head of approved quality as specified in the bill of quantities.
- 10.3 Concealed stop cocks shall be so fixed as to keep the wall flange clear off the finished wall. Wall flanges embedded in the finishing shall not be accepted.

11.0 ACCESSORIES

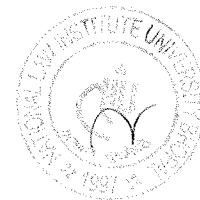
- 11.1 Contractor shall install all chromium plated and porcelain accessories as shown on the drawings or directed by Architect, and given in the bill of quantities.
- 11.2 All C.P. accessories shall be fixed with C.P. brass half round head screws and cup washers in wall with rawl plugs or nylon sleeves and shall include cutting and making good as required or directed buy Architect.
- 11.3 Porcelain accessories shall be fixed in walls and set in cement mortar 1:2 (1 cement: 2 coarse sand) and fixed in relation to the tiling work.

12.0 URINAL PARTITIONS

- 12.1 Urinal partitions shall be white glazed vitreous china or 25mm thick marble of size specified in the schedule of quantities.
- 12.2 Porcelain partitions shall be fixed at proper heights with C.P. brass bolts, anchor fasteners and M.S. clips as recommended by the manufacturer and directed by Architect.

13.0 MEASUREMENT

- 13.1 Rate for providing and fixing of sanitary fixtures accessories, urinal partitions shall include all items and operations stated in the respective specifications and bill of quantities and nothing extra is payable.
- 13.2 Rates for all items under specifications para above shall be inclusive of cutting holes and chases and making good the same, C.P. screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning.



SECTION-II

SOIL, WASTE & VENT PIPES

1.0 SCOPE OF WORK

- 1.1 Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes as required by the drawings, specified hereinafter and given in the bill of quantities.
- 1.2 Without restricting to the generally of the foregoing, the soil, waste, vent and rainwater pipes system shall include the followings:
- a). Vertical and horizontal soil, waste and vent pipes, rainwater pipes and fittings, joints clamps and connections to fixtures.
 - b). Connection of pipes to gully traps & manholes etc.
 - d). Waste pipes connections from all fixtures e.g. wash basin, sinks, urinals, kitchen equipments.
 - e). Testing of all pipes.

2.0 GENERAL REQUIREMENTS

- 2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of Architect.
- 2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- 2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.
- 2.4 Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified.
- 2.5 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.
- 2.6 All works shall be executed as directed by Architect.

3.0 CAST IRON PIPES & FITTINGS

- 3.1a) Soil, waste, vent anti-siphonage and rainwater pipes shall be cast iron pipes. All pipes shall be straight and smooth and inside free from irregular bore, blow holes, cracks and other manufacturing defects. Pipes shall be centrifugally spun iron soil pipes conforming to I.S.3989-1970, or sand cast I.S. 1729-1967.
- b). Standard weight, dimensions and pig lead required for joints shall be as follows:

For pipes conforming to I.S. 3989-1970 (Centrifugally spun soil pipes).



Nominal Diameter	Thickness	Overall	Internal Depth	Depth	
		weight	diameter of	of	
		6'length of socket	lead		
		or 1.83m			
INCH	MM	MM	KG	MM	MM

2	50	3.5	8.5	73	25
3	75	3.5	12.7	99	25
4	100	4.0	19.2	126	25
6	150	5.0	35.5	178	38

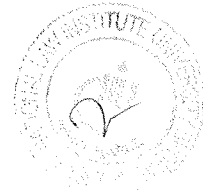
For conforming to I.S.1729-1967 (sand cast iron soil pipes and fittings)

Nominal Diameter		Thickness	Overall	Internal	Depth
			weight	diameter of	lead
			6'length	of socket	
			or 1.83m		
INCH	MM	MM	KG	MM	MM
2	50	5	11.41	76	25
3	75	5	16.52	101	25
4	100	5	21.67	129	25
6	150	5	31.91	181	38

c). Tolerance

Acceptable tolerance for pipes to I.S. 3989 and I.S. 1729 shall be as follows:

- a). Wall thickness -15%
- b). Length +20 mm
- c). Weight -10%



3.2 Fittings

- a). Fittings shall conform to the same Indian Standard as for matching contractor use pipes and fittings of matching specifications.
- b). Fittings shall be of the required degree of curvature with or without access doors.
- c). Access door shall be made up with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal later. The fixing shall be air water tight.

3.3 Fixing

- a). All vertical pipes shall be fixed by M.S. clamps truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard.)
- b). Horizontal pipes running along ceiling shall be fixed on structural adjustable clamps of special design shown on the drawings or as directed. Horizontal pipes shall be laid to uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.
- c). Contractor shall provide all sleeves, openings, hangers, inserts during the construction. He shall provide all necessary information to the building contractor for making such provisions in the structure as necessary. All damages shall be made good to restore the surface.

3.4 Cast Iron pipes for Drainage

- a). All drainage lines passing under , floors and roads, in exposed position above ground or at basement ceiling level shall be C.I. LA pipes position of such pipes shall be generally shown either on ground level drawings or ceiling of basement.
- b). Cast iron pipes shall be centrifugally spun iron pipes conforming to I.S:1536-1967. Quality certificates shall be furnished.

c). **Fittings and Inspection Chambers.**

- i). Fittings used for C.I. drainage pipe shall conform to I.S.1538-1967. Wherever possible junction from branch pipes shall be made by a 'Y-tee.'
- ii) Contractor shall provide cast iron inspection chamber at all junction as indicated on drawings or directed by architects inspection chambers shall be specially cast with inlet, outlet and branches of appropriate and required sizes. Branches shall be Y type wherever possible.
- iii) Cleanout plugs shall be provided on head of each drain and at location indicated on plans or directed by architects. Cleanout plugs shall be of size matching the

Laying

- i) All cast iron pipes and fittings shall be jointed with best quality soft pig lead. Which shall be free from impurities. In wet trenches joints shall be made from lead wool. Nothing extra will be paid for lead wool joints. Depth of pig lead and weight for joints shall be as given in sub section 3.1.2 of Section-II.
- ii) The spigot of pipe of fittings shall be centered in the adjoining socket by caulking. Sufficient turns of tarred gaskin will be given to leave unfilled the required depth of socket for depth of 45mm when the gaskin has been caulked tightly barrel and against the face of the socket. Molten pig lead shall then be poured to fill the remainder of the socket. This shall then be done in line pouring. The lead shall then be solidly caulked with suitable tools and hammers weighing not less than 2 Kg.
- iii) For lead wool joints the socket shall be caulked with tarred gaskin, as explained above. The lead wool shall be inserted into the sockets and tightly caulked home skein by skein with suitable tools and hammers of not less than 2 kg. weight until joint is filled.

Testing

All cast iron pipes for drainage shall be tested to a hydraulic test of 3 meter head. Test for straightness shall be same as for stoneware pipe given above. A test register shall be maintained which shall be signed and dated by contractor, and representative of architects.



4.0 CLAMPS

- 4.1 M.S. clamps shall be of standard design and fabricated from M.S. flat 40x3mm thick. They shall be painted with two coats of black bitumen paint before fixing.
- 4.2 Where M.S. clamps are to be fixed on RCC columns or slotted angles, walls or beam they shall be fixed with 40x3mm flat iron "U" type clamps with anchor fasteners of approved design or 6mm nuts and bolts.
- 4.3 Structural clamps shall be fabricated from M.S. structural members e.g. rods, angles, channels flats as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding material and paint the clamps with one coat of red oxide and two or more coats of black enamel paint. Wooden saddles, where required shall be provided free of cost.
- 4.4 Slotted angle/channel supports on walls shall be provided wherever shown on drawings. Angles/channels shall be of sizes shown on drawings or specified in bill of quantities; angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. The spacing of support bolts horizontally shall not exceed 1mm.
- 4.5 Wherever M.S. clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement and making good with cement concrete 1:2:4 mix as directed by the Architect.

5. TRAPS

5.1 Nahani Trap or Floor Traps

Nahni traps or floor traps shall be cast iron, deep seal with an effective seal of 50mm. The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:3 mix and extended to 40mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30x30 cms of the required depth.

5.2 Urinal Traps

Urinal traps shall be cast iron P or S trap with or without vent and set in cement concrete block specified in para above without extra charge.

5.3 Floor Trap Inlet

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, contractor shall provide a special type cast iron inlet hopper without or with one, two or three inlet sockets to receive the waste pipe. Joint between waste and hopper inlet socket shall be lead caulked joint. Hopper shall be connected to a C.I. P or S trap with at least 50mm seal (Hopper and traps shall be paid for separately.) Floor trap inlet hoppers and the traps shall be set in cement concrete blocks as specified in para above without extra charge.

5.4 C.P./Stainless Steel Gratings

Soil, waste vent and rainwater pipes shall be jointed with refined pig lead conforming to IS:27-1977. A sufficient skein or jute rope shall be caulked to leave a minimum space for the pig lead as given in sub-section 3.1.2 of section-II to be poured in. After pouring the lead shall be caulked into the joint with caulking tool and hammer. All surplus lead shall be cut and joint left flush with the rim of the socket neatly.

7.0 CLEANOUT PLUGS

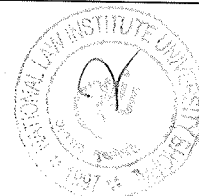
Contractor shall provide cast brass cleanout plugs as required. Cleanout plugs shall be threaded and provided with key holes for opening. Cleanout plugs shall be fixed to the pipe by a G.I. socket and lead caulked joint.

8.0 WASTE PIPE FROM APPLIANCES

8.1 Waste pipe from appliances e.g. wash basins, sinks, urinals, bathtubs, water coolers shall be of galvanized steel, lead or PVC as given in the bill of quantities or shown on the drawings.

8.2 All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:

	Vertical	Horizontal
G.I.Pipes	300 cms	240 cms
P.V.C.Pipes	180 cms	120 cms
Lead pipes	120 cms	120 cms



8.3 Galvanized pipes

Pipes shall be galvanized steel tubes conforming to IS:1239-1979 (medium class) and quality certificates shall be furnished. Pipes shall be provided with all required fittings e.g. tees, couplings, bends, elbows, unions, reducers, Nipples, plugs, all G.I. waste pipes shall be terminated at the point of connection with the appliances with an outlet of suitable diameter.

9.0 LEAD PIPES

- 9.1 Where specified lead pipes shall be used for wastes and connections to anti-siphonage pipes and W.C. connections.
- 9.2 Lead pipes shall be seamless drawn pipes conforming to IS:404 (part-I) 1977. Weight and wall thickness shall be as follows:

Nominal I/D	Wall thickness	Wt.kg / M
32mm	2.6	3.28
40mm	2.6	3.95
50mm	2.7	5.07
75mm	2.7	7.48
100mm	2.7	9.88

- 9.3 Lead pipes shall be straightened by wooden mandrel and bent to required shape by filling sand. Connection between appliances, stacks or traps shall be made with solder joints. Solder shall be 64% lead and 36% pure tin. All lead waste pipes in exposed positions shall be painted with one coat of red primer and two or more coats of synthetic enamel paint of approved quality and shade.

10. POLYTHENE PIPES

- 10.1 Where specified, polythene pipes shall be high density polythene pipes conforming to IS: 4984-78. The details of the nominal outer diameter, weight and working pressure at 20 °C shall be as per the above standards.
- 10.2 Polythene pipes may be cold bending to a radius of not less than eight times of their external diameter. Pipes bent for smaller radius may be made by hot bendings.
- 10.3 Fittings used for polythene pipes shall be compression moulded fittings matching to the above specifications.

10.4 Jointing

Jointing for polythene pipes shall be made by means of butt welding or detachable joints or flanged joints or screwed joints. The type of joints shall be used as per the site conditions. Where polythene pipes are used for rain water pipes the pipe will be finished with G.I. joint complete as directed by Architect.

- 10.5 All pipes shall be tested after installation for a pressure equal to twice the maximum working pressure in the line.

11.0 CEMENT CONCRETE

- 11.1 Cast iron soil and waste pipes under floors in sunken slabs and in wall chases (when cut specially for the pipe) shall be encased in cement concrete 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 12mm size) 75mm in bed and all round. When pipes are running well above the structural slab, the encased pipes shall be supported with suitable cement concrete pillars of required height and size at intervals as directed by Architect.

12.0 PAINTING

- 12.1 Soil, waste vent and rainwater pipes in exposed location, in shafts and pipe spaces shall be painted with two or more coats of synthetic enamel paint to give an even shade.
- 12.2 Paint shall be of approved quality and shade, where directed pipes shall be painted in accordance with approved pipe colour code.
- 12.3 Waste pipes in chase shall be painted with two coats of bitumen paint, covered with polythene tape and a final coat of bitumen paint. Exposed pipes shall be painted with two or more coats of synthetic enamel paint.
- 12.4 C.I. soil and waste pipes below ground and covered in cement concrete or lead pipes shall not be painted.



13.0 CUTTING AND MAKING GOOD

- 13.1 Pipes shall be fixed and tested as building proceeds. Contractor shall provide all necessary holes cutouts and chases in structural members as building work proceeds. Wherever holes are cut or left originally, they shall be made good with cement concrete 1:2:4 (cement: 2 coarse sand: 4 stone aggregate 20mm nominal size) or cement mortar 1:2 (1 cement: 2 coarse sand) and the surface restored as in original condition.

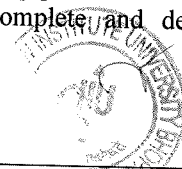
14.0 TESTING

- 14.1 Before use at site all C.I. soil pipes shall be tested by filling up with water for at least 10 minutes. After filling, pipes shall be struck with a hammer and inspected for blow holes and cracks. All defective pipes shall be rejected and removed from the site pipes shall be rejected and removed from the site within 48 hours. Pipes with minor sweating shall be accepted at the discretion of the Architect.
- 14.2 Pipes shall be tested after installation, by filling up the stack with water. All opening and connections shall be suitably plugged. The total head in the stack shall however not exceed 3M.
- 14.3 Alternatively contractor may test all soil and waste stacks by a smoke testing machine. Smoke shall be pumped into the stack after plugging all inlets and connections. The top end shall however be left open. The stack shall then be observed for leakiness and all defective pipes and fittings removed or repaired as directed by the Architect.
- 14.4 A test register shall be maintained and all entries shall be signed and dated by contractors and Architect.

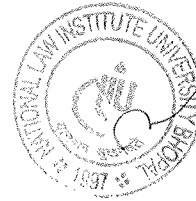
15.0 MEASUREMENTS

15.1 General

- a). Rates for all items quoted shall be inclusive of all work and items given in the above mentioned specifications and schedule of quantities and applicable for the work under floor in shafts or at ceiling level at all heights and depths.
- b). All rates are inclusive of cutting holes and chases in RCC and masonry work and making good the same.
- c). All rates are inclusive of pre testing and on site testing of the installations, materials and commissioning.
- 15.2 Pipes (Unit of measurement. Linear meter to the nearest centimeter).
- a). C.I. (L.A) pipes shall be measured along the centre line when fixed, correct to a centimeter including all fittings and lead caulked joints along its length.
- b). C.I. soil, waste vent and rainwater pipes shall be measured overall along the centre line correct to a centimeter including all fittings along its length. The rate for these pipes shall be inclusive of all fittings, holder bat clamps, lead caulked joints and all other items described in the schedule of quantities. Traps structural clamps and cement concrete shall however be paid separately under the relevant item.
- c). G.I., PVC polythene or lead pipes shall measured per running meter correct to a centimeter for the finished work, which shall include fittings e.g. Bends, Tees, Elbows, Reducers, Crosses, Sockets, Nipples and Nuts but exclude brass or gunmetal taps (cocks), valves lead connection pipes and shower rose. The length shall be taken along centre line of the pipes and fittings. All pipes and fittings shall be classified according to their diameter, method of jointing and fixing substance, quality and finish. The diameters shall be nominal diameter of internal bore. The pipes shall be described as including all cutting and waste. In case of fittings of unequal bore, the largest bore shall be measured.
- 15.3 Cement concrete around pipes shall be measured along the centre of the pipe line measured per linear meter and include any masonry supports, shuttering and centering cutting complete and described in the relevant specifications.



- 15.4 Slotted angles/channels shall be measured per linear meter of finished length and shall include support bolts and nuts embedded in masonry walls with cement concrete blocks and nothing extra will be paid for making good the same.
- 15.5 Painting: Painting of pipes shall be measured per running meter and shall be inclusive of all fittings and clamps. No deduction for fittings shall be made.
- 15.6 Structural clamps: Structural clamps and U clamps shall be paid for by weight per kg. rates shall be inclusive of all nuts, bolts, drilling, cutting, welding. Weight of clamps shall be calculated from the actual length used in structural members multiplied by its theoretical weight given in manufacturers catalogues. Weight of nuts, bolts, shall not be taken into account.
- 15.7 Excavation for soil pipes: No extra payment shall be admissible with respect to excavation, refilling and disposal of surplus earth for cast iron soil and waste pipes.



SECTION-III

EXCAVATION FOR PIPE LINE



1.0 EXCAVATION

The excavation for pipe works shall be open cutting unless the permission of the Architect for the ground to be tunneled is obtained in writing. Where sewers have to be constructed along narrow passages, the Architect may order the excavation to be made partly in tunnel and in such cases the excavated soil shall be brought back later on for refilling the trenches or tunnel.

1.2 Opening out Trenches

In excavation the trenches, etc. the solid road metal ling, pavement, curbing etc. and turf is to be placed on one side and preserved for reinstatement when the trenches or other excavation shall be filled up. Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Architect and of the owners of the roads or other property traversed and the contractor shall not cut out or break down any live fence of trees in the line of the proposed works but shall tunnel under them, unless the Architect shall order to the contrary.

The contractor shall grub up and clear the surface over the trenches and other excavations of all trees, stumps roots and all other encumbrances affecting execution of the work and shall remove them from the site to the approval of the Architect.

1.3 Obstruction of Roads

The contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and sufficient space shall then be left for public and private transit, he shall remove the materials excavated and bring them back again when the trench is required to be refilled. The contractor shall obtain the consent of the Architect in writing before closing any road to vehicular traffic and the foot walks must be clear at all times.

1.4 Removal of Filth

All night soil, filth or any other offensive matter met with during the execution of the works, immediately after it is taken out of any trench, sewer or cess pool, shall not be deposited on to the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall be at once put into the carts and removed to a suitable place to be provided by the contractor.

1.5 Excavation to be taken to proper Depths

The trenches shall be excavated to such a depth that the pipes shall rest on concrete or on firm bedding as described in the several clauses relating these to so that the inverts may be at the levels given in the sections. In bad ground, the Architect may order the contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of the sewers with concrete, broken stone, gravel or other materials. For such extra excavation and concrete, broken stone, gravel or other materials, the contractor shall be paid extra at rates laid down for such works in the schedule, if the rates laid down for such works in the schedule, if the extra work was ordered by the Architect in writing, but if the contractor should excavate the trench to a greater depth than is required without a specific order to that effect in writing of the Architect the extra depth shall have to be filled up with concrete 1:5:10 mix at the contractors own cost and charges to the requirements and satisfactions of the Architect.

1.6 Refilling

After the pipes or other work has been laid and proved to be water tight, the trench or other excavations shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to the sewer and other permanent work. The filling in the haunches and up to 75 cms above the crown of the sewer shall consist of the finest selected materials placed carefully in 15 cms layers and flooded and consolidated. After this has been laid, the trench and other excavation shall be refilled carefully in 15 cms layers with materials taken from the excavation, each layer being watered to assist in the consolidation unless the Architect shall otherwise direct.

1.7 Contractor to restore settlement and damages.

The contractor shall, at his own costs and charges, make good promptly during the whole period the works are in hand, any settlement that may occur in the surfaces of roads, berms, footpaths, gardens, open spaces etc. Whether public or private caused by his trenches or by his other excavations and he shall be liable for any accidents caused thereby. He shall also, at his own expenses and charges, repair and make good and damage done to buildings and other property. If in the opinion of the Architect he fails to make good such works with all practicable dispatch, the Architect shall be at liberty to get the work done by the contractor or deducted from any money that may be or become due to him or recovered from him in any other manner according to the law of the land.

1.8 Disposal of Surplus Soil

The contractor shall at his own cost and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled the surplus soil shall be immediately removed, the surface properly restored and roadways and sides left clear.

1.9 Timbering of Sewer and Trenches

- a). The contractor shall at all times support efficiently and effectively the sides of the sewer trenches and other excavations by suitable timbering, piling and sheeting and they shall be close, timbered in loose or sandy strata and below the surface of the sub soil water level.
- b). All timbering, sheeting and piling with their walling and supports shall be of adequate dimensions and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place.
- c). The contractor shall be held responsible and will be accountable for the sufficiency of all timbering, branches, sheeting and piling used as also for all damage to persons and property resulting from improper quality, strength, placing, maintaining or removing of the same.

1.9 Shoring of buildings

The contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damages to persons or property resulting from any accident.

1.10 Removal of water from Sewer, Trench etc.

The contractor shall at all times during the progress of the work keep the trenches and excavations free from water which shall be disposed of by him in manner as will neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surface of any roads or streets, nor cause any interference with the use of the same by the public.

1.11 Width and Depth of Trench

The Architect shall have power by giving an order in writing to the contractor to increase the maximum width in respect of which payment will be allowed for excavation in trenches for various classes of sewer, manholes, and other works in certain lengths to be specifically laid down by him, where on account of bad ground or other unusual conditions, he considers that such increase widths are necessary in view of the site conditions.

2.0 MEASUREMENTS

2.1 Excavation

Measurement for excavation of pipe trenches shall be made per linear meter under the respective category of soil classification encountered at site.

- a). ordinary soil
- b). Hard soil (Hard moorum & soft rock)



- c). Hard rock required chiseling
 - d). Hard rock requiring blasting
 - i). Trenches shall be measured between outside walls of manholes at top and the depth shall be the average depth between the two ends to the nearest cm. The rate quoted shall be for a depth up to 1.5m or as given in the bill of quantities.
 - ii). Payment for trenches more than 1.5m in depth shall be made separately and as given in bill of quantities.
- 2.2 Refilling, consolidation and Disposal of Surplus earth

Rate quoted for Excavation of trenches shall be inclusive of refilling consolidation and disposal of surplus earth within a lead of 50m. No separate payment for refilling shall be made.



SECTION-IV

WATER SUPPLY

1.0 SCOPE OF WORK

- 1.1 Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the bill of quantities.
- 1.2 Without restricting to the generality of the foregoing, the water supply system shall include the following:-
- All water lines to different parts of building and making connection from source etc.
 - Pipe protection and painting
 - Providing hot water system and insulation of hot water pipe lines, wherever required.
 - Control valves, masonry chambers and other appurtenances.
 - Connections to all plumbing fixtures, kitchen equipment, tanks and appliances.
 - Excavation and refilling of pipe trenches, wherever necessary.



2.0 GENERAL REQUIREMENTS

- 2.1 All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Architect.
- 2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- 2.3 Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections.
As far as possible all bends shall be formed by means of a hydraulic pipe bending machine for pipes up to 65mm dia.
- 2.4 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passage etc.
- 2.5 Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified.
- 2.6 Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

3.0 G.I.PIPES, FITTINGS & VALVES

- 3.1 All pipes inside the buildings and where specified, outside the building shall be galvanized steel tubes conforming to I.S. 1239-1979 of class specified. When class is not specified they shall be medium class.
- 3.2 Fittings shall be malleable iron galvanized fittings, of approved make. All fittings shall have manufacturer's trade mark stamped on it. Fittings for G.I.pipes shall include couplings, bends, tees, reducers, nipples, unions, bushes. Fittings shall be of I.S. : 1879 - (Part I to X) 1975.
- 3.3.1 Pipes and fittings shall be jointed with screwed fittings care shall be taken to remove burr from the end of the pipe after cutting by a round file. Genuine red lead with grumet and a few strands of fine hemp shall be applied. All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. G.I. pipes inside toilets shall be fixed in wall chases well above the floor. No pipes shall be run inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors and other as shown on drawings.

4.0 S.S.PIPES, FITTINGS & VALVES.

All pipes for process piping works shall be SS-316 press fittings as per European Standards and as per detailed specifications. conforming to EN 10312 Material No.1.4401(X5 CrNiMo 17-12-2) with 2.3% Mo(S.S.Grade-316) ,complete with Press Type fittings Make- Viega Sanpress Inox Material No.1.4408 suitable for doubly secure pressing (two pressings simultaneously- one in front of the crimp and one behind it) for torsion proof and

longitudinally force locked connection with Black; EPDM Sealing Element with SC-Contur in accordance with DVGW regulation W534, DW 8501 BL 0551, DW 8511 BQ 0245) for Hot and Cold water supply capable to withstand temperature up to 110 degree centigrade and working pressure 16 bar, such as sockets, bends, elbows, tees, reducers, unions, Flanges etc.

5.0 COPPER PIPES, FITTINGS & VALVES.

copper pipes confirming to BS:EN 1057 (Make- Mexflow) complete with Press Type fittings Make- Viega Profipress suitable for doubly secure pressing (two pressings simultaneously– one in front of the crimp and one behind it) for torsion proof and longitudinally force locked connection. with Black; EPDM Sealing Element with SC-Contur in accordance with DVGW regulation W534,DVGW-Reg.-Nr.DW 8511 AP 3139 and DVGW-Reg.-Nr.DW 8511 AT 2347 for Hot and Cold water supply capable to withstand temperature up to 110 degree centigrade and working pressure 16 bar, such as sockets, bends, elbows, tees, reducers, unions, Flanges etc. necessary adapters for GI/Copper and CP fittings. Clamps with hanger at a spacing as required , jointing, sundries, cutting holes in walls/floors/slabs & making good complete.

6.0 CLAMPS

- 4.1 S.S. clamps shall be of standard design and fabricated from S.S. flat 40x3mm thick.
- 4.2 Where S.S. clamps are to be fixed on RCC columns or slotted angles, walls or beam they shall be fixed with 40x3mm S.S "U" type clamps with anchor fasteners of approved design or 6mm nuts and bolts.
- 4.3 Structural clamps shall be fabricated from S.S. structural members e.g. rods, angles, channels flats as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding material Wooden saddles, where required shall be provided free of cost.
- 4.4 Slotted angle/channel supports on walls shall be provided wherever shown on drawings. Angles/channels shall be of sizes shown on drawings or specified in bill of quantities; angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasters. The spacing of support bolts horizontally shall not exceed 1mm.
- 4.5 Wherever S.S. clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement and making good with cement concrete 1:2:4 mix as directed by the Architect.
- 4.6 G.I. pipes in shafts and other locations shall be supported by M.S. clamps of design approved by Architect. Pipe in wall chases shall be anchored by iron hooks. Pipes at ceiling level shall be supported on structural clamps fabricated from M.S. structural as described in section II. Pipes in typical shafts shall be supported on slotted angles / channels as specified elsewhere.



7.0 UNIONS

Contractor shall provide adequate number of unions on all pipes to enable dismantling later. Unions shall be provided near each gunmetal valve, stop cocks, or check valves and on straight runs as necessary at appropriate locations as required and / or directed by Architect.

8.0 FLANGES

Flanged connections shall be provided on pipes where shown on the drawings, all equipment connections as necessary and required or as directed by Architect. Connections shall be made with 3 mm thick insertion rubber washer. Where hot water or steam connections are made insertion gasket shall be or suitable high temperature grade and quality approved by Architect. Bolt hole dia for flanges shall conform to match the specification for C.I. sluice valve to I.S. 780.

9.0 TRENCHES

All G.I. pipes below ground laid in trenches shall have a minimum cover of 60 cms. Excavation for trenches shall be done as specified under section - III but the width and depth of the trenches shall be as follows :-

Dia of pipe	Width of trench	Depth of trench
15mm to 50mm	30 cms	45 cms
65mm to 100mm	45 cms	75 cms

Where specified in the bill of quantities all G.I. pipes in trenches shall be protected with fine sand, 15 cms thick layer all-round before filling in the trenches.

10.0 PAINTING

All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality. Pipes shall be painted to standard colour code specified by Architect.

10.2 All pipes in chases and below floor shall be painted with two or more coats of anti-corrosive bitumen paint.

11. PIPE PROTECTION

11.1 Where specified in the bill of quantities all pipes below ground shall be protected against corrosion by two coats bitumastic paint, wrapping with polythene tape and then applying a final coat of bitumastic paint.

12.0 H.D.P.E. THREADED PIPES

12.1 The H.D.P.E. pipes shall be of threaded type of G.I. standard i.e. Having specifications equivalent to G.I. of IS: 1239 medium class.

12.2 The H.D.P.E. pipe shall conform to pressure rating of 10 Kg./Sq. cm shall only be used for internal cold water supply in the building.

12.3 All other specifications for laying and jointing shall conform to as that G.I. pipes including for fittings etc., except No pipe protection is required in this case as specified in para 9.1, 9.2 and 10.1.

13.0 GUNMETAL VALVES

13.1 Valves 65mm dia and below shall be heavy gunmetal fullway valves or globe valves conforming to I.S. 778-1971 20 Kg/Sq.cm class. Valves shall be tested at manufacturer's works and the same stamped on it.

13.2 All valves shall be approved by the Architect before they are allowed to be used on work.

14.0 SLUICE VALVES

14.1 All valves 80mm dia and above shall be C.I. double flanged sluice valves. Sluice valves shall be cast iron double flanged, with rising spindle. Each sluice valve shall be provided with wheel for valves in exposed positions and cap top for underground valves. Contractor shall provide suitable operating keys for sluice valves with cap tops.

14.2 Sluice valves shall be of best quality conforming to I.S.780-1969 of class specified.

15.0 TESTING

15.1 All pipes, fittings and valves shall be tested by hydrostatic pressure of 7Kg/Sq.cm.

Pressure shall be maintained for a period of 30 minutes without any drop in pressure after fixing at site.

A test register shall be maintained and all entries shall be signed and dated by contractor(s) and Architect.

15.2 In addition to the sectional testing carried out during the construction, contractor shall test entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages, and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings to the building, furniture and fixtures shall be made good by the contractor during the defects liability period without any cost.

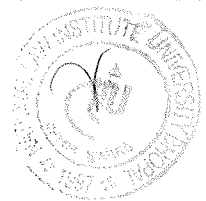
15.3 After commissioning of the water supply system, contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above.

16.0 INSULATION

16.1 Magnesia Insulation:

Hot water pipes fixed in chase shall be insulated by wrapping 6mm thick asbestos rope dipped in 85% magnesia solution around the pipes and finished with a coat of 1:3 cement plaster mixed with rapid hardening cement.

- 16.2 External hot water pipes laid in shafts, exposed on terrace along ceiling level and trenches shall be insulated with resin bonded, rock wool, pre-formed pipe sections as follows:
- 16.2.1 Cleaning the pipe surface to be insulated to make it free from dust and oil
 - 16.2.2 Applying a layer of zinc chromate / anti-rust Japanese primer.
 - 16.2.3 Fixing resin bonded rock wool preformed pipe section of app. density 144 Kg. Cu.m.
 - 16.2.4 Covering it all-round with 24 gauge x 3/4" wire netting with proper butt joint and tightly wrapped.
 - 16.2.5 Applying tow layers of 6mm thick each cement plaster in the ratio of 1:4 (1 cement: 4 fine sand)
 - 16.2.6 Applying weather-proofing coating of insulkote or of approved material over the cement plaster.
- 17.0 CAST IRON PIPES :**
- 17.1 Pipes for water supply mains shall be cast iron pipes shall be centrifugally spun iron pipes class LA conforming to I.S.1536. Quality certificates shall be furnished.
 - 17.2 Fittings and Inspection Chambers.
Fittings used for C.I. drainage pipe shall conform to I.S.1538-1967. Whenever possible junctions from branch pipes shall be made by a 'Y-tee'.
 - 17.3 Anchor Block
Suitable anchor blocks shall be provided at all bends and tees to encounter the excessive thrust developed due to water hammer.
 - 17.4 Rubber Joints
Joints between two pipes shall be made by premoulded rubber joints with suitable tackles in a manner recommended and approved by the manufacturer. No joints shall be covered until the lines are hydraulically tested.
 - 17.5 Lead caulked joints :
 - a) Joints between pipes and C.I. fittings shall be made with refined pig lead. The spigot of the pipe shall be centered in the adjoining socket by caulking sufficient turns of tarred gaskin which will be caulked into the joint to leave a depth of 45mm for pig lead. Molten pig lead shall then be poured into the joint in one pouring. The lead shall then be solidly caulked with suitable tools and hammers.
 - b) Contractor may used lead wool joints in wet trench conditions. No additional payment for lead wool joints be admissible.
- 18.0 VALVES:**
- 18.1 Sluice Valves:
 - a) Sluice valves shall be socketed type or double flanged type conforming to I.S.780.
 - b) Joints for socketed valves shall be lead caulked joints as specified above.
 - c) Joints for double flanged sluice valves shall be made with suitable tail / socket pieces on the pipe line and flanges joints made with 3mm thick insertion rubber gasket with appropriate number of bolts, nuts and washers.
 - d) Sluice valves shall be installed at all branches and as shown on the drawings.



18.2 Scour Valves:

Scour valves shall be C.I. sluice valves as specified above. They shall be installed at the lowest level or tail end of the apten as shown on drawings and directed by Architect.

18.3 Air Valves

- a) Air valves shall be single acting type air valves with cast iron body and bronze / gunmetal internal parts and plastic float.
- b) Each air valve shall be provided with a cast iron isolating sluice valve of specification given above.

19.0 FIRE HYDRANTS :

19.1 Fire hydrants shall be cast iron stand post type with 63mm dia instantaneous gunmetal outlets conforming to I.S.908.

19.2 Each fire hydrant shall be provided with a 80mm cast iron sluice valve, duct foot bend and a suitable 63mm dia flanged cast iron pipe for correcting the installation height of the hydrant.

20.0 VALVE CHAMBERS

Contractor shall provide suitable brick masonry chambers in cement mortar 1:5 (1 cement : 5 coarse sand) on cement concrete foundations 150mm thick 1:5:10 mix (1 cement : 5 fine sand : 10 graded stone aggregate 40mm nominal size) 15mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back filling complete. Valve chambers shall be of following sizes :

For depths 90 cms

60 x 60 cms

For depths unto 100 cms beyond

120 x 120 cms



21.0 TESTING

21.1 All pipes, fittings and valves shall be tested by hydrostatic pressure of 7 kg/sq.m. Pressure shall be maintained of a period of at least two hours without appreciable drop in the pressure after fixing at site. (±10 %).

A test register shall be maintained and all entries shall be signed and dated by contractor(s) and Architect.

21.2 In addition to the sectional testing carried out during the construction, contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages, and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and fixtures shall be made good during the defects liability period without any extra cost.

21.3 After completion of the water supply system, contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves which do not effectively operate shall be replaced by new ones at no extra cost and the same shall be tested as above.

22.0 MEASUREMENT :

22.1 Pipes :

Pipes shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. couplings, tees, bends, elbows, unions, deduction for valves shall be made, cutting holes chases and making good the same and all items mentioned in the specifications and bill of quantities.

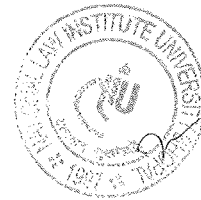
22.2 Gunmetal and cast iron valves shall be measured by numbers.

- 22.3 Single flanges shall be measured by numbers (per single flange) and shall include bolts,, nuts, washers and 3mm thick rubber gasket complete.
- 22.4 Pair of flanges shall be measured by number of pairs and shall include bolts, nuts, washers, and 3mm thick rubber gasket complete.
- 22.5 **Making Connections**
Making connections to pumps, equipment, heat exchangers and appliances shall be paid by number and shall include the labour and fixing arrangement for each connections. Flanges, pipes and valves for connections shall be paid for separately under the relevant items. No payment under this item shall be admissible for making connections to R.C.C. under ground tanks.
- 22.6 **Insulation :**
Insulation for hot water pipes shall be measured per linear metre (to the nearest cm) along the centre line of pipe and shall be measured over all fittings and flanges. No separate or additional payment shall be made for insulation of bends, tees, flanges or other fittings and valves. The rate shall include all items specified in the bill of quantities and given in the specifications.
- 22.7 Aluminium cladding shall be measured by square meter area of the finished surface. The rate shall be inclusive of all items given in the schedule of quantities.
- 22.8 **Painting**
Painting for pipes and over insulation shall be measured per linear meter over finished surface and shall include all valves and fittings for which no deduction shall be made.
- 23.0 DISINFECTION**
- 23.1 After completion of the work contractor shall flush clean the entire system with the city's filtered water after connection has been made.
- 23.2 After the first flushing, add commercial bleaching powder or achieve a dosage of 2 to 3mg/1 of water in the system added and flushed. This operation should be performed twice to ensure that the system is fully disinfected and usable.
- 24.0 PRE COMMISSIONING:**
- 24.1 Ensure that all pipes are free from debris and obstructions.
- 24.2 Check all valves and fire hydrant for effective opening and closing action. Defects should be rectified or valves replaced.
- 24.3 Ensure that all connections to branches have been made.
- 24.4 Ensure that mains have been connected to the respective pumps, underground and overhead tanks.
- 24.5 Water supply should be available at main underground tank.
- 24.6 All main line valves should be closed.
- 25.0 COMMISSIONING:**
- 25.1 Fill underground tank with water. Add 1 Kg fresh bleaching powder after making a solution to be added near inlet.
- 25.2 Start water supply pump and allow water to fill main underground tank. Water will first fill the fire tank and then overflow to the domestic tanks.
- 25.3 After filling overhead reservoir drain the same to its one forth capacity through tank scour valve. (This is to ensure removal of all mud, debris etc. from the tank).
- 25.3 Fill overhead tank to full.
- 25.5 Release water in the main lines by opening valves in each circuit. Drain out water in the system through system scour valves or fire hydrant in lower regions. Ensure clean water is now coming out of the system.

- 25.6 Open valves for individual clusters. Observe for leakages or malfunctions, check pressure and flow at end of line by opening hydrants etc. Remove and rectify defects notice.
- 25.7 Check all fire hydrants for proper operation by opening each valve and allowing water to flow for a few minutes. Also check for effective closure of valve.
- 25.8 The entire water supply system should be disinfected with bleaching powder and system flush cleaned.
- 25.9 Send four samples of water drawn from four extreme locations for testing for bacteriological test in sterilized bottles obtained from the concerned laboratory. (Laboratory personal may collect the samples themselves).

26.0 RESPONSIBILITY:

Responsibility for various activities in precommissioning and commissioning procedures will rest with the contractors.



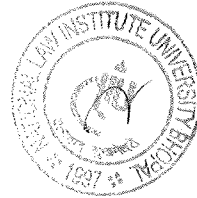
SECTION-V

SEWERAGE / DRAINAGE SYSTEM

1.0 SCOPE OF WORK

- 1.1 Work under this section shall consist of furnishing all labour, materials, equipments and appliances necessary and required to completely finish sewerage/drainage system as required by the drawings and specified hereinafter or given in the bill of quantities.
- 1.2 Without restricting to the generality of the foregoing, the sewerage system shall include :

- a) Internal/external sewer line.
- b) Excavations including refilling etc.
- c) Construction of collection chambers, manholes and drop connections.
- d) Construction of grease trap etc.,
- e) Construction of septic tanks and connection to external sewer line.
- f) Storm water drainage and disposal



2.0 GENERAL REQUIREMENTS.

- 2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of the Architect.
- 2.2 Drainage lines shall be laid to the required gradients and profiles.
- 2.3 All drainage work shall be done in accordance with the local municipal bye-laws.
- 2.4 Location of all manholes, catch basins etc., shall be got confirmed from the contractor from the Architect before the actual execution of work at site.
- 2.5 All works shall be executed as directed by Architect.

3.0 ALIGNMENT AND GRADE

The sewer pipes shall be laid to alignment and gradient shall be permitted except by the express direction in writing of the Architect.

4.0 SALT GLAZED STONEWARE PIPES

- 4.1 Stoneware pipes shall be of first class quality salt glazed and free from rough texture inside or outside and straight. All pipes shall have the manufacturers name marked on it and shall comply to IS:651-1971 approved makes (PERFECT or BURN).
- 4.2 Laying and jointing of Stoneware Salt Glazed Pipes.
- a) Pipes are liable to be damaged in transit and not withstanding tests that may have been made before dispatch each pipe shall be examined carefully on arrival at site. Each pipe shall be rung with a wooden hammer or mallet and those that do not ring true and clear shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes should be segregated, marked in a conspicuous manner and their use in the works prevented.
 - b) The pipe shall be laid with sockets leading uphill and should rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the pipe joiner room to work right round the pipe and as short as practicable to admit the socket and allow the joint to be made.
 - c) Where pipes are not bedded on concrete the trench bottom shall be left slightly high and carefully bottomed up as pipe laying proceeds so that the pipe barrels rest on firm ground. If excavation has been carried too low it shall be made up with cement concrete 1:5:10 mix at the contractor's cost and charges.

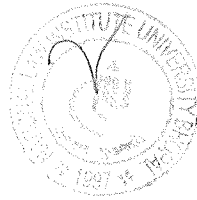
- d) If the bottom of the trench consists of rock or very hard ground that cannot be easily excavated to a smooth surface, the pipes shall be laid on cement concrete bed of 1:5:10 mix to ensure even bearing.

4.3 Jointing of Pipes

- a) Tared gaskin shall first be wrapped round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid, the pipe shall then be adjusted and fixed in its correct position and the gaskin caulked tightly home so as to fill not more than one quarter of the total length of the socket.
- b) The remainder of the socket shall be filled with stiff mix of cement mortar (1 cement: 1 clear sharp washed sand). When the socket is filled, a fillet should be formed round the joint with a trowel forming an angle of 45 degrees with the barrel of the pipe. The mortar shall be beaten up and used after it has begun to set.
- b) After the joint has been made any extraneous materials shall be removed from inside of the joint with a suitable scraper or "Badger". The newly made joints shall be protected until set from the sun, drying winds, rain or dust. Sacking or other materials which can be kept damp shall be used. The joints shall be exposed and space left all round the pipes for inspection by the Architect. The inside of the sewer must be left absolutely clear in bore and free from cement mortar or other obstructions throughout its entire length, and shall efficiently drain and discharge.

4.4 Testing

- a) All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole. All pipes shall be subjected to a test pressure of at least 1.5 meter head of water. The test pressure shall, however, not exceed 1.5 meter head at any point. The pipes shall be plugged preferably with standard design rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.
- b) Sewer lines shall be tested for straightness by :
- (i) Inserting a smooth ball 12mm less than the internal diameter of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball should roll down the invent of the pipe and emerge at the lower end.
- (ii) Means of a mirror at one end and a lamp at the other end. If the pipe line is straight the full circle of light will be seen otherwise obstruction of deviation will be apparent.
- c) The contractor shall give a smoke test to the drains and sewer at his own expense and charges. if directed by the Architect.
- d) A test register shall be maintained which shall be signed and dated by contractor, Architect and representative of architects.



5.0 GULLY TRAPS

- 5.1. Gully traps shall be of the same quality as described for stoneware pipes in clause 4.
- 5.2. Gully traps shall be fixed in cement concrete 1:5:10 mix (1 cement : 5 coarse sand : 10 stone aggregate 40mm nominal size) and a brick masonry chamber 30x30 cms inside in cement mortar 1:5 with 15x15 cms grating inside and 30x30 cms C.I. sealed cover and frame weighting not less than 7.3 kg to be constructed as per standard drawing. Where necessary, sealed cover shall be replaced with C.I. grating of the same size.

6.0 REINFORCED CEMENT CONCRETE PIPES

- 6.1. All underground storm water drainage pipes and sewer lines where specified (Other than those specified cast iron) shall be centrifugally spun RCC pipes of specified class. Pipes shall be true and straight with uniform bore. Throughout cracked, warped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the contractor shall produce, when directed a certificate to that effect from the manufacturer.
- 6.2. Laying
R.C.C. spun pipes shall be laid on cement concrete bed or cradles as specified and shown on the detailed drawings the cradles may be precast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12mm below the invert level of the pipe properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and bonding rods etc. cradles or concrete bed may be omitted, if directed by the Architect.
- 6.3. Jointing
After setting out the pipes the collars shall be centered over the joint and filled in with tarred gaskin, so that sufficient space is left on either side of the collar to receive the mortar. The space shall then be filled with cement mortar 1:2 (1 cement : 2 fine sand) and caulked by means of proper tools all joints shall be finished at an angle of 45 degree to the longitudinal axis of the pipe on both side of the collars neatly.
- 6.4. Testing
All pipes shall be tested to a Hydraulic test of 1.5m head for at least 50 minutes at the highest point in the section under test. Test shall also be carried out similar to those for stoneware pipes given above. The smoke test shall be carried out by the contractor, if directed by the Architect, at the expense and charges of the contractor. A test register shall be maintained which shall be signed and dated by contractor / Architect and representative of Architect.
- ## 7.0 CAST IRON PIPES FOR DRAINAGE
- 7.1. All drainage lines passing under building, floors and roads with heavy traffic, in exposed position above ground e.g. service floor and basement ceiling shall be cast iron pipes. Position of such pipes shall generally be shown on the drawings.
- 7.2. Cast iron pipes shall be centrifugally spun iron pipes conforming to IS:1536-1967. Quality certificates shall be furnished.
- 7.3. Fittings and Inspection Chambers
- a) Fittings used for C.I. drainage pipes shall conform to IS:1538-1967. Wherever possible junction from branch pipes shall be made by a 'Y tee'.
- b) Clean out plugs shall be provided on head of each drain and at location indicated on plans or directed by Architect. Clean out plugs shall be of size matching the full bore of the pipe. Plugs shall be made out with G.I. coupling caulked into the socket of the pipe or fittings. The end shall be provided with a brass screwed plug with suitable key for opening.
- 7.4. Laying
- a) All cast iron pipes and fittings shall be jointed with best quality soft pig lead (conforming to IS:27-1977) which shall be free from impurities. In wet trenches joints shall be made from lead wool. Nothing extra will be paid for lead wool joints. Depth of pig lead and weight for joints shall be as given in I.S.code.
- b) The spigot of pipe or fittings shall be centered in the adjoining socket by caulking. Sufficient turn of tarred gaskin to leave unfilled the required depth of socket for depth of 45mm when the gaskin has been caulked tightly home. Jointing ring shall be placed round the barrel and against then be poured to fill the

remainder of the socket. This shall then be done in one pouring. The lead shall be solidly caulked with suitable tools and hammers weighting not less than 2 kg.

- c) For lead wool joints the socket shall be caulked with tarred gaskin, as explained above. The lead wool shall be inserted into the sockets and tightly caulked home skein by skein with suitable tools and hammers of not less than 2 kg weight until joint as filled.

7.5 Testing

All cast iron pipes for drainage shall be tested to a hydraulic test of 3 meter head. Test for straightness shall be same as for stoneware pipe given above. A test register shall be maintained which shall be signed and dated by contractor and representative of Architect.

8.0 CEMENT CONCRETE AND MASONRY WORKS (FOR MANHOLES AND CHAMBERS ETC.)

8.1 Materials

- a) **WATER** : Water used for all the construction purposes shall be clear and free from oil, acid, alkali, organic and other harmful matters, which deteriorate the strength and / or durability of the structure. In general, the water suitable for drinking purposes shall be considered good enough for construction purposes.
- b) **AGGREGATE FOR CONCRETE** : The aggregate for concrete shall be in accordance with I.S.383 and I.S. 515 in general, these shall be free from all impurities that may cause corrosion of the reinforcement. Before actual use these shall be washed in water, if required as per the direction of Architect. The size of the coarse aggregate shall be done as per I.S.383.
- c) **SAND** : Sand for various construction purposes shall comply in all respects with I.S.650 and I.S.2116. It shall be clean, coarse hard and strong, sharp, durable, uncoated, free from any mixture of clay, dust, vegetable matters, mica, iron impurities soft or flaky and elongated particles, alkali, organic matters, salt, loam and other impurities which may be considered by Architect as harmful for the construction.
- d) **CEMENT** : The cement used for all the constructional purposes shall be ordinary Portland cement or rapid hardening Portland cement conforming to I.S.8112.
- e) **MILD STEEL REINFORCEMENT** : The mild steel for the reinforcement bars shall be in the form of round bars conforming to all requirements of I.S. 432 (Grade - I).
- f) **BRICKS** : Bricks shall have uniform colour, thoroughly burnt but not over burnt, shall have plan rectangular faces with parallel sides and sharp right angled edges. They should give ringing sound when struck. Brick shall not absorb more than 20% to 22% of water, when immersed in water for 24 hours. Bricks to be used shall be approved by the Architect.
- g) **OTHER MATERIALS** : Other materials not fully specified in these specifications and which may be required in the work shall conform to the latest I.S. All such materials shall be approved by the Architect before use.

8.2 Cement Concrete (Plain or Reinforced)

- a) Cement concrete pipes bedding, cradles, foundations and RCC slabs for all works shall be mixed by a mechanical mixer where quantities of the concrete poured at one time permit. Hand mixing on properly constructed platforms may be allowed for small quantities by the Architect. Rate for cement concrete shall be inclusive of all shuttering and centering at all depth and heights.
- b) Concrete work shall be of such thickness and mix as given in the schedule of quantities.
- c) All concrete work shall be cured for a period of atleast 7 days. Such work shall be kept moist by means of gunny bass at all times. All pipe trenches and foundations shall be kept dry during the curing period.

8.3 Masonry Work

Masonry work for manholes, chambers, brick masonry pipe trench and such other works as required shall be constructed from 1st class bricks or 2nd class as specified in the bill of quantities in cement mortar 1:5 mix (1 cement : 5 coarse sand). All joints shall be properly raked to receive plaster.

8.4 Cement Concrete for Pipe Support

- a) Wherever specified or shown on the drawing, all pipes shall be supported in bed all round or in haunches. The thickness and mix of the concrete shall be given in the bill of quantities. Width of the bedding shall be as described in para 'B' of sub-section 8.4 specifications.
- b) Unless otherwise directed by the Architect cement concrete for bed, all round or in haunches shall be laid as follows :-

	Upto 1.5m depth	Upto 3 M depth	Beyond 3 M depth
Stoneware pipes in open ground	All round (1:4:8)	In Haunches (1:4:8)	All round (1:4:8)
RCC Pipes (all) in open ground water condition	All round (1:4:8)	All round (1:4:8)	All round (1:4:8)
RCC pipes	All round (1:4:8)	In Haunches (1:4:8) or as specified	In Haunches (1:4:8) or as specified
SW / RCC pipes or C. I. Pipes under the building or at road crossing or under public places	All round (1:4:8)	All round (1:4:8)	All round (1:4:8)

Building (1=1 cement, 3-5 coarse sand, 6-10 stone aggregate 40mm nominal size)

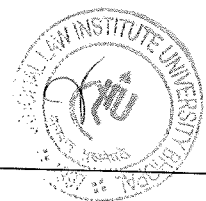
- c) R.C.C. pipes or C.I. pipes, may be supported on brick masonry or precast R.C.C. or Cast in situ cradles. Cradles shall be as shown on the drawings.
- d) Pipes in loose soil or above ground shall be supported on brick or RCC anchor blocks as shown on the drawings.

9.0 MANHOLES AND CHAMBERS

9.1 All manholes, chambers and other such works as specified shall be constructed in brick masonry in cement mortar 1:5 (1 cement : 5 coarse sand) or as specified in the bill of quantities.

9.2 All manholes, chambers, etc., shall be supported on base of cement concrete of such thickness and mix as given in the bill of quantities or shown on the drawings.
Where not specified, manholes shall be constructed as follows:-
(All dimensions internal clear in cms)

Size of manhole type	90x80	120x90	140 dia
	Rect.	Rect.	Circular
Maximum depth	100	245	Any depth beyond 245
Average thickness of RCC slab	15	15	-----
Size of cover and frame (Internal diameter)	61x45.5	50 dia	50 dia



Weight of cover and frame	38 kg. or Heavier ++ as specified	116 kg	116 kg or 208 kg or as specified	or 208 kg or as specified
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- 9.3 All manholes shall be proved with cement concrete benching in 1:2:4 mix (1 cement : 2 coarse sand : 4 stone aggregate 20mm nominal size). The benching shall have a slope of 10cm towards the channel. The depth of the channel shall be full diameter of the pipe. Benching shall be finished with a floating coat of neat cement.
- 9.4 All manholes shall be plastered with 12/15mm thick cement mortar 1:3 (1 cement : 3 coarse sand) and finished with a floating coat of neat cement inside. Manhole shall be plastered outside as above but with rough plaster.
- 9.5 All manholes with depths greater than 1 m. shall be provided with 20mm square or 25mm round rods catch rings set in cement concrete blocks 25x10x10cms in 1:2:4 mix 30cms vertically and staggered. Foot rests shall be coated with coal tar before embedding.
- 9.6 All manholes shall be provided with cast iron covers and frames and embedded in reinforced cement concrete slab. Weight of cover, frame and thickness of slab shall be as specified in the bill of quantities or given above.
- 9.7 All rain water collection chamber shall be of the size 50x45x60cm (internal) with horizontal C.I. grating. The grating along with frame, shall be of size 500x450mm grating having total Wt.of app. 38 Kg. and of approved design and quality as per instruction of Architect. The remaining details of construction shall be same as stated above for the construction of the manholes etc.

10.0 DROP CONNECTION

- 10.1 Drop connections shall be provided between branch sewer and main sewer or in the main sewer itself in steep ground when the difference in invert level of the two exceeds 45cms of the required sizes.
- 10.2 Drop connections from gully traps to main sewer on rectangular manholes shall be made inside the manholes and shall have H.C.I. special type door on top and heel rest bend at bottom connected by a H.C.I. pipe. This pipe shall be supported by holder bat clamps at 180 cms intervals with at least one clamp for each drop connection. All joints shall be lead caulked joints 25mm deep.
- 10.3 Drop connections from branch sewer to main sewer shall be made outside the manhole wall with glazed stoneware pipe tee connections, vertical pipe and bend at the bottoms. The top of the tee shall be finished up to the surface level and provided with a C.I. hinged type frame and cover 30cms x 30cms The connection shall be embedded in cement concrete 1:2:4 mix 15 cms all round the pipe and tee up to the surface chamber of the tee.
- 10.4 Drop connection made from vertical stacks directly into manholes shall not be considered as drop connections. They shall be paid for under the relevant soil and waste pipes.

11.0 MAKING CONNECTIONS

Contractor shall connect the new sewer line to the existing manhole by cutting the walls, benching and restoring them to the original condition. A new channel shall be cut in the benching of the existing manhole for the new connection. contractor shall remove all sewage and water if encountered in making the connection without additional cost.

12.0 MEASUREMENT

12.1 Stoneware Pipes / R.C.C. Pipes / C.I. Pipes

Stoneware pipes / R.C.C. pipes / C.I. Pipes shall be measured for the finished length of the pipe line per linear meter i.e. (a) lengths between manholes shall be recorded from inside of one manhole to inside of other manhole, (b) length between socket of pipe near gully trap and inside of manhole, Rate shall include all items given in the schedule of quantities and specifications.

12.2 Gully Traps

Gully traps shall be measured by the number and rate shall include all excavation, foundation, concrete brick masonry, cement plaster inside and outside, C.I. grating and sealed cover and frame.

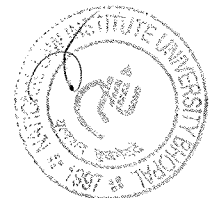
- 12.3 **Manholes**
- a) All manholes shall be measured by numbers and shall include all items specified above and necessary excavation, refilling & disposal of surplus earth.
 - b) Manholes with depths greater than specified under the main item shall be paid for under "Extra depth" and shall include all items as given for manholes. Measurement shall be done to the nearest cm. Depth of the manholes shall be measured from top of the manhole cover to bottom of channel.
- 12.4 **Drop Connections**
Drop connections shall be measured by number for a depth of 60cms or part thereof between invert levels. Additional depth shall be paid for as extra per meter depth as per the actual length of the drop connection, measured to the nearest cm.
- 12.5 **Making Connections**
Item for making connection to municipal sewer shall be paid for by number and shall include all items given in the bill of quantities and specifications.
- 12.6 **Masonry Drains**
Payment for masonry drains shall be made under individual items of masonry, cement concrete and plaster by volume or area as given in the bill of quantities.
- 12.7 **Brick masonry and cement concrete shall be measured per cubic meter and shall include all item as given in the bill of quantities.**
- 12.8 **Cement plaster shall be measured per square meter area.**
- 13. SEPTIC TANK**
- 13.1 **Location**
It should be located at a place open to sky, as far away as possible from the exterior of the wall of building and should not be located in swampy area or areas prone to flooding and in a place where maintenance and mechanical clearing is easily carried out.
- 13.2 **Ventilation**
The ventilating pipe shall extend to a height which would cause no smell nuisance to any building min the area. The ventilation pipe is extended to a height of about 2m when the tank is beyond 20m of any habitable building and to a height of 2m above the top of the building when it is located within 20m. The final termination of vent can be done, as per site conditions, keeping the above guidelines.
- 13.3 **Wall**
The walls of the tank should be 1st class brick with 1:3 sand cement mortar and plastered both inside and outside with 12mm thick plaster of 1:3 mix sand cement and waterproof compound to make the wall waterproof.
- 13.4 **Floor**
The floor should be of 1:2:4 plain concrete with waterproof compound to make it waterproof.
- 13.5 **Commissioning**
The tank should be filled with water to its outlet level before the sewerage is let into the tank. It should be seeded with small quantities of well digested sludge obtained from any septic tank which is in operation.



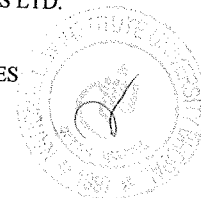
SECTION-VI

LIST OF APPROVED MAKES OF MATERIALS

SNO.	MATERIALS	IS NO.	BRAND /MANUFACTURER NAME	
1.	VITREOUS CHINA SANITARYWARE (1ST CLASS QUALITY)	2556	PARRYWARE	E.I.D.PARRY, MADRAS
			CERA	MADHUSUDAN CERAMICS N.D.S.E.PART-II, NEW DELHI.
			NEYCER	NEYVELI CERAMICS * REFRATORIES LTD. MADRAS
			HINDWARE	HINDUSTAN SANITARY WARE & INDS. LTD. NEW DELHI.
2.	PLASTIC W.C.SEATS		DURAVIT / TOTO / AMERICAN STANDARD	
			COMMANDAR	PHENOWELD POLYMER PVT. LTD. BOMBAY
3.	C.P.FITTINGS		GROHE/HANS GROHE / JAQUAR / LAURET / AQUAPLUS	
4.	FLUSH VALVE		GROHE/HANS GROHE / JAQUAR / PARKO / LAURET/AQUAPLUS	
5.	CONCEALED CISTERN		GROHE/VIEGA/GEBERITE/COMMANDER	
6.	C.P.BOTTLE TRAP		GROHE/HANS GROHE / JAQUAR / AQUAPLUS / PARKO / LAURET	
7.	STAINLESS STEEL SINK		COBRA / AMC / NEEL KANTH	
8.	BATHROOM C.P. ACCESSORIES		GROHE/HANS GROHE / JAQUAR / LAURET / PARKO / AQUAPLUS	
9.	SOIL, WASTE & RAIN WATER PIPES & FITTINGS			
	A). CENTRIFUGAL SPUN TYPE (S&S)	3989	NECO	JAYASWALS NECO LTD. NAGPUR, IISCO.
10.	G.I. AND M.S. PIPES		JINDAL / HISSAR	
11.	G.I. FITTINGS (MALLEABLE CAST IRON)	(1879) PART-I TO X)	R	R.M.ENGG. WORKS AHMEDABAD
			UNIK	UNIQUE MFG. CO. JALANDHAR
			ZOLOTO	ZOLOTO INDUSTRIES JALANDHAR
12.	GUNMETAL VALVE (FULLWAY, CHECK AND GLOBE VALVES)	778	LEADER	LEADER ENGG. WORKS JALANDHAR.
			JDR	ARKAY SALES CORPN. DELHI.



SNO.	MATERIALS	IS NO.	BRAND /MANUFACTURER NAME	
13.	BUTTERFLY VALVE		Cim/SKS VIRGO LEHRY	PROJECT EQUIPEMENT VIRGO ENGINEERING LTD LEHRY VALVE
			AUDCO L & T	
			LEADER	
14.	C.I.DOUBLE FLANGED SLUICE VALVE & CHECK VALVES		Cim/SKS	PROJECT EQUIPEMENT
			ARROW	ARROW ENGG.LTD, DELHI
			LEHRY	PVT. LTD. VADODARA LEHRY VALVE
15.	BALL VALVES		Cim/ZOLOTO AUDCO L & T LEHRY	PROJECT EQUIPEMENT LEHRY VALVE
16A)	FLOAT VALVE (GUNMETAL) UPTO 40M		LEADER	LEADER ENGG. WORKS JALANDHAR
			GG	BOMBAY METAL & ALLOYS MFG. CO. LTD. BOMBAY.
			SANT	SANT BRASS METAL WORKS, JALANDHAR.
			LEHRY	LEHRY VALVE
B)	FLOAT VALVE (CI) 50M AND ABOVE		IVC	INDIAN VALVE CO. LTD. CALCUTTA
			LEHRY	LEHRY VALVE
			LEADER	LEADER ENGG. WORKS JALANDHAR
17.	FOOT VALVE		Cim/ IVC	PROJECT EQUIPEMENT INDIAN VALVE CO. LTD. CALCUTTA
			LEADER	LEADER ENGG. WORKS JALANDHAR
18.	C.I. MANHOLES COVER & G.I. GRATING	1726	RIF	RAJ IRON FOUND AGRA
			B.C.	B.C. IRON FOUNDRY AGRA.
19.	BIB & STOP COCKS (BRASS)	781	JDR	AARKEY SALES CO. DELHI.
			GPA	GOVERDHAN P.A. JALLANDHAR
20.	STONEWARE PIPES & GULLY TRAPS	651		PERFECT POTTERI JABALPUR
			HIND	HIND CERAMICS LTD. CALCUTTA
			BURN	BURN POTTERIES JABALPUR



SNO.	MATERIALS	IS NO.	BRAND /MANUFACTURER NAME	
21	R.C.C. PIPES	458	IHP	INDIAN HUME PIPE CO. LTD. -OR EQUIVALENT- JAIN SPUN PIPE BHIWANI-DADRI ROAD HALUWAS (BHIWANI)
22	C.I.	1536	KESORAM	KESORMA SPUN PIPE & FOUNDARIES, CALCUTTA.
			IISCO	INDIAN IRON & CO. LTD. CALCUTTA.
			NECO	JAYASWALS NECO LTD. NAGPUR, IISCO
23	S.S. PIPES		VIEGA	VIEGA GERMANY
24.	HAND DRIER		KOPAL	KOPAL ENGG.CORPN. NEW DELHI
			ASKON	ASKON ENGINEERS BOMBAY
25.	LIQUID SOAP DISPENSOR		ASKON	ASKON ENGINEERS BOMBAY
26.	STORAGE TYPE WATER HEATER		RACOLD	RACOLD APPLIANCES LTD. NEW DELHI.
			SPHERHOT	JASHAWANTLAL KANTILAL (P) LTD. GUJRAT.
27.	ULTRA VIOLET WATER TREATMENT		ULTRA VIOLET	ULTRA VIOLET WATER TECHNOLOGY (BOMBAY) PVT.LTD.
28.	WATER PROOFING		PROTEK	EMCO GENERAL PLASTIC INDUSTRIES (P) LTD. NEW DELHI. PHONE:331 9763
29.	PVC PIPES & FITTINGS			GEORGE FISHER/FINOLEX, PRAKASH, KISAN / SUPPREME/PRINCE/ASTRAL



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A. GENERAL

1. Scope

In general, the contractor shall supply, store, erect, test and commission all the equipment as specified in the BOQ. The contractor shall furnish all the materials, labour, tools and equipment for electrical work, as shown in the accompanying drawings and in the bill of quantities and specifications hereinafter described.

The scope of works is generally as follows but not limited to,

a) Supply, installation, testing & commissioning of the entire electrical system which includes-

- Sub Power Panels.
- LT Cabling system including Control Cabling.
- External Lighting.
- Earthing System.
- Lightning Protection System.
- Distribution Boards.
- Lighting, Fans & Power Sockets.
- Light and Power Wiring.
- Etc.

b) All civil works related to light and power wiring like wall chasing, surface finish, fixing of sleeves for electrical cable, etc.

c) All Electrical works shall be carried out as per BOQ, specifications and relevant Indian/Global Standards.

2. Site Condition

Rating of all equipment shall be appropriate for the conditions of the location where the equipment will be installed and used. All the equipment shall be suitable for continuous operation under most service conditions of site and shall be rated for the following ambient condition in without any de-ration.

- Location : BHOPAL,MP
- Altitude :
- Ambient Temp (Max) :
- Ambient Temp (Min) :



3. Contractor

The contractor shall be a licensed electrical contractor, possessing a valid electrical contractor's license in the state, employing licensed supervisors and skilled workers having valid permits as per the regulation of Indian Electricity Rules and Local Electrical Inspector's requirements.

4. Drawing

The drawings, specifications and bill of quantities shall be considered as part of this contract and any work or materials shown on the drawings and not called for specifically or vice-versa shall be executed as if specifically called for in both. The contract drawings indicate the extent and general arrangement of various equipment and

their wiring etc. and are essentially diagrammatic. The drawings indicate the point of termination of conduit runs and broadly suggest the routes to be followed. The work shall be installed as indicated on the drawings. However, any minor change if found essential to co-ordinate the installation of this work with other traders shall be made without any additional cost to the owners. The date given herein and on the drawings is as could be secured but its complete accuracy is not guaranteed. The drawings and specifications are for the assistance and guidance of contractor. The exact location, distance and levels etc. will be governed by the space conditions. The contractor shall examine all architectural, structural, plumbing and sanitary, air-conditioning and electrical drawings, before starting the work and report to the architect any discrepancies, which in his opinion appear on them, and get them clarified. He shall not be entitled to any extras, for omissions or defects in electrical drawings or when they conflict with other work.

5. Foreman/Supervisor

The contractor shall employ a competent, licensed qualified full time electrical Foreman/Supervisor to direct the work for electrical installation in accordance with the drawings, specifications, relevant Indian Standards and IE Rules/local electricity rule.

The Foreman/Supervisor shall be available at all times on the site to receive instructions from the Architect/Engineer in the day to day activities throughout the duration of the contract.

The Foreman/Supervisor shall correlate the progress of the work in conjunction with all the relevant requirements of the supply authority. The skilled workers employed for the work should have requisite qualifications and should possess competency certificate from the Electrical Inspector of the Local Authority.

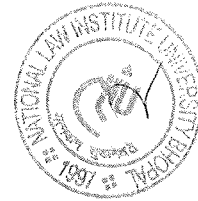


B. STANDARDS AND DEFINITIONS

1. Definitions

The following abbreviations may be used in the bill of quantities, specifications and drawings-

ABCB	Air Blast Circuit Breaker
AC	Alternating Current
ACB	Air Circuit Breaker
ACSR	Steel Reinforced Aluminium Conductor
AL, Al	Aluminium
Amp /A	Amperes
APLSTS	Aluminium Conductor, paper insulated lead sheathed double steel tape armoured and served.
ASS	Ammeter Selector Switch
Amb	Amber Colour
B	Blue
BOCB	Bulk Oil Circuit Breaker
BS	British Standard
BLC	Black
BSCP	British Standard Code of Practice
CI	Cast Iron
CFS	Combined Fuse Switch
CT	Current Transformer
CU	Copper
DB	Distribution Board
DC	Direct Current
DP	Double Pole
ELCB	Earth Leakage Current Circuit Breaker



FDB	Fuse Distribution Board
Freq	Frequency in Hertz
FSU	Fuse Switch Unit
G.I	Hot Dip Galvanized Iron
HRC	High Rupturing Capacity
HT	High Tension
HV	High Voltage
IER	Indian Electricity Rules
IDMT	Inverse Definite Minimum Time
IC TPN	Iron Clad Triple pole and Neutral
IL	Indicating Light
IS	Indian Standards
ISL	Insulator
KA	Kilo Amperes
KV	Kilo Volts
KVA	Kilo Volt Amperes
KVAH	Kilo Volt Ampere Hour
KW	Kilo Watt
KWH	Kilo Watt Hour
KG	Kilogram
LA	Lightning Arrestor
LT	Low Tension
LV	Low Voltage
Lts	Litres
MCB	Miniature Circuit Breaker
MCC	Motor Control Centre
MCCB	Moulded Case Circuit Breaker
MDB	Main Distribution Board



MOCB	Minimum Oil Circuit Breaker
MS	Mild Steel
MT	Medium Tension
MV	Medium Voltage
MVA	Mega Volt Ampere
MW	Mega Watt
N	Neutral
NC	Normally Closed
NO	Normally Open
NV	No Volt
OC	On Coil
OCB	Oil Circuit Breaker
O/C	Over Current
O/L	Over Load
OV	over Voltage
PB	Push Button
PCC	Power Control Centre
PF	Power Factor
PI	Post Insulator
PILCA	Paper Insulated Lead Covered Aluminium Conductor
PT	Potential Transformer
PVC	Polyvinyl Chloride
Ph	Phase
R	Red
SDB	Sub Distribution Board
SFU	Switch Fuse Unit
SP	Single Pole

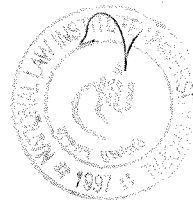


SPN	Single Pole and Neutral
ST	Shunt Trip
SWG	Standard Wire Gauge
TC	Tap Changer
TP	Triple Pole
TPN	Triple Pole and Neutral
UV	Under Volt
VA	Volt Amperes
VC	Vacuum Contractor
Volt/V	Voltage
VSS	Voltmeter Selector Switch
VT	Voltage Transformer
XLPE	Cross Linked Polyethylene
Y	Yellow

2. Regulations and Standards

The Installation shall conform in all respects to Indian Standard Code of Practice for Electrical wiring installation IS: 732-1989. It shall also be in conformity with the current Indian Electricity Rules and the Regulations and requirements of the Local Electric Supply Authority so far as these become applicable to the installation. Wherever this specification calls for a higher standard of materials and/or workmanship than those required by any of the above regulations, this specification shall take precedence over the said regulations and standards. In general, the materials, equipment and workmanship not covered by the above shall conform to the following Indian Standards, unless otherwise called for.

IS: 335-1993	:	Transformer Oil
IS: 371-1979	:	Ceiling Roses
IS: 374-1979	:	Electrical fans & Regulators
IS: 5578-1985, 11353-1985	:	Marking arrangement of switchgear, Bus bars, Main and Auxiliary wiring.
IS: 398 (Pt-I)-1976	:	Aluminium conductors for overhead transmission purposes: Pt 1-Aluminium Stranded conductors (Second Revision).
IS: 398 (Pt-2)-1976	:	Aluminium conductors for overhead transmission purposes: Pt-2-Aluminium conductors galvanized steel reinforced (Second Revision)



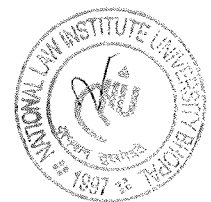
IS: 398 (Pt-3)-1992	:	Aluminium conductors- aluminized steel reinforced (Second revision)
(Pt-1-5)-1993	:	Low Voltage Switch gear and Control gear.
IS: 12360-1988	:	AC transmission and distribution system, voltages and frequency (Revised)
IS: 692-1973	:	Paper insulated lead-sheathed cables for electricity supply (Second Revision)
IS: 694-1990	:	PVC insulated cables for voltage up to and including 1100 Volts.
IS: 722 and IS: 8530	:	AC induction meters.
IS: 731-1971	:	Porcelain insulators for overhead power lines with a normal voltage greater than 1000 Volts (Second Revision)
IS: 802 (Pt-1)-1977 (Pt-2)-1978	:	Code of practice for use of structural steel in overhead transmission line tower.
IS: 933-1989	:	Portable chemical fire extinguisher, foam type (Third Revision).
IS: 934-1989	:	Portable chemical fire extinguisher soda acid type (Fourth Revision).
IS: 1180 (Pt-1)-1989	:	Three-phase distribution transformer up to and including 100 KVA, 11 KV, outdoors Part-1 Non-sealed type (Third Revision).
IS: 1180 (Pt-2)-1989	:	Three-phase distribution transformer up to and including 100 KVA, 11 KV, outdoors Part-2 sealed type (First Revision).
IS: 1248 (Pt-1-9)	:	Direct acting Electrical Indicating Instruments.
IS: 1255-1983	:	Code of practice for installation and maintenance of power cables (Upton and including 33 KV).
IS: 1293-1988	:	3 pin plugs & sockets.
IS: 6875 (Pt-1-3)-1973	:	Control switches.
IS: 1554 (Pt-1)-1988	:	PVC insulated (heavy-duty) electrical cables Part-1, for working voltage up to and including 1100 Volts (Third Revision).
IS: 1554 (Pt-2)-1988	:	PVC insulated (heavy-duty) Electro cables Part-2, for working voltages from 3.3 KV up to and including 11 KV (Second Revision).
IS: 1646-1982	:	Code of practice for fire safety of building (General) Electrical installation (First Revision).



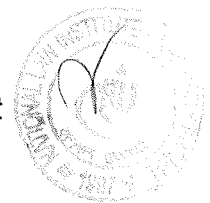
IS: 1651-1991	:	Stationery cells and Batteries-Lead Acid Type [with tubular positive plates] (Third Revision).
IS: 1652-1991	:	Stationery cells and Batteries-Lead Acid Type with Plate positive plates (Third Revision).
IS: 1977-1978	:	Industrial luminaries with metal reflectors (First Revision).
IS: 95237 (Pt-2)	:	Specification for Rigid Steel Conduits for electrical wiring
IS: 1866-1983	:	Code of practice for maintenance and supervision of insulating oil in service (Second revision).
IS: 1913-1978	:	General & safety requirements for Electrical light fittings.
IS: 1944, 1970/81	:	Lighting for public thoroughfares
IS: 2026 (Pt-1)-1977	:	Power transformers Part 1: General (First revision).
IS: 2026 (Pt-2)-1977	:	Power transformers Part 2: Temperature rise (First revision).
IS: 2026 (Pt-3)-1981	:	Power transformers Part 3: Insulation level and dielectric tests (Second revision).
IS: 2026 (Pt-4)-1977	:	Power transformers Part 4: Terminals, marking tapping and connections (First revision).
IS: 2032 (Pt-2)-1962	:	Graphical symbols used in Electro-technology, Pt-2: Kind of current distribution system and methods of connections.
IS: 2032 (Pt-4)-1964	:	Graphical symbols used in Electro-technology, Pt-4: Rotating machine and transformers.
IS: 2032 (Pt-5)-1965	:	Graphical symbols used in Electro-technology, Pt-5: Generating stations and substations.
IS: 2032 (Pt-7)-1974	:	Graphical symbols used in Electro-technology, Pt-7: Switch gear and auxiliaries.
IS: 2099-1986	:	Bushing for alternating voltages above 1000 Volts (Second revision).
IS: 2121-1981	:	Conductors & earth-wire accessories for overhead power lines.
IS: 10322 (Pt-5)	:	Street Lighting Luminaries
IS: 2165 (Pt-1)-1977	:	Insulation co ordination, Part-1: Phase to earth insulation co ordination principle and rules (Second revision).



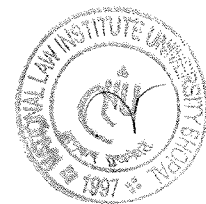
IS: 2165 (Pt-2)-1983	:	Insulation co ordination, Part-2: Phase to phase insulation co ordination principle and rules.
IS: 2190-1992	:	Code of practice for selection, installation and maintenance of portable first-aid fire extinguishers (Second revision).
IS: 9224 (Pt-1)-1979	:	HRC cartridge fuse links 650 volts.
IS: 2309-1989	:	Code of practice for the protection of building & allied structure against lightning.
IS: 2312-1967	:	Propeller type AC ventilating fans.
IS: 2448-1968	:	Adhesive insulating tapes for electrical purpose (Part I & II).
IS: 2486 (Pt-1)-1993	:	Specification for insulator fittings for overhead power lines with a nominal voltage greater than 1000 Volt, Part-1: General requirements and tests.
IS: 13118-1991, Parts 1-5	:	AC circuit breakers.
IS: 2544-1973	:	Porcelain post insulators for system with nominal voltages greater than 1000 Volts (First revision).
IS: 2667-1988	:	Rigid Steel Conduit fittings.
IS: 2675-1983	:	Specification for enclosed distribution fuse boards & cutouts (Second revision).
IS: 2705 (Pt-1)-1992	:	Current transformers, Part 1: General requirements.
IS: 2705 (Pt-2)-1992	:	Current transformers, Part 2: Measuring current transformers.
IS: 2705 (Pt-3)-1992	:	Current transformers, Part 3: Protection current transformers.
IS: 2705 (Pt-4)-1992	:	Current transformers, Part 4: Protection current transformers for special purpose applications.
IS: 2834-1986	:	Shunt capacitors for power system (Second revision).
IS: 3034-1993	:	Code of practice for fire safety of industrial building, electrical generating and distributing stations (First revision).
IS: 3043-1987	:	Code of practice for earthing.
IS: 3070-(Pt-1)-1985	:	Lightning arrestors for alternating current systems, Part-1: Non-linear resistor type lightning arrestors



IS: 3070- (Pt-2)-1993	:	(Second revision). Lightning arrestors for alternating current systems, Part-2: Metal oxide lightning arrestors without gap.
IS: 3151-1982	:	Earthing transformers (First revision).
IS: 3156 (Pt-1)-1992	:	Voltage transformers, Part-1: General requirements (Second revision).
IS: 3156 (Pt-2)-1992	:	Voltage transformers, Part-2: Measuring voltage transformers (Second revision).
IS: 3156 (Pt-3)-1992	:	Voltage transformers, Part-3: Protection voltage transformers (Second revision).
IS: 3156 (Pt-4)-1992	:	Voltage transformers, Part-4: Capacitor voltage transformers (Second revision).
IS: 3231 (Pt-0-3)	:	Relays
IS: 3427-1969	:	Metal Enclosed Switch-gears >1000 V, <11000 V.
IS: 3452 (Pt-1-2)-1966	:	Toggle Switches
IS: 3646 (Pt-1)-1992	:	Code of practice for interior illumination.
IS: 3646 (Pt-2)-1966	:	Code of practice for interior illumination.
IS: 3646 (Pt-3)-1968	:	Code of practice for interior illumination.
IS: 3716-1978	:	Application guide for insulation co-ordination (First revision).
IS: 3837-1976	:	Specifications for accessories for rigid steel conduit for electrical wiring (First revision).
IS: 3842 (Pt-1-12)	:	Application guides for Electrical relays.
IS: 3854-1988	:	Domestic Switches (First revision).
IS: 4004-1985	:	Application guide for surge arrestors with series gap & non-linear resistor for AC system (First revision).
IS: 4146-1983	:	Application guide for voltage transformers (First revision).
IS: 4201-1983	:	Application guide for voltage transformers (First revision).
IS: 4237-1982	:	Gen. Requirements of switch gear and control



IS: 5082-1981	:	gear for voltages below 1000V (First revision).
IS: 5133 (Pt-1)-1969	:	Wrought Aluminium & Aluminium alloy bars, rod tubes and section for electrical purposes (First revision).
IS: 5216 (Pt-1-2)-1969	:	Boxes for the enclosure of electrical accessories steel & CI boxes.
IS: 5547-1983	:	Guide for safety procedures & practice in electrical work (First revision).
IS: 5553 (Pt-1)-1989	:	Application guide for capacitor voltage transformers (First revision).
IS: 5561-1970	:	Shunt reactors.
IS: 5613 (Pt-1-2)	:	Electrical power connectors.
IS: 7098 (Pt-2)-1985	:	Overhead power lines.
IS: 7752 (Pt-1)-1975	:	Cross-linked polyethylene insulated PVC sheathed cables (First revision).
IS: 8437 (Pt-1-2)-1977	:	Guide for improvement of Power factor in consumer installation.
IS: 8623 (Pt-1-2)-1993	:	Guide on effects of currents passing through human bodies (First revision).
IS: 9224-1979	:	Factory Built assemblies (First revision).
IS: 9249-1979	:	Low Voltage fuses.
IS: 9385-1980	:	Safety requirement of indicating and recording meters.
IS: 9921	:	High Voltage HRC fuses
Part-1 1981	:	Alternating current disconnects (isolators for voltages above 1000 Volt).
Part-2 1982	:	General & Definitions.
Part-3 1982	:	Rating.
Part-4 1985	:	Design & construction.
Part-5 1985	:	Type tests & routine tests.
	:	Information to be given with tenders, inquiries & orders.
IS: 10118	:	Switchgear and control gear selection, installation and maintenance code of practice.



Part-1	1982	:	General
Part-2	1982	:	Selection
Part-3	1982	:	Installation
Part-4	1982	:	Maintenance
IS: 10136-1982		:	Code of practice for selection of discs insulator fittings for highest system voltages of 72.5 KV & above.
IS: 10162-1982		:	Spacers & Spacer dampers for twin horizontal bundle conductors.
IS: 10561-1983		:	Application guide for power transformers.
ANSI/IEEE-80-1986		:	IEEE Guide for safety in AC substation Grounding.
IS: 10028 (Pt-1)-1985		:	Code of practice for selection installation and maintenance of transformers - selection.
IS: 10028 (Pt-2)-1985		:	Code of practice for selection installation and maintenance of transformers - installation.
IS: 10028 (Pt-3)-1985		:	Code of practice for selection installation and maintenance of transformers - maintenance.
IS: 12063-1987		:	Classification of degrees of protection provided by enclosures of electrical equipment.
IS: 13234-1992		:	Short circuit current calculation in 3 phase AC systems.



C. MEDIUM VOLTAGE SWITCHBOARD PANELS

1. General

Medium voltage power control centers (generally termed as switchboard panels) shall be in sheet steel clad cubicle pattern, free floor standing type, totally enclosed, compartmentalized design. This specification shall cover three types of panels, viz. a draw out design incorporating air circuit breakers, one incorporating air circuit breaker / moulded case circuit breaker as incoming and out-goings, non-draw out design shall be in standard full size or three-fourth or half size panels incorporating air circuit breakers / moulded case circuit breakers shall either be in single tier or in two tier arrangement depending upon the rating of the breaker. The panels shall be of extensible type with provision of bus bar extensions. Panels shall conform to the requirements of BS: 3659, BS: 3185, IS: 8623 or IEC 157-I in all respects.

2. Construction

Switch board panels or power control centers of free standing type shall have a bus bar chamber at the top and the cable compartment at the bottom depending upon the specific requirements of the job. The space between the bus chamber and cable compartment shall be suitably (Form 3b) compartmentalized to accommodate either air circuit breakers / moulded case circuit breakers of various ratings. The cable terminations shall be carried out on the rear side of the panels for which adequate space and clamping arrangements shall be provided. Where panels have to be installed with very little access space at the rear, the cable terminations shall be carried out in suitable cable alleys provided on the front of the panel. All the live parts shall be properly shrouded with Bakelite barriers. Arrangements and marking of bus bars, main connections and wiring shall be in accordance with IS: 5578 - 1985 and IS: 11353 - 1985.

The structure of the panel shall be robust and provided with adequate bracing to withstand the operation of the equipment and stresses due to system short circuit. The panels shall be fabricated out of best quality heavy gauge 2.0 mm thick CRCA. The panel shall be machine pressed with punched openings for meters, indicating lamps etc.

3. Dimensions

All power control centers shall have dimensions not more than that given on the layout drawings. Panels arranged side by side shall have the same height and depth. The height of the panel should be limited to 2200mm. All the operating levers, handles etc. of the heights unit shall not be at a height more than 1.7 metres. For all incoming cables a removable gland plate will be provided in the panel and a minimum distance of 300mm will be provided between the gland plate and the nearest terminal for proper dressing and termination of the cable. All the components of a module will be mounted on a component plate using the machine screws and taped holes (excepting the components mounted on the door). These component plates should be fixed with bolts for easy replacement. Standardization will be adopted while making these plates so that the component plates of the same size modules can be changed from one module to another. In case of panel of lengths of more than 4 meters the fabrication of any single section will be limited to a maximum length of 4 mtr. for the purpose of shipping and shifting at the site. These sections will be assembled at the location of installation with the help of nuts and bolts. While making these sections, consideration will be given to the place of sectionalisation and select the location where the minimum electrical connections are transferred from one section to another. All the hardware used in the assembly will be electroplated for protection and neat appearance.

4. Bus Bars

The bus bars shall be suitable for 4-wire, 415 volts, 50 Hz system. The main bus bar shall be made of high conductivity electrolytic grade Aluminium and shall be liberally sized. In case of copper bus bar it shall be electrolytic grade copper and at the time of joining of two copper buses tinning will be done on the copper strip ends to a length equal to the lap length of the joint plus one each. The bus bars shall have uniform cross section

throughout. The bus bars shall be capable of carrying the rated current at 415 volts continuously. The bus bar will run in a separate busbar chamber using bus insulators made of non-deteriorating, vermin proof, non-hygroscopic materials such as epoxy fiber, reinforced polyester or moulding compound. The interval between the two insulators will be designed after considering:

- (a) Strength and safe load rating of the insulator,
- (b) The vibrating force generated during a fault,
- (c) A Factor of safety of 1.8
- (d) A set of insulators at both ends of the bus.

The bus size calculations must be approved by the consultants. The bus bars shall be designed to withstand a temperature rise of 45° centigrade above the ambient. To limit the temperature rise in the bus bar chamber a set of louvers can be provided at strategic places considering the air circulation. The louvers provided will have a brass wire mesh covering from inside with more than 100 openings per sq. inch. The overall temperature of bus bar shall not exceed 85°C. A current density of 0.8 Amp / sq.mm shall not be exceeded for aluminium bus bars.

All the bus bars shall be insulated with PVC heat shrinking sleeves suitably throughout (except at joints) the length. The Electro galvanized high tensile steel nuts, bolts, plain or spring washers of suitable size will be used in connecting the various section of the bus bar. A minimum of 1.6 times the width of bus bar will be the lapping length of each joint.

5. Earthing

The panels shall be provided with an aluminium/G.I earth strip running throughout the length of the switchboard. Suitable earthing eyes/bolts shall be provided on the main earthing bus to connect the same to the earth grid at the site. Sufficient number of star washers shall be provided at the joints to achieve earth continuity between the panels and the sheet metal parts.

6. Mountings

Panels incorporating circuit breakers shall be mounted such that they are accessible from the front of the panel. More than two circuit breakers shall not be incorporated in a vertical section. The breaker compartment shall be divided into two parts, one for the breaker and the other for incorporating associated control gear. The necessary instrumentation shall be provided on the door of the compartment. Protection relays and KWH meters shall be fixed on the rear side of the panels.

7. Interlocking

The panels shall be provided with the following interlocking arrangement-

- a) The door of the breaker compartment is so interlocked with the switch drive or handle that the door can be opened only if the switch is in 'OFF' position. De-interlocking arrangement shall also be provided for occasional inspection.
- b) It shall not be possible for the breaker to be withdrawn when in 'ON' position.
- c) It shall not be possible for the breakers to be switched on unless it is either in fully inserted positions or for testing purposes in fully isolated position.
- d) The breaker shall be capable of being raked in to 'testing' 'isolated' and 'maintenance' positions and kept locked in any of these positions.
- e) A safety latch to ensure that the movement of the breaker as it is withdrawn, is checked before it is completely out of the cubicle shall be provided.

8. Protection & Instrumentation

Protection and instrumentation shall be as per schedule of quantities.

9. Wiring

All the interconnecting between the incoming, bus and the outgoing of 100A and above rating shall be done by insulated Aluminium/copper strips of suitable sizes. Equipment below 100 A rating shall be wired with insulated copper conductors. The wiring for instrumentation protection and control equipment shall be carried out with insulated flexible copper conductors. The power interconnecting shall be carried out by means of pressure clamps, special washers, etc. The wiring shall be terminated by using crimping sockets. Wiring shall be laid out neatly in bunches which are firmly fastened to the steel members of the panel. When the wiring is crossing from fixed parts to moving parts such as door etc. the wires will be run in PVC sleeve of suitable size. Under no circumstances the wiring should be under any kind of stress. All the potential circuits shall be protected by MCB's mounted near the tap-off point from the main connections.

10. Terminals

All the control, instrumentation and protection wiring shall be provided with printed PVC ferrules at both ends. For terminating control cables on to the equipment in the panels, suitable terminal blocks shall be provided. The terminal shall also be numbered for easy identification and maintenance.

11. Surface treatment

All sheet metal accessories and components of power control centers and switchboard panels shall be applied with 9-tank process and thoroughly cleaned, degreased, derusted, rinsed and hot-dip phosphatized etc. before drying and doing red oxide primer. The panel shall be stove enameled to the required final finish. The interior surfaces of the panel shall be painted as per standard practice.

12. Enclosure

The panel enclosure shall be totally dust and vermin proof and shall be suitable for indoor installation. All the cubicles will have front located, outward opening lockable doors having hidden hinges and a bolted back cover both using no deteriorating neoprene/rubber gasket. Enclosure design shall be in accordance with degree of protection IP 42 as per IS 13947-1993.



13. Name plate

The panel as well as the feeder compartment doors shall be provided with name plate giving the switchboard/feeder descriptions as indicated on the drawings. Name plate shall be of anodized aluminium, with white engraving on black background. They shall be properly secured with self-tapping screws.

14. Testing

The power control centers shall be tested at factory after assembling of all components and completion of all inter-connections and wiring. Tests shall be conducted in accordance with the requirements of BS: 3659 and 3185/IS: 8623-1993.

a) Insulation Test

- i) Insulation of the main circuit, that is, the insulation resistance of each pole to the earth and that between the poles shall be measured.
- ii) Insulation resistance to earth of all secondary wiring should be tested with 1000 volt meggar.

Insulation test shall be carried out both before and after high voltage test.

- b) High Voltage Test
A high voltage test with 2.5 KV for one minute shall be applied between the poles and earth. Test shall be carried out on each pole in turn with the remaining poles earthed, all units raked in position and the breakers closed. Original test certificate shall be submitted along with panel.

15. **Storing, Erection and Commissioning**

- a) The panels shall be stored in a well-ventilated, dry place. Suitable rain-proof Polyethylene covers shall be provided for necessary protection against moisture.

b) Erection

Switch boards shall be installed on suitable foundation. Foundation shall be as per the dimensions supplied by the panel manufacturer. The foundation shall be flat and level. Suitable grouting holes shall be provided in the foundation. Suitable MS base channel shall be embedded in foundation on which the panel can be directly installed. The switch boards shall be properly aligned and bolted to the foundation by at least four bolts. Cables shall be terminated on the bottom plate or top plate as the case may be, by using brass double compression glands. The individual cables shall then be led through the panel to the required feeder compartments for necessary terminations. The cables shall be clamped to the supporting arrangement. The switchboard earth bus shall be connected to the local earth grid.

c) Pre-commission Tests

Panels shall be commissioned only after the successful completion of the following tests. The tests shall be carried in the presence of Architect's / Consultants representative.

- i) All main and auxiliary bus bar connections shall be checked and tightened.
- ii) All wiring termination and bus bar joints shall be checked and tightened.
- iii) Wiring shall be checked to ensure that it is according to the drawing.
- iv) All wiring shall be tested for insulation resistance by a 1000 volts meggar.
- v) Phase rotation tests shall be conducted.
- vi) Suitable injection tests shall be applied to all the measuring instruments to establish the correctness and accuracy of calibration and working order.
- vii) All relays and protective devices shall be tested for correctness of settings and operation by introducing a current generator and an ammeter in the circuit.



D. MEDIUM VOLTAGE AIR CIRCUIT BREAKER

1. General

Air circuit breakers shall be incorporated in power control center and motor control centers wherever specified. ACB shall conform to IEC 60947 PART I & II AND IS 13947 PART I & II in all respects. ACBS shall be suitable for operation on 415 volts, 3 phase, 50 Hz, AC supply.

The breaker shall comply with the isolation function requirement of IEC 60947 Section 7.12 and marked as Suitable for Isolation / disconnection function to ensure safety of operating personnel.

The breaker shall provide CLASS – II front facia. All circuit breakers can be reverse fed without reduction in performance.

2. Type and construction

Air circuit breakers shall be of moulded case design with trip free operating mechanism. Air Circuit breakers shall be withdrawable type with horizontal draw out carriage. The ACBs shall be strong and robust in construction with suitable arrangement for anchoring when in fully engaged or fully drawn out positions. The carriage or cradle on which the breaker is mounted shall be of robust design made of fabricated steel, supported on rollers. Cradle shall also comprise of main and secondary separable contacts and all draw out mechanisms in a completely fig welded assembly. There shall be no dependence upon the panel board frame for any critical alignment. The withdrawal arrangement shall be such as to allow smooth and easy movement.

All ACBs accessories shall be front fitted type. All the releases like U/v, Shunt and Closing coils shall be rated for Continuous operation.

All 4 pole ACBs shall be capable of setting neutral protection to N or N/2 to ensure precise neutral protection.

All the current carrying parts of the circuit breakers shall be silver plated. Suitable arcing contacts shall be provided to protect the main contacts. The contacts shall be of spring loaded design. The sequence of operation of the contacts shall be such that arcing contacts 'make' before and 'break' after the main contacts. Arcing contacts shall be provided with efficient arc chutes on each pole. The contact tips and arc chutes shall be suitable for ready replacement. Self-aligning isolating contacts with automatic shutters to screen the live parts shall be provided. The design of the breaker shall be such that all the components are easily accessible to inspection, maintenance and replacement.

Operating Mechanism

Air circuit breaker shall be provided with a quick-make, trip-free operating mechanism. The operating mechanism shall be strain-free spring operated. The operating shall be "handle front of the panel" type. The design shall be such that the circuit breaker compartment door need not be opened while moving the breaker from completely connected, through test, in to the disconnected position. A flush mounted manual trip shall be provided on the front of the panel. The breaker shall also be provided with a hand reset automatic trip indicator. All breakers will have switching ON and OFF time of less than 4 cycles.

There shall be mechanical indication on the front panel for "Ready to Close" situation for the ACB by checking all interlocking. ACB shall be convertible from manual to electrical at site.

Interlocking and safety arrangement

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

- i) It shall not be possible for breaker to be withdrawn when in 'ON' position.



- ii) It shall not be possible for the breaker to be switched on until it is either in fully inserted position or for testing purposes it is in fully isolated position.
- iii) The breaker shall be capable of being raked in to 'testing' isolated and maintenance positions and kept locked in any of these positions.
- iv) A safety latch to ensure that the movement of the breaker, as it is withdrawn is checked before it is completely out of the cubicle.
- v) The operating mechanism shall provide for raking the breaker in to connected, test and disconnected positions without opening the compartment door.
- vi) Mechanical interlocks will be provided between the operation of different breakers with the help of individually unique and matched castle key-locks (if specifically asked for).

Protections

ACB should be provided with Thermal Magnetic, or microprocessor based releases as mentioned in the specifications or Bill of Quantities.

(A) Micro Processor based Release

The microprocessor releases unit shall be provided on circuit breaker for Long time (Over Load), Short time (Short Circuit) and earth fault protection all with adjustable setting and adjustable time delay by dial. Releases shall also have instantaneous protection, true RMS sensing with EMC/EMI Compatibility.

Thermal Memory: When the breaker shall re close after tripping on overload, then the thermal stress caused by the overload if not dissipated completely, shall get stored in the memory of releases and this thermal memory shall ensure reduced tripping time in case of subsequent overloads and earth fault. Realistic hot/cold curves shall take into account the integrated heating effects to offer closer protection to the system. Breaker shall have facility of zone selective interlocking.

(B) Thermal Magnetic Trip Unit

Breaking capacity should be minimum 65 kA up to 3200 A. Breaker shall be of Category B & ultimate breaking capacity Icu should be equal to service breaking capacity Ics.

The over current relay shall be of thermal type.

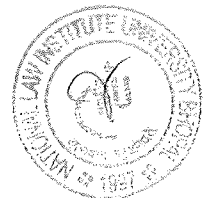
- It shall be bimetal based and be integrated as part of the circuit breaker.
- The over current relay shall be connected with epoxy coated CT.
- The over current relay shall have a wide adjustment range (50 –100%) to allow flexibility of the setting on site.

The short circuit release should have the following characteristics:

- It should be direct acting type. Instead of sensing through a CT it should sense the current directly.
- It should be possible to have phase wise indication of fault operation for short circuit release.
- There should be a provision of resetting the release after every short circuit fault to have anti-pumping feature.

Earth fault release should have the following characteristics

- Current setting should be available from 0.2 In to 0.6 In.
- Time delay from instantaneous to 1 second should be possible with various steps in between.



E. MOULDED CASE CIRCUIT BREAKERS

1. General

Moulded case circuit breakers shall be incorporated in the switch board wherever specified. MCCB shall conform to the latest IEC 60947-Part 1&2 & IS 13947:1993 in all respects.

- They shall be of Category A with a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu).
- Rated insulation voltage shall be 750V AC (50/60 Hz).
- MCCB shall be suitable either for single phase AC 230 Volts or three phase 415 volts. Suitable discrimination shall be provided between upstream and down stream breakers in the range of 10-20 milli seconds.
- The circuit breaker shall comply with the isolation function requirement of IEC 60947-2 Section 7.1.2 as suitable for isolation/disconnection to facilitate safety of operating personnel while the breaker is in use.
- MCCBs shall be available in fixed or plug in / withdrawable version as well as in 3P & 4P version. A safety trip shall provide advanced opening to prevent connection and disconnection of a closed circuit breaker.
- The MCCB shall provide class II insulation between the front and internal power circuit. It should be suitable for reverse fed.
- All MCCBs required as per BOQ shall have Ics=100% Icu, with following minimum service breaking capacity requirements

2. Construction

The MCCB cover and case shall be made of high strength heat-resistant and flame retardant thermosetting insulating material, operating handle shall be quick make/quick break. The operating handle shall have suitable 'ON' 'OFF' and 'TRIPPED' mechanical indicators notable from outside. Three phase MCCBs shall have a common operating handle for simultaneous operation and tripping of all the three phases.

MCCB shall be equipped with a "push to trip" button in front to test operation and the opening of poles. MCCB should provide instantaneous protection feature in event of high value short circuit current independent of thermal magnetic or electronic trip unit.

3. Contact

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

4. Accessories

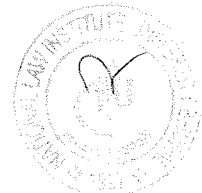
MCCB shall be provided with the following accessories, if specified in schedule of quantities.

- i) Under voltage trip
- ii) Shunt trip
- iii) Alarm switch
- iv) Auxiliary switches

All the accessories shall be rated for continuous operation. These Auxiliaries shall be common for the similar type and range of MCCBs.

It should be possible to equip MCCBs with a motor mechanism for electrically controlled operation.

5. Interlocking



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

- a) Handle interlock to prevent unnecessary manipulations of the breaker.
- b) Door interlock to prevent the door being opened when the breaker is in ON position.
- c) Defeat-interlocking device to open the door even if the breaker is in ON position.

6. The MCCB shall be current limiting type and comprise of quick make-break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable short circuit pick-up. Where earth fault protection is indicated they shall be integral and have adjustability from 20% to 100% of rated current with adjustable time delays.

7. The trip command shall override all other commands. The MCCB shall employ maintenance free double break contact system to minimize the let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables (with test certificates) and let-through energy curves. Line and Load connections shall be interchangeable.

8. **Testing**

- a) Original test certificate of the MCCB as per IEC 60947-1 & 2 or IS13947 shall be furnished.
- b) Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.



F. METERING, INSTRUMENTATION AND PROTECTION

1. General

The specifications hereinafter laid down shall cover all the meters, instrumentation and protective devices required for the electrical work. The ratings, type and quantity of meters, instruments and protective devices shall be as per the schedule of quantities and drawings.

2. Instrument Transformers

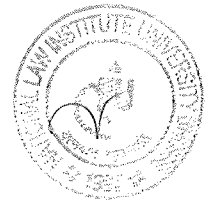
a. Current Transformers

Current transformers shall be in conformity with IS: 2705 (Part-I, II, & III) in all respects. All current transformers used for medium voltage applications shall be rated for 1 kV. Current transformers shall have rated primary current, rated burden and class of accuracy as specified in the schedule. However, the rated secondary current shall be 5 A unless otherwise specified. The acceptable minimum class of various applications shall be as given below:

For energy measuring	:	Class 0.5 to 1
Protection	:	Class 5P10.

Current transformers shall be capable of withstanding without damage, magnetic and thermal stresses due to short circuit fault on medium voltage system. Terminals of the current transformers shall be marked permanently for easy identification of poles. Current transformers shall be provided with earthing terminals for earthing chassis frame work and fixed part of the metal casing (if any). Each CT shall be provided with rating plate indicating the following:

- i) Name and make
- ii) Serial Number
- iii) Transformation ratio
- iv) Rated burden
- v) Rated voltage
- vi) Accuracy class



Current transformers shall be mounted such that they are easily accessible for inspection, maintenance and replacement. The wiring for CTs shall be copper conductor, PVC insulated wires with proper termination lugs and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner.

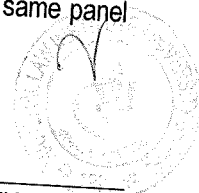
b. Potential transformers

Potential transformers shall be provided if specifically called for. Potential transformers shall comply with the requirements of IS: 3156 (Part-I, II & III) in all respects.

3. Measuring Instruments

- a) Where specified, an "intelligent" control, protection and monitoring system shall be provided in accordance with this document. Protective relays shall be numerical type.
- b) Metering, protection and control shall be provided as shown on the Single Line Diagram.
- c) Meters shall be flush mounting and fitted on the front of the Panel.
- d) External zero adjustment / calibration shall be possible on all indicating instruments to facilitate adjustment without dismantling the instrument.

- e) Protective relays shall, wherever possible, be of the draw out type with hand reset operation indicator. Lockout relays shall be of the hand-reset type.
- f) Status indication illuminators (green-open, red-closed, amber-tripped, white-trip circuit healthy) and positive drive mechanical position indicators shall be provided for each circuit breaker. Contacts for remote indication shall be provided.
- g) All unused or spare contacts of the circuit breaker, protection, auxiliary, control relays shall be wired up to the terminal blocks.
- h) All control cabling/ wiring shall be 2.5 sq.mm FRLS type. Insulated sleeves shall be provided for control wires. Stud type terminals and ring type lugs shall be used for control cables.
- i) All terminals of different control voltages shall be separate from each other.
- j) Control of circuit breakers shall be carried out at either:-
- Control Switch at Cubicle Door
 - Remote control desk / Synchronization panel / SCADA (Remote selector switch position indication shall be provided)
 - It shall be possible to both mechanically and electrically trip circuit breakers at the switchgear.
- k) Protection Coordination shall comply with Type 2 IEC 60947-4-1.
- l) It shall be possible to trip mechanically 'latched' contactors at the MCC.
- m) In MCC's, one normally open contact and one normally closed contact shall be provided for remote indication.
- n) Digital metering shall be of the microprocessor based type with serial communication facility.
- o) A local-remote control selected switch shall be provided at each panel. Contacts shall be provided for remote indication of which mode of control is selected.
- p) Sufficient auxiliary contacts of breaker and breaker contact service/trip position shall be provided for interface with SCADA/ PLC system.
- q) Indicating lamps shall be LED type and low wattage type with low wattage glow protection. The lamps shall be suitable for the voltage supply as given in single line diagram.
- r) It shall be possible to replace the indicating lamp without opening the compartment door.
- s) The trip, neutral and closed position shall be clearly indicated. The movement shall be such that the switch cannot be operated inadvertently and that it is mechanically interlocked to trip before close.
- t) For Incoming & outgoing feeders, measuring instruments shall be digital multi-functional meter square pattern, flush mounting type, 96x96mm. Instruments shall be provided wherever indicated in drawings. All auxiliary equipment such as shunts, transducers, CTs, PTs, that are required shall be included in that supply of the switchboard. Digital multifunction meter shall have network connectivity of Modbus /Back net protocol.
- u) Indicating instruments and protective relay for respective feeder shall be located preferably in the same panel as per SLD.



- v) Sufficient space and support arrangement shall be provided in the cubicles to accommodate cables. The number of cables per circuit, sizes and types shall be as specified in specific requirements.
- w) When the circuit breaker is in the test, withdrawn or earth position, operation shall only be possible from the switchgear.
- x) One normally open contact and one normally closed contact shall be provided for remote indication for breakers.

4. Relays

a. General

All Protection relays shall be numeric type & wherever required to trip and isolate the particular section under fault. All the relays shall be adjusted and coordinated for proper range of the particular circuit or equipment.

b) Over current relays

Over current relays shall be numeric type. The over current relays shall be provided with adjustable current and time settings. The setting for current shall be 50-200% in step of 25%. The IDMT over current relays shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be adjustable from 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5 Amperes.

c) Earth fault relay

Earth fault relay shall have current setting of 10% to 40% in steps of 10%, otherwise, the earth fault relays shall conform to specification laid down for over current relays.

d) Under Voltage Relays

Under voltage relays shall be induction type and shall have inverse limit operation characteristic, with pick up voltage range of 50 - 90% of the rated voltage.

5. Testing

Instrument transformers shall be tested at factory as per IS: 2705 & IS: 3156. The test shall incorporate the following:

- a) Type tests
- b) Routine tests

Original test certificates in triplicate shall be provided.

Meters shall be tested as per IS: 1248. The tests shall include both type tests and routine tests. Original test certificate in triplicate shall be furnished.

- a) Suitable injection tests shall be applied to the secondary circuit of every instrument to establish the correctness of calibration and working order.
- b) All relays and protective devices shall be tested to establish correctness of setting and operation by introducing a current generator and an ammeter in the circuit.



G. MEDIUM VOLTAGE CABLES

1. Type

Medium voltage cables shall be Aluminium OR Copper conductor, XLPE insulated, PVC sheathed and steel wire armoured or steel tape armoured construction. The conductors of cable of size 2.5 sq.mm to 10.0 sq. mm shall be solid circular. Sector shaped stranded conductors shall be used for cables of 16 sq.mm size and above. The cables shall conform to IS: 1554 part-I in all respects.

2. Rating

The cable shall be rated for a voltage of 650/1100 volts.

3. Construction

The conductors shall be made of electrical purity Aluminium OR Copper. The conductors shall be insulated with high quality XLPE/PVC base compound. A common covering (bedding) shall be applied over the laid up cores by extruded sheath of unvulcanised compound. Armouring shall be applied over the inner sheath of bedding. Over the armouring a tough outer sheath of PVC sheathing shall be extruded. The outer sheath shall bear the manufactures name and trade mark at every meter length.

4. Core identification

Core shall be provided with the following colour scheme.

1	Core	: Red/Black/Yellow/Blue
2	Core	: Red and Black
3	Core	: Red, Yellow & Blue
4	Core	: Red, Yellow, Blue & Black

5. Current Rating

The current ratings shall be based on the following condition:

a)	Maximum conductor temperature	:	75°C
b)	Ambient Air temperature	:	40°C/45°C
c)	Ground temperature	:	30°C
d)	Depth of laying	:	750 mm



6. Reference Standards

- XLPE Cable shall be As per IS: 7098 Part II.
- PVC cable shall be As per IS: 1554 Part I & II.
- Installation and maintenance of Cable shall be As per IS: 1255

7. Selection of cables

Cables have been selected considering the conditions of the maximum connected load, ambient temperature, grouping of cables and the allowable voltage drop. However, the contractors shall re-check the size before the cables are fixed and connected to the service.

8. **Storing, laying, jointing and terminations**

a) All the cables shall be supplied in drums. On receipt of cables at site, the cables shall be inspected and stored in drums with flanges of the cable drum in vertical position.

b) Laying

Cables shall be laid as per the specifications given below:

i) Duct system: Wherever specified cables shall be laid in underground ducts. The duct system shall consist of a required number of reinforced 'Hume' pipes with simplex joints. Wherever asbestos cement pipes are used, the pipes shall be encased in concrete of 75mm thick. The ducts shall be properly anchored to prevent any movement. The top surface of the cable ducts shall not be less than 60 cm. below the ground level. The ducts shall be laid a gradient of at least 1:300. The duct shall be provided with inspection/manholes at all direction changes and at required regular intervals for drawing the cables. The manholes shall be of reinforced concrete either cast-in-situ or precast. The manhole cover and frame shall be of cast iron and machine finished to ensure a perfect joint. The manhole covers shall be installed flush with the ground or paved surfaces. The duct entry to the manholes shall be made leak-proof with lead-wool joints. The ducts shall be properly plugged at the ends to prevent entry of water, rodents, etc. Suitable duct markers shall be placed along the run of the cable ducts. The duct markers shall at least be 15 cm square embedded in concrete, indicating duct. Suitable cable supports made of angle iron shall be provided in the manholes for supporting the cables. Proper identification tags shall be provided for each cable at both end and manholes.

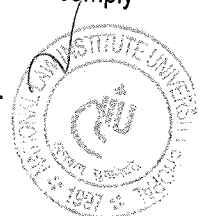
ii) Cables in outdoor trenches: Cable shall be laid in outdoor trenches wherever called for. The depth of the trenches shall not be less than 75cm from the final ground level. The width of the trenches shall not be less than 45 cm. However, where more than one cable is laid, an axial distance of not less than 15 cm shall be allowed between the cables. The trenches shall be cut square with vertical side walls and with uniform depth. Suitable shoring and propping may be done to avoid caving in of trench walls. The floor of the trench shall be rammed and leveled. The cables shall be laid in trenches over the rolling. Wherever cables are bent, the minimum bending radius shall not be less than 12 times the diameter of the cable. After the cable is laid and straightened, it shall be covered with 8 cm thick layer of sand. Cable shall then be lifted and placed over this sand cushion. The cable shall then be covered with an 8 cm thick sand cushion. Over this a course of cable protection tiles or burnt brick shall be provided to cover the cables by 5 cm. on either side. The trench shall be backfilled with earth and consolidated. Cable shall be laid in Hume pipes/stone-ware pipes at all road crossings and in GI pipes at the wall entries. Proper identification tags shall be provided for each cable at both ends.

iii) Cables in indoor trenches: Cables shall be laid in indoor trenches wherever specified. The trench shall be made of brick masonry with smooth cement mortar finish. The dimensions of the trenches shall be determined depending upon the maximum number of cables that is expected to be accommodated. Cables shall be arranged in tier formation in trenches. Suitable clamps, hooks and saddles shall be used for securing the cables in position. Spacing between the cables shall not be less than 15 cm center to center. Wherever specified, trenches shall be filled with fine sand and covered with RCC or steel chequered trench covers. Proper identification tags shall be provided for each cable at both ends.

iv) Cables in Trays/Racks: Cable shall be laid on cable trays/racks wherever specified. Cable racks/trays shall be have ladder, trough or channel design suitable for the purpose. The nominal depth of the trays/racks shall be 150 mm. The width of the trays shall be made of steel or aluminium. The trays/racks shall be completed with end plates, tees, elbows, risers, and all necessary hardware; steel trays shall be hot dip galvanized. Cable trays shall be erected properly to present a neat and clean appearance. Suitable cleats or saddles made of aluminium strips with PVC covering shall be used for securing the cables to the cable trays. The cable trays shall comply with the following requirements:

a) The tray shall have suitable strength and rigidity to provide adequate support for all contained cables.

b) It shall not present sharp edges, burrs or projections injurious to the insulation of wiring/cables.



- c) If made of metal, it shall be adequately protected against corrosion or shall be made of corrosion-resistant material.
- d) It shall have side rails or equivalent structural members.
- e) It shall include fittings or other suitable means for changes in direction and elevation of runs.

Installation

- Cable trays shall be installed as a complete system. Trays shall be supported properly from the building structure. The entire cable tray system shall be rigid.
- Each run of the cable tray shall be completed before the installation of cables.
- In portions where additional protection is required, non combustible covers/enclosures shall be used.
- Cable trays shall be exposed and accessible.
- Where cables of different system are installed on the same cable tray, non combustible, solid barriers shall be used for segregating the cables.
- Cable trays shall be grounded by two nos. earth continuity wires. Cable trays shall not be used as equipment grounding conductors.

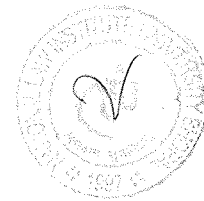
c) Jointing and terminations

Cable jointing shall be done as per the recommendations of the cable manufacturer. Jointing shall be done by qualified cable jointers.

Each termination shall be carried out using brass double compression glands and cable sockets. Hydraulic crimping tool shall be used for making the end terminations. Cable gland shall be bonded to the earth by using suitable size copper wire/tape.

9. **Testing**

- a) Cable jointing shall be tested at factory as per the requirements of IS: 1554, Part-I. The tests shall incorporate routine tests, type tests and acceptance tests.
- b) Cable shall be tested at site after installation and the results shall be submitted to the Architects/Engineer.
- c) Insulation resistance test between conductors and neutral and conductors and earth.
- d) Pressure test for 15 minutes.



H. EARTHING FOR ELECTRICAL WORKS

1. General

All non-current carrying metal parts of the electrical installation shall be earthed as per IS 3043. All metal conduits, trunkings, cable sheaths, switchgear, distribution boards, meters, light fixtures, fans and all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to earth electrodes. Earthing shall also be in conformity with the provisions of Rule 32, 61, 62, 67 and 88 of IER 1956.

2. Earthing Conductors

2.1 All earthing conductors shall be of high conductivity Copper/ Aluminium/GI as specified and shall be protected against mechanical damage and corrosion. The size of earth conductors shall not be less than half that of the largest current carrying conductor. The connection of earth continuity conductors of earth bus and earth electrodes shall be strong and sound and shall be rigidly fixed to the walls, cable trenches, cable trays or conduits and cable by using suitable clamps made of non ferrous metals. The following earthing conductors are required to be used for various sections of the installation.

- a) All fixtures - lighting, fan and switch enclosures, lighting conduits shall be earthed with 16 SWG bare copper wires or 1.5 sq.mm PVC insulated copper conductor wires as specified.
 - b) 3rd pin of power socket outlet up to 20 A shall be earthed with 14 SWG bare copper wires or 2.5 sq.mm PVC insulated copper conductor wires as specified.
 - c) All single phase switches and DBs up to 32 A rating shall be earthed with one run of 12 SWG bare copper wires or 4.0 sq. mm PVC insulated copper conductor wires as specified.
 - d) All single phase switches and DBs above 32 A and up to 63 A. rating shall be earthed with one run of 10 SWG bare copper wires or 6.0 sq.mm PVC insulated copper conductor wires as specified.
 - e) All three phase switches/DBs up to 32 A rating shall be earthed with 2 runs of 12 SWG copper wires or 4.0 sq. mm PVC insulated copper conductor wires as specified.
 - f) All three phase switches/DBs above 32 A and up to 63 A shall be earthed with 2 runs of 10 SWG copper wires or 6.0 sq. mm PVC insulated copper conductor wires as specified.
 - g) All three phase switches/DBs above 63 A and up to 100 A shall be earthed with 2 runs of 8 SWG copper wires.
 - h) All three phase switches/DBs of 200 A rating and above shall be earthed with 2 runs of 25 x 3 mm copper tapes.
 - i) All motor frames shall be earthed by two earthing conductors of specified cross section.
 - j) All cable glands should be earthed using 16 SWG copper bare wires.
- 2.2 Main earth bus shall be taken from the main medium voltage panel to the earth electrodes. The number of electrodes required shall be arrived at taking in to consideration the anticipated fault on the medium voltage network.



- 2.3 All the sub mains and sub circuits shall be provided with earth continuity conductors as specified and connected to the main earth bus. Earth conductors for equipment shall be run from the exposed metal surface of the equipment and connected to a suitable point on the sub main or main earthing bus. All switch boards, distribution boards and isolators, disconnect switches shall be connected to the earth bus. Earthing conductors shall be terminated at the equipment using suitable lugs, bolts, washers, and nuts.
- 2.4 All conduits, cable armouring, raceways, rising mains, etc. shall be connected to the earth all along their run by earthing conductors of suitable cross sectional area. Sprinkler pipes, LPG pipes, water pipes, steel structural elements, lightning conductors shall not be used as a means of earthing an installation. The electrical resistance of earthing conductors shall be low enough to permit the passage of fault current necessary to operate a protective device/ circuit breaker and shall not exceed 2 ohms As rough guide the following size of earth continuity conductors shall be used for circuit wiring.

	Size of Circuit wires/cables		Size of copper earth wire
a)	Up to 7/0.91 mm conductors	:	14 SWG
b)	10 mm ² conductors	:	14 SWG
c)	16 mm ² conductors	:	12 SWG
d)	25 mm ² conductors & } 35 mm ² conductors }	:	12 SWG
e)	50 mm ² and 70 mm ² conductors	:	10 SWG

All single-phase wiring shall have one run of copper earth wire and three phase wiring shall be provided with two runs of copper earth wires.

3.1 Earthing Electrodes

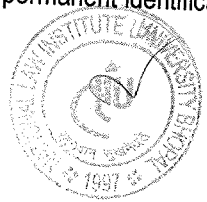
Earthing electrodes shall be designed as per the requirement of Clause 9 of IS 3043. The number and size of earth electrodes shall be calculated so that under fault conditions no electrode is loaded above its maximum permissible current density. The resistance of earth electrode shall be as low as possible, the maximum allowable value being one ohm.

Earthing electrodes of either plate type or pipe type may be adopted. The choice of plate or pipe electrode shall be decided according to the anticipated fault level of the network and local soil conditions. Generally, plate electrodes shall be used for substations and large medium voltage network and pipe electrodes for small medium voltage network and installations.

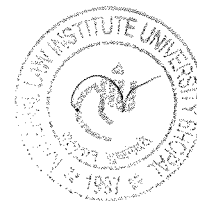
3.2 Plate Electrode

Plate electrodes shall be made of GI plate of 6.3 mm thick/ specified in BOQ specification and 60x60 cm size. The plate shall be buried vertically in ground at depth of not less than 2 meters to the top of the plate, the plate being encased in charcoal to a thickness of 15 cm. all round. It is preferable to bury the electrode to a depth where sub-soil water is present. Earth leads to the electrode shall be laid in a GI pipe and connected to the plate electrode with GI bolts, nuts and washers. A GI pipe of not less than 19 mm dia. shall be placed vertically over the plate and terminated in a funnel at 5 cm above ground. The funnel shall be provided with a wire mesh. The funnel shall be enclosed in cement concrete chamber of 45 x 45 x 45 cm. dimensions. The chamber shall be provided with CI frame and CI cover or as specified. The earth station shall also be provided with a suitable permanent identification label/tag.

Note: If copper plate is used it shall be of 3.15 mm thickness.



- 3.3 Pipe electrode shall comprise of a 2.5 Mtr long 40 mm dia. GI pipe buried vertically in a pit of 35 x 35 cm size and filled with alternate layers of charcoal, salt and river sand and connected at the top to a GI pipe of 19 mm, 1 Mtr. long with a funnel at the other end, 5 cm above the ground. The earth lead shall be properly fixed to the pipe electrode with brass bolts, nuts and washers. The funnel and earth lead connections shall be enclosed in a cement concrete chamber of 45 x 45 x 45 cm dimensions. The chamber shall be provided with a CI frame and CI cover or as specified. Proper permanent identification tag/label shall be provided for each electrode.
- 3.4 Rod electrode shall be as per schedule of quantities.
- 3.5 **Inspection Chamber:** A 450x450 mm concrete box / brick masonry chamber and CI cover shall be provided on the top of the earth system. The inspection chamber shall be finished flush with the ground surface.
- 4.0 Precautions**
- 4.1 Earthing system shall be mechanically robust and the joints shall be capable of retaining low resistance even after passages of fault currents.
- 4.2 Joints shall be soldered, tinned and double riveted. All the joints shall be mechanically and electrically continuous and effective. Joints shall be provided against corrosion.
- 5.0 Testing**
- 5.1 On the completion of the entire installation, the following tests shall be conducted as per clause 37 of IS: 3043.
- a) Earth resistance of electrodes.
 - b) Impedance of earth continuity conductors.
 - c) Effectiveness of earthing.
- 5.2 All meters, instruments and labour required for the tests shall be provided by the contractor. The test results shall be submitted in triplicate to the Architects for approval.



I. MEDIUM VOLTAGE DISTRIBUTION BOARDS

1. General

Distribution board shall be suitable for 415 volts, 3 phase AC supply or 230 volts single phase AC supply as required. Distribution boards shall generally conform to IS 2675 or BS 214. However, the specifications hereinafter described shall take precedence over the above wherever this specification calls for a higher standard for material or workmanship.

2. Type and construction

Distribution boards shall be of totally enclosed dead front safety type. The enclosure shall be made of best quality sheet steel of not less than 16 gauge. The sheet steel shall be treated with a rigorous rust inhibited process before fabrication. The distribution boards shall comprise of moulded case circuit breaker or miniature circuit breaker as incoming and required number of miniature circuit breakers as outgoing. The main and outgoing shall have rating as specified on the drawings and schedule.

3. Bus bars

Suitable bus bars made of high conductivity copper strips and mounted on non-hygroscopic insulating supports shall be provided.

4. Circuit Breakers

Moulded case circuit breakers and miniature circuit breakers shall be of approved design and make. Circuit breakers shall be equipped with individually insulated, traced and protected connectors. The front face of all the breakers shall be flush with each other. Each breaker shall be provided with card holder and neatly printed card identifying the circuit. The position of handle of the breaker shall clearly indicate the condition of breakers such as 'ON/OFF/TRIPPED'.

5. Safety & interlocks

All the live parts shall be shrouded such that accidental contacts with live parts are totally avoided. Distribution board shall be provided with a front hinged door. Distribution board interior assembly shall be dead front with the front cover removed. Main lugs shall be shrouded on five sides. Suitable insulating barrier made of arc resistant material shall be provided for phase separation. Ends of the bus structures shall also be shrouded.

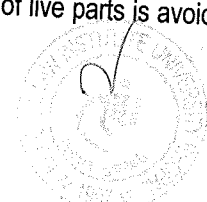
6. Cabinet design

The distribution board cabinet shall be totally enclosed type with dust and vermin proof construction. The cabinet shall be stove enameled to Grey/off-white shade finish or as per approval. The interior surface shall be finished to an off-white shade. The interior components shall be mounted on separate sheet steel which is mounted and locked on to the studs provided inside the cabinet. Over this, a cover made of Hylam sheet or stove enameled sheet steel shall be provided with slots for operating handles of breakers. The cabinet shall be equipped with a front door having a spring latch and a vault lock. Cabinets shall have detachable gland plates at both top and bottom.

7. Terminals

Distribution boards shall be provided with a terminal block of adequate size to receive mains and outgoing circuits. The location of the terminal block shall be so located that crowding of wires in the proximity of live parts is avoided. A neutral link having rating equal to that of phase bus shall be provided.

8. Director



Distribution boards shall be provided with a directory indicating the area or loads served by each circuit breaker, the rating of breakers, size of conductors, etc. The directory shall be mounted in metal holder with a laminated sheet for trouble shooting purpose, on inside surface of the front door. Labelling needs to be done up to the end user isolation / controlling point.

9. Installation

Distribution boards shall be surface mounted or recessed mounted as required by the Architects and at the locations shown on the drawings. The boards shall be fixed with suitable angle iron clamps and bolts. All the cables/conduits shall be properly terminated using glands/grips / check nuts etc. Wiring shall be terminated properly using crimping lugs/sockets and PVC identification ferrules. No bare conductor shall be allowed inside the board. Distribution boards shall be bonded to the earth at least at two points using brass bolts and lugs. Suitable name plate, danger plate, indicating the voltage shall be fixed to the front cover.

10. Testing

Distribution boards shall be tested at factory as per IS 2675. The tests shall include insulation test, high voltage tests etc.

Distribution boards shall be tested for insulation resistance after the erection.



J. MEDIUM VOLTAGE DISTRIBUTION SYSTEM

1. General

Medium voltage distribution system shall be applicable for wiring 3 phase, 4 wire, 415 volts, 50 HZ, AC supply and single phase, 2 wire 230 Volts, 50 HZ, AC supply.

2. Regulations and Standards

The system shall be governed by the requirements of IS: 732, IE Rules, and IEEE regulations. MS conduit shall be as per IS: 9537 & conduit fittings shall be as per IS: 2667.

3. Rigid steel conduits and accessories

3.1 General conduits shall be of welded and screwed sheet steel construction. Conduits shall be black stove enameled inside and outside. The wall thickness of conduits shall be as follows:

a)	19mm, 25mm and 32 mm	-	16 gauge
b)	38mm and above	-	14 gauge

3.2 The sheet steel conduits shall conform to the requirements of IS: 1653 (Latest Edition) in all respect. The conduits shall have uniform wall thickness and uniform cross section throughout. The welding shall be uniform and good such that welded joints do not yield when subjected to a flattening test. The conduit shall be free from welding burrs. Welded joints shall not break when threaded or bent at an angle. Conduits shall bear the name or trade mark of the manufacturer on each length. The conduits shall be delivered to the site in original bundles. Conduits of less than 19 mm dia. shall not be used.

Conduit accessories such as bends, inspection bends, inspection tees, elbows, draw boxes, junction boxes etc. shall conform in all respects to IS: 3837. Boxes shall have internally tapped spouts. Junction boxes/inspection boxes shall be provided with suitable covers.

3.3 Open/Surface conduit system

Wherever specifically called for, surface conduit system shall be adopted. Conduits shall be run in square and symmetrical lines. Before the conduits are installed, the exact route shall be marked at site and approval of the Architect shall be obtained. Conduits shall be fixed by heavy gauge GI saddles, secured to suitable rawl plugs, at an interval of not more than 1 meter. Wherever couplers, bends or similar fittings are used, the saddles shall be provided on either side at distance of 30 cm. from the centre of such fittings. Conduits shall be jointed by means of screwed couplers and screwed accessories only. In long distance straight runs of conduit inspection type couplers or running type couplers with jam nut shall be provided. Threading shall be long enough to accommodate pipes to the full threaded portion of the couplers and accessories. Cut end of the conduits shall have no sharp edges or any burrs left to avoid damage to the insulation of the conductors.

Bends in conduit runs shall be done by bending conduits by pipe bending machine or any other suitable device as far as possible. Bends which cannot be negotiated by pipe bends shall be accompanied by introducing solid bends, inspection bends or cast iron inspection box. The radius of solid bends shall not be less than 7.5 cm. Not more than three equivalent 900 bends shall be used in conduit run from outlet to outlet.

Conduit shall be properly drained and ventilated to prevent sweating or condensation inside the pipes. All the conduit openings shall be properly plugged with PVC stopper/bushes. A breather, drainer shall be provided in the lowest position of the conduit system. The conduits shall be adequately protected against rust by applying two coats of approved synthetic enamel paint after the installation is completed.



- a) Wherever conduits terminate in to point control box, outlet box, distribution board etc. conduits shall be rigidly connected to the box/board with check nuts on either side of the entry to ensure proper electrical and mechanical continuity.

The entire conduit system after installation shall be bonded to the earth as per the specifications given in specification, 'Earthing for Electrical work'.

- b) Recessed conduit system
All the conduits including bends, unions, junction boxes, etc. shall be cleaned and painted with two coats of bitumen paint before they are fixed in position.

Conduits which are to be taken in the ceiling slab shall be laid on the prepared shuttering work of the ceiling slab before concrete is poured. The conduits shall be properly threaded and screwed in to sockets, bends, junction boxes, outlet boxes and shall be made watertight by using bituminous hemp yarn at the screwed ends. The conduits in ceiling slab shall be straight as far as possible to facilitate easy drawing of wires through them. Before conduits are laid in the ceiling the positions of outlet points, point controls, junction boxes shall be set out clearly so as to minimize off-sets and bends.

Conduits recessed in walls shall be secured rigidly by means of steel hooks/staples at 0.8 metre intervals. Before conduit is concealed in the walls, all chases shall be neatly made to proper dimensions to accommodate the required number of conduits, chases in the walls shall be made with electric cutter and the same shall be filled up by the electrical contractor before plastering. The outlet boxes, point control boxes, inspection and drawn boxes shall be fixed as and when conduit is being laid. The recessing of conduits in walls shall be so arranged as to allow at least 12mm plaster cover on the same. All grooves, chases, etc. shall be refilled with cement mortar and finishing up to the wall surface before plastering of walls is taken up by the general contractor. Where conduits pass through expansion joints in the building, adequate expansion fittings or other approved devices shall be used to take care of any relative movement wherever conduits terminate in to point control boxes, distributing boards etc. conduits shall be rigidly connected to the boxes, boards etc. with check nuts on either side of the entry to ensure electrical continuity.

Running joints in conduits wherever necessary shall be rigidly held in aligned position by a check nut tightened on running side. After conduits, junction boxes, outlet boxes etc. are fixed in position their outlets shall be properly plugged with PVC stoppers or with any other suitable material so that water, mortar, vermin or any other foreign material do not enter in to the conduit system.

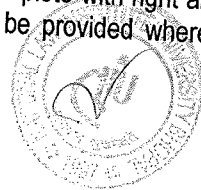
A breather-drainer shall be provided in lowest position of the conduit for draining and ventilating. All conduit ends terminating in to an outlet, draw boxes, junction box, point control boxes, etc. shall be provided with bushes of PVC or rubber, after the conduit ends are properly filed to remove burrs and sharp edges.

Concealed conduit laying, above false ceilings shall be executed in similar manner described above.

Necessary GI pull wires shall be inserted in to the conduit for drawing wires and proper size earth continuity wire shall be run throughout the length of the conduit with the earth wire being efficiently fastened to the conduit by means of special clamps.

4.0 Cable trunking / raceways

- 4.1 Cable trunking or raceways shall be of sheet steel construction. The thickness of sheet steel shall not be less than 16 gauge. The sheet steel before fabrication shall be given a rigorous anti-corrosive treatment. The trunking shall be provided with removable, covers of 1 metre length. The trunkings shall be supplied in suitable lengths; however, the maximum length of a single trunking shall not exceed 6 meter. The trunking shall be complete with right angle bends, 145° bends, adapters, tee pieces, couplers etc. Removable cable retainers shall be provided wherever required.



4.2 Installation

Trunking/race-ways shall be installed in readily accessible places. Trunking shall be supported at regular intervals of two meters. Trunking shall be aligned properly during the erection to present a neat appearance. Standard lengths of trunking shall be jointed together by suitable couplers. Wherever required right angled bends, 145° bends, tees etc. shall be provided in the run of cable trunk/raceways. However, not more than 60% of cross sectional area of the raceway shall be occupied by the conductor. Trunking shall be painted with two coats of approved synthetic enamel paint.

5.0 Enclosure for electrical accessories

5.1 Enclosure for electrical accessories such as switches, sockets, fan regulators, etc. shall be of cast iron or mild steel conforming to IS: 5133-Part-I. The dimensions of the enclosures shall be as per Clause 3.1 to 6.3.1 of IS: 5133. The wall thickness of CI enclosures shall not be less than 3mm and that of MS enclosure shall not be less than 1.6 mm. Wherever specifically called for, galvanized sheet steel boxes shall be provided. The enclosure boxes shall be provided with a minimum of four fixing lugs located at the corners for fixing the covers. All fixing lugs shall have tapped holes to take machined brass screws.

5.2 Sufficient number of knock-outs of 38mm/32mm/25mm/20mm dia. shall be provided for conduit entries. Enclosures shall be sufficiently strong to resist mechanical damage under normal service conditions. Provision shall be made for bonding the enclosures to the earth. The enclosure shall be adequately protected against rust and corrosion with suitable air drying paint. The enclosures shall be provided with 5mm thick white PVC or Perspex sheet cover with rounded corners and beveled edges for mounting switches, sockets etc. Wherever different phase conductors are brought in to the same enclosure, phase barriers shall be provided.

5.3 In case of plate type or modular type accessories, the enclosures used shall be of the same make as that of the accessories.

6.0 Wiring Conductors

6.1 All wiring conductors shall be multi stranded FRLS PVC insulated, single/stranded copper or aluminium conductors of 1100 V grade as required Wiring conductors shall conform in all respects to IS 694 (Latest Edition).

The current rating for wiring conductors shall be based on the following parameters:

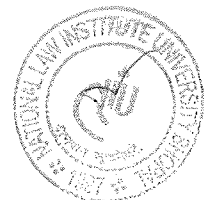
- i) Ambient temperature - 40°C.
- ii) Conductor temperature - 70°C.

Wiring conductors shall be supplied in RED, BLACK, YELLOW, BLUE colours for easy identification of wires. The wiring conductors shall be supplied in sealed coils of 100 metre length. The wiring conductors shall bear manufacturer's trade mark, name, ISI mark, voltage grade etc.

6.2 Installation of wiring conductors/cables

The wiring conductors shall not be drawn in to the conduits until all the works of any nature that may cause damage to the wires are completed. Before drawing the wires, the conduits shall be thoroughly cleaned, drained and ventilated. Proper care shall be taken in pulling the wires to see that no damage occurs to the insulation of the wires. The installation and termination of wires shall be carried out with due regard to the following:

- a) While drawing the wiring conductors, care shall be taken to avoid scratches and kinks which cause breakage of conductors. There shall be no sharp bends in the conduit system.
- b) Insulation shall be shaved off like sharpening a pencil.



- c) Strands of the wires shall not be cut for connecting to the terminals or lugs. The terminals shall have adequate cross section to take all the strands.
 - d) Ends of the wiring conductors shall be terminated by using crimping sockets. Soldering of sockets shall not be done.
 - e) Oxide inhibition grease shall be applied at all terminals and connections.
 - f) Brass flat washers of large area shall be used for bolted terminals.
 - g) Bimetallic connectors should be used wherever aluminium conductors are tapped from copper mains or vice-versa.
- 6.3 Wiring for power and lighting circuits shall be carried out in separate and distinct wiring system. Balancing of circuits in a three phase system shall be arranged before the installation is taken up.
- 6.4 The wiring system envisaged is generally shown on the layout drawings and line diagrams. However, a brief account of the general wiring system is given below:
- a) Sub mains wiring - Wiring from switchboards to the individual distribution boards.
 - b) Circuit wiring - Wiring from DBs to the point control boxes for lighting, fans 5 A. sockets, call bells etc. and from DBs to the power sockets in the case of power wiring.
- 6.5 The sub main wiring shall be either in 3 phase, 4 wire or single phase, 2 wire system. Each sub main wiring circuit shall also have its own copper earth continuity wire. The number and size of earth continuity wire shall be as per the detailed drawings and standard specifications.

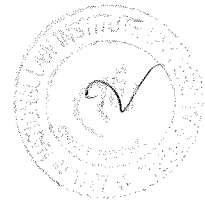


TABLE OF RECOMMENDED WIRING SYSTEM

**Max. permissible number of 250V/650V Grade Single Core cables that
can be drawn into Rigid Steel Conduits
(IS: 732 - 1963)**

SIZE OF CABLE	Size of conduit (mm)													
	16		20		25		32		40		50		63	
Nominal Number Cross and dia Sectional in mm of Area Sq. mm 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) (3/1.06)	3	2	-	5	10	8	18	12	-	-	-	-	-
4	(1/2.24) (7/1.06)	3	2	4	3	7	8	12	10	-	-	-	-	-
6	(1/2.80) (7/1.06)	2	-	3	2	6	5	10	8	-	-	-	-	-
10	(1/3.55) (7/1.40)	-	-	2	-	5	4	8	7	-	-	-	-	-
16	7/1.70	-	-	-	-	4	3	6	5	-	-	-	-	-
25	7/2.24	-	-	-	-	-	-	-	-	-	-	-	-	-
35	7/2.50	-	-	-	-	-	-	-	-	-	-	-	-	-
50	(7/3.00) - (19/1.80)	-	-	-	-	-	-	-	-	-	-	-	-	-

Number of Cables, Max.



- 6.6 Circuit wiring shall generally be in single phase system. However a maximum of 3 to 4 single phase circuit belonging to the same pole/phase could be installed in the same conduit or raceway. Each circuit wiring shall be provided with suitable GI earth continuity conductor as per standard specifications. Not more than 8 light points/fan points shall be grouped on one lighting circuit. The load per circuit shall not exceed 800 watts. The minimum size of conductor for wiring of lighting circuit shall not be less than 2.5 sq. mm. Power circuit wiring shall not have more than 4 to 6 sockets of 6 A, two sockets of 16 A and single socket above 16 A connected to one circuit. All the wiring shall be carried out in loop in loop out system.

The maximum number of various size conductors that could be drawn in to various sizes of conduits shall be as per table II of IS 732 (Latest Edition). The wiring shall be colour coded for easy identification of phases and neutral. The following colour code shall be adopted.

Phases:	R	-	Red
	Y	-	Yellow
	B	-	Blue
Neutral	Black		
Earth	Green		

- 6.7 All circuit wiring shall be provided with printed PVC identification ferrules at either end bearing the circuit number and designation.

7.0 Switches, Sockets and Accessories

7.1 General requirements

Light control switches shall be of minimum 6A rating. Light control switches shall be of piano-key/moulded/modular type design suitable for flush mounting for general lighting. Wherever specifically called for tumbler type switches shall be used for surface mounting. Light control switch shall have either integral mounting plates or white PVC/Perspex covers plates as approved.

- 7.2 All sockets 6 A and 16 A ratings shall be of flush mounting/ moulded/modular type with control switches of piano-key/ moulded/ modular type design of the same rating as that of the sockets. All sockets outlet shall be of 3 pin type. The base of the socket shall be of high quality porcelain with pins made of brass alloy and plated with a noble metal. Sockets shall be provided with PVC surface outlet plates with round corners and beveled edges. All the sockets shall be provided with plug tops of approved quality and design.

7.3 Industrial type sockets

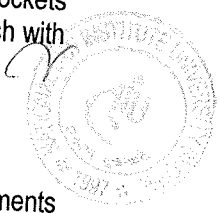
Industrial type sockets shall be provided wherever specifically called for industrial sockets shall be totally metal and with porcelain base incorporating the pins. Sockets shall have 3 pins for single phase applications and 4 pins and scrapping earth for 3 phase applications. The sockets shall be provided with suitable metal clad plug top with suitable cable entry. Sockets shall have metal covers with chain. Industrial type sockets shall be provided with a suitable sheet steel housing made of 16 gauge with the socket mounted in flush with cover of the housing.

7.4 Lamp Holders, Ceiling Roses etc.

Accessories for light outlets such as lamp holders, ceiling roses, etc. shall be in conformity with requirements of relevant IS specifications. Only approved make of accessories shall be supplied.

7.5 Installation of switches, sockets and accessories

Plate/Modular type: Fixing shall be done as per manufacturer's instructions. Connections shall be made only after testing the wires for continuity, cross phase, etc. with the help of a meggar. Switches, sockets, fan regulators etc. shall be housed in proper sheet steel enclosure with PVC/Perspex sheet. For wall plug sockets the conductors may be terminated directly in to the switches and sockets. The outlets, point control boxes, etc. shall be set out as shown on the drawings, before fixing these, the contractor shall obtain clearance from the Engineer/Architect with regard to their proper locations. The enclosures of sockets /and



3rd pin of the socket shall be connected to the ground through a proper size earth continuity wires as laid out in standard specifications.

8.0 Luminaires

8.1 General

All the materials used in the construction of luminaries shall be of such quality, design and construction that will provide adequate protection in normal use, against mechanical, electrical failures/faults and exposure to the risk of injury or electric shock and shall withstand the effects of exposure to atmosphere.

8.2 LED/Fluorescent lamp luminaires

Luminaries shall be supplied as per the design specified in the schedule of quantities. Luminaries shall be complete in all respects with basic mounting channel, shock-proof insert contact rotor lamp holder, polyester ballast, HPF capacitor, connector block, internal wiring and decorative attachments, if any. The mounting channel shall be made of mild steel sheets suitably rust inhibited and stove enameled. A dust proof cover stove enameled to white shade shall be provided for the channel to protect the accessories and wiring from dust and vermin and to act as a reflector.

Driver/Ballast shall be copper wound conventional type or electronic type as specified.

Driver/Ballast shall be silent in operation. Driver/Ballast shall have a long life and shall be highly reliable. A suitable capacitor shall be hermetically sealed. Diffusers, louvers etc. shall be of opal acrylic/polystyrene. The decorative attachments shall be guaranteed against dis-colourisation, warping and deformation under continuous operation. Fluorescent lamps shall conform to BS: 1853 in all respects. Fluorescent lamps shall be of bi-pin pattern. The colour of the light shall be white or cool daylight, as required. Unless otherwise specified, the lamps shall be of energy efficient LED/T5/CFL or as specified. Luminaries shall be provided with an earthing terminal for bonding the body of the luminaire to earth. Luminaires shall be installed as specified in the drawings. Wherever luminaries are fixed on the false ceiling suitable supporting and fixing arrangements independent of the frame work of false ceiling shall be provided. Suspended luminaries shall be provided with swivel type hangers, comprising of suspension pipes, swivel sockets, screws, bolts etc. for installing the luminaries.

Luminaires shall be suspended true to alignment, plumb and level and capable of resisting all lateral and vertical forces. Lead in wires shall have a cross section of 1.5 sq. mm (40/0.193 mm). Lead in wires shall be protected from abrasion. Erection of fixtures shall include assembling of all components of the fixture such as Driver/ballasts, condensers, starters, decorative attachments etc.

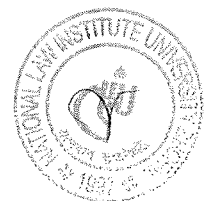
9.0 Point Wiring

9.1 Point wiring shall commence from the first point control box/local control box for the points connected to the same circuit. Point wiring for lights, fans, 5 Amps sockets, call bells, etc. shall be carried out with multi stranded FRLS PVC insulated copper wire of 2.5 sq.mm cross section. The point wiring shall be inclusive of 20mm/32mm sheet steel conduits of standard and of approved make (as specified) along with approved quality conduit accessories such as bends, inspection bends, reducers, junction boxes etc. together with wiring accessories such as ceiling roses, lamp holders, connectors, point control boxes (enclosure for electrical accessories), etc. Point wiring shall be provided with 1.5 sq.mm multi stranded FRLS PVC insulated single core wire for earthing 3rd pin of sockets, luminaires and fan fixtures. Light control shall be either single, twin or multiple points controlled by a switch as specified.

10.0 Testing of electrical installation

10.1 Testing of installation shall be as per IS 732 - 1989 (Third revision).

a) The insulation resistance shall be measured by applying between earth and the whole system of conductors or any section thereof with all fuses in places and all switches closed and except in earthed concentric wiring shall be all lamps in position or both poles of the installation otherwise electrically connected together, where



a direct current pressure of not less than twice the working pressure provided with it need not exceed 500 volts for medium voltage circuits. Where the supply is derived from the three wire (AC or DC) or a poly phase 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 outer or phase conductor and the neutral.

- b) The insulation resistance measured as above shall not be less than 50 divided by the number of points on the circuits provided that the whole installation shall be required to have an insulation resistance greater than one mega ohm.
- c) Control rheostats, heating and power appliances and electric signs may, if required, be disconnected from the circuit during the test, but in the event, the insulation resistance between the case or frame work and all live parts of each rheostat appliance and sign shall not be less than that specified in the relevant Indian Standard specification or where there is no such specification shall not be less than half a mega ohm.
- d) The insulation resistance shall also be measured between all conductors connected to one pole or phase conductors of the supply and all the conductors connected to the middle wire or the neutral or to the other pole or phase conductors of the supply and its value shall not be less than specified.
- e) On completion of an electric installation (or an extension to an installation) a certificate shall be furnished by the contractor countersigned by the qualified supervisor under whose direct supervision the installation was carried out. The certificate shall be in the prescribed form as required by the Local Electric Supply authorities.

10.2 Testing of earth continuity path

The earth continuity conductor including metal conduits and metallic envelopes 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 leakage circuit breaker measured from the connection with the earth electrodes to any point in the earth continuity conductor in the completed installation shall not exceed one mega ohm.

10.3 Testing of polarity of non-linked single pole switches

- a) In a two wire installation a test shall be made to verify that all non linked single pole switches have been fitted in the same conductor throughout and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply.
- b) In a three wire or a four wire installation, a test shall be made to verify that every non-linked single switch is fitted in a conductor which is labeled marked for connection to one of the outer phase conductors of the supply.



K. LIGHTNING PROTECTION SYSTEM

1. Scope

This specification covers the requirements of supply, installation, testing and commissioning of lightning protection system in conformity with the requirements of IS: 2309, consisting of vertical air termination the horizontal air terminations, down conductors and earth stations.

2. Air Terminations

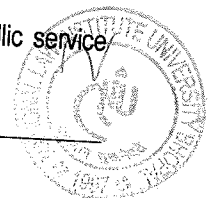
The air terminations shall be provided at the points shown on the drawings. The vertical air terminations shall consist of copper spikes fixed onto 25 mm dia. copper tubes of at least 1.5 metre long grouted to the surface of the roof with base plate as approved by Consultants. The horizontal air terminations shall consist of a rigid network of tapes fixed to the surface of the roof. All exposed metal work and roof structures forming part of the structure to be protected shall be bonded to the network by the conductors of the appropriate cross section.

3. Down Conductors

Air terminations shall be connected to the earth terminations by tapes fixed onto walls of the structures with spacers. The tapes shall be securely fixed to walls by means of brass saddles and metallic fasteners. Where the down conductors are laid underground, they shall be laid at a depth of 750 mm below the ground level, buried in trench, covered with a 100 mm thick layer of sand and protected by cable protection tiles. All metallic parts of the building above the main roof level including ducts, towers, pipes gutters and other mechanical equipment's shall be bonded to the down conductors.

4. General

- 4.1 The materials shall be free from rust, scale and other electrical and mechanical defects. The size, materials and quantity shall be as specified.
- 4.2 Steel earthing conductors above ground shall be hot dip galvanized. If painted it shall be given two coats of approved bitumen paint/anti-corrosive paint.
- 4.3 Test links in suitable enclosures shall be installed by the contractor at no extra cost for connection between each lightning down conductor and earth electrode.
- 4.4 The scope of installation of lightning conductors on the roof of buildings shall include laying, anchoring, fastening and cleating of horizontal conductors, grouting of vertical rods where necessary, laying, fastening/cleating/welding of the down-comers on the walls/columns of the building and connection to the test links above ground level, and up to earth station.
- 4.5.1 Lightning protection conductors shall not be connected to other general earthing conductors.
- 4.6 The lightning protection air termination rods and/or horizontal air termination conductors shall be fixed in such a way that they remain in their installed position even during adverse weather conditions.
- 4.7 The down conductors shall follow a direct path to earth. There shall not be any sharp turns and kinks in the down conductors.
- 4.8 All joints in the down conductors shall be of welded/brazed type. All metallic structures within 2m vicinity of down conductors shall be bonded to the lightning protection system.
- 4.9 Every down conductor shall be provided with a test link at about 1000 mm above ground level. The test link shall be directly connected to the earthing system/electrode.
- 4.10 The lightning protection system shall not be in direct contact with the underground metallic service ducts, cables, cable conduits and metal enclosures of electrical equipment's.



4.11 Lightning conductors shall not pass through or run inside G.I conduits.

5. **Joints Bonding**

The system shall have preferably no joints and they shall be made mechanically and electrically strong and effective. Bolted joints should only be used on test points or on bonds to as existing metal. Generally jointing/connections/installations shall be as in earthing system.

6. **Earth Terminations**

Suitable number of earth terminations shall be provided. The earth termination shall consist of pipe/plate earth electrode as specified elsewhere in the earthing specification, and generally conforming to IS: 3043. The earth terminations shall be complete in all respects with chamber and cover, etc. as per the detailed specifications.

Before installing the lightning protection system, the contractor shall obtain approval from the Engineer with respect to the locations of air termination's and the routes for the down conductors.

7. **Test Clamps/Links**

Test clamps/links shall be manufactured from phosphor bronze or approved equivalent with four fixing holes. Tape conductors shall be fixed to flat roof surfaces by means of suitable fixing arrangement as approved.

All fixing screws shall be brass.

8. **Testing**

Suitable testing links shall be provided at required points as per the code of practice CP 326/IS 2309. The contractor shall carry out tests on completion of the installation and submit the readings for approval.



L. STREET LIGHTING

1. The specification covers the supply, installation, testing and commissioning of:

- a) Street/Boundary lighting poles complete with all accessories e.g. lamps, fixtures, looping box etc.
- b) Wiring of street light fixtures with 3 x 2.5 mm² flexible cable from MCB to light fixture inside the pole.
- c) Cable laying, earthing and interconnection.
- d) Foundation of poles and erection.

2. Steel Tubular / G.I Octagonal pole

The Steel Tubular poles for street lighting purpose shall be complete in all respects and shall conform to IS: 2713 unless otherwise specified. All poles shall be complete with base plate of minimum 300mm x 300mm x 10mm thick welded to bottom unless otherwise specified. The poles shall be provided terminal box for looping in and looping out of cables and shall consist of MCBs. The looping box shall be suitable for outdoor installation and complete with all hardware such as clamp, bolts, earthing studs, lockable door etc. and shall be painted in the same manner as specified for poles. The poles shall be provided with two number windows of suitable dia. for cable entry as shown in drawing. The poles shall be painted with two coats of oxide primer and two coats of synthetic enamel paint of approved shade.

3. Erection of pole

While loading, transporting, unloading and erecting the poles care shall be taken so that the poles do not get bent out of shape and where necessary such defects shall be rectified before the poles are erected in position. The poles shall be erected in plumb line and correct level as indicated in the drawing and to the satisfaction of the Engineer-in-charge. They shall be kept in this position with the help of manila ropes until the foundations are constructed (for a minimum period of 10 days) and the backfilling is complete. Foundation shall be made with reinforced cement concrete (1:2:4). The pole base plate shall be fixed over 150 mm thick concrete bed. Foundation shall be continued up to 300 mm or more above ground level as per location of the pole to avoid ingress of water logging etc. The foundation shall be tapered suitably into a collar. The excavated portion shall be filled back with earth and consolidated. The cement concrete foundations shall be cured properly by covering the same with water soaked or moist gunny bags.

4. Cabling and wiring of light fixtures

All cable installation work shall be done as per relevant clauses of Cable specifications. The wiring of lighting fixtures from terminal block shall be by means of 2.5 sq. mm PVC insulated single core copper conductor through a suitable rated MCB and neutral. Cost of cables and terminations is paid separately but cost of single core connecting cable from junction box to lighting fixture and earth wire complete with connections are included.

5. Tests

Before handing over the installation, tests on all fittings and cables shall be carried out as per IS specification. The tests shall include:

- a) Megger test
- b) Continuity test
- c) Polarity test

M. SPECIAL CONDITIONS

1. General

The drawings, specifications and bill of quantities shall be considered as a part of this contract and any work or materials shown on the drawings and not called for in the specifications or vice-versa, shall be executed as if specifically called for in both. The contract drawings indicate the extent and general arrangement of various equipment and their wiring, etc. and are essentially diagrammatic. The drawings indicate the point of termination for conduit runs and broadly suggest the routes to be followed. The work shall be done as



indicated on the drawings. However, any minor change if found essential to co-ordinate the installation of this work with other trades shall be made without any additional cost to the owners. The data given herein and on the drawings is as could be secured but its complete accuracy is not guaranteed. The drawings and specifications are for the assistance and guidance of the contractor. The exact location, distances and levels etc. will be governed by the space conditions. The contractor shall examine all Architectural, Structural, Plumbing and Sanitary, Air-conditioning and Electrical drawings before starting the work and report to the architect any discrepancies which in his opinion appear on them, and get them clarified. He shall not be entitled to any extras, for omissions or defects in electrical drawings or when they conflict with other works.

The Contractor shall submit the completed data sheet, dimensional drawings and catalogues of the LV panel and related brought out items etc. along with quote and detailed general arrangement drawings of the LV panel within 07 days of signing of the contract for Client/Consultant's approval.

The GA drawings shall also show all setting out details and physical data/dimensions of all components used in the system, etc.

Units shall be in the Metric / SI system unless otherwise specified.

2. Shop Drawings

The Contractor shall prepare and submit to the Consultant for their approval detailed shop drawings within 30 days of signing of the contract or before 7 days of particular work or whichever is earlier. The shop drawings shall clearly indicate-

- a) The general arrangement and schematic diagram of all distribution boards, switch boards, feeder pillars etc. clearly stipulating the material, size of sheet steel, bus bar, interconnection details, make and rating of switchgear and other equipments etc.
- b) Number, size and route of the conduits, location of junction/ inspection/pull boxes, size of switch boxes and number, make and size of wires carried in each conduit along with the installation mode.
- c) Total number of cable runs, size, make, material and type of cables with clear routing, trench/tray detail, installation mode, starting and termination point of each individual cable etc.
- d) The shop drawings shall also show all setting out details and physical dimensions of all components used in the system, location of manholes fixing, cutout details etc.

3. Quality

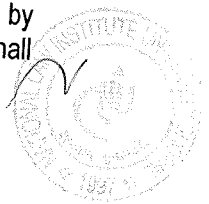
The Employer/Consultant's decision with regard to the quality of the material and workmanship will be final and binding, any material rejected by the Employer/Consultant shall be immediately removed by the Contractor from the site. The Employer/Consultant or their representative shall at all reasonable times have free access to the works and/or to the workshops, factories or other places where materials are being prepared or constructed for the contract and also to any place where the material lying or from which they are being obtained, and the contractor shall give every facility necessary for inspection and examinations and test of the material and workmanship.

4. Construction of Prototypes or Sample of work

The Contractor shall construct proto types or sample of works as laid down in the contract or as entrusted by the Consultant/Employer. Such prototypes or sample of work, after approval by the Consultant/Employer shall serve as the standards to be achieved in the final construction.

5. Cost of Samples and Tests

All samples shall be supplied by the Contractor at his own cost and the cost of making any test as per specifications shall be borne by the Contractor. The Contractor shall submit four copies of all brochures, manufacturers' description, data and similar literature. One copy will be returned to the Contractor after approval.



6. Foreman/Supervisor

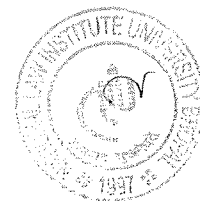
The Contractor shall employ competent, licensed, qualified full time electrical foremen/supervisors to direct the work of electrical installations in accordance with the drawings and specifications. The Foreman/Supervisor shall be available at all times at the site to receive instructions from the Architect/Engineer in the day to day activities throughout the duration of the Contract and as long thereafter as the Consultant may consider necessary until the expiration of the "Defect Liability Period". The Foreman/Supervisor shall correlate the progress of the work in conjunction with all the relevant requirements of the Electricity Supply Authority. The skilled workers employed for the work should have requisite qualifications and should possess competency certificate from the Electrical Inspectorate of the Local Government. The Contractor shall on the request of the Consultant immediately dismiss from the works any person employed there on who may, in the opinion of the Consultant, be unsuitable or incompetent or who may misconduct himself and such person shall not be again employed or allowed on the work without the permission of Consultant.

7. Inspection and Testing

The Contractor shall employ a full time qualified Engineer who shall be available at all working hours at site for taking instructions and to look after the quality of the work. Instructions given to the Engineer of the Contractor shall be construed as issued to the Contractor.

The Contractor shall maintain at site the following tools and instruments, but not limited to the list below in working conditions:

- a) Clip-on Ammeter and voltmeter
- b) 1000 V Meggar and 5 kV Meggar
- c) Steel tapes of various lengths
- d) Spirit Level
- e) Hydraulic Crimping Tool
- f) Earth Testing Meggar
- g) Pipe bending Tool, thread cutting die, bench vice etc.
- h) Cable jointing kit
etc.



The Contractor shall provide at least four permanent benchmarks at site which shall be preserved till the completion of works. These are essential for laying of cables at correct levels.

Factory acceptance test for all equipment like LT Panel etc. shall be done in presence of Client's representative/PMC Engineer & shall be arranged by the Contractor in accordance with the guaranteed technical particulars. Client shall witness the factory inspection, the vendors should send the inspection invite 15 days in advance and the expenses incurred for the visit of inspection shall be included in the quoted price.

8. Clearance from Local Authorities

The Contractor shall liaise with local authorities, Electrical Inspectorate, to get the entire installation tested, inspected and for final approval. He will also undertake the liaison work with Local Electricity Supply Company /Electrical Inspectorate for obtaining the Electrical Service Connection as per sanctioned demand.

9. Handing Over

At the completion of the work and before issuance of certificate of virtual completion the Contractor should hand over the works / equipments / systems covered under this contract only after they have been completely installed, tested and commissioned in all respects by the Contractor to the entire satisfaction of the Client /Consultant. And all relevant test forms/certificates, operation and maintenance manuals, as built drawings, etc. should be forwarded to the Client /Consultant. Any incomplete /partly commissioned works / equipments /system will not be taken over by the Client. In this regard, the decision of the Client /Consultant shall be final and binding on the Contractor.

The following documents shall be handed over to Client/Consultant/PMC-

S. No	Description	Details
1	As built drawings	3 copies & 3 CD AUTOCAD version
2	Factory Test Certificate	3 copies
3	Warranty Compliance certificate	3 copies
4	Factory Inspection Report	3 copies
5	Erection check list, Pre-Commissioning checks, Commissioning Report	3 copies
6	Operational & Maintenance Manuals	3 copies
7	Demo & Training to client's maintenance team on SOP of operations, Troubleshooting (Class room and field session)	Commissioning engineer and maintenance engineers should be present for the Demo training
8	Panels' control circuits – as built	3 copies
9	Contact details of brought out items	3 copies
10	Statutory correspondence and safety certificates	3 copies
11	Parts Ordering Manuals	3 copies
12	All the GFC and shop drawings executed in the project	3 copies
13	Bill of materials erected – Final site inventory and spares handing over	3 copies

Training shall be provided by the commissioning engineer for the O&M staff of client.

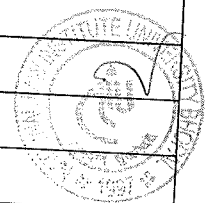
Note: In case of conflict between documents and standards the following priority of documents (weightage sequence) shall apply:

- Approved Drawings & Data sheets
- Bill of Quantities
- Technical Specifications
- CPWD Electrical Guidelines
- Relevant National Standards
- International Standards



N. LIST OF APPROVED MATERIALS (AS APPLICABLE TO BOQ)

Sl.No.	List of Items	Approved Makes
1	HT Stabilizer	Recons Power/ Jindal / Globe Rectifier
2	Distribution Transformers	Areva/Crompton/Voltamp/RPG
3.0	Brought out Item related to Stabilizer & Transformer	
3.1	Radiator with air release plug	CTR/Techni/Tarang
3.2	Valves	Yogi/Bimal/Petson
3.3	Conservator	OEM manufacture
3.4	Prismatic Oil Level gauge	OEM manufacture
3.5	Magnetic Oil Level gauge	Sukrut
3.6	Silica Gel Breather	Forge/I&C
3.7	Pressure relief valve	Sukrut
3.8	Jacking pad	Oem manufacture
3.9	Buchholz Relay	Prayog/I&C
3.10	Marshalling box	OEM manufacture
3.11	OTI/WTI	Perfact Control/Precimeasure
3.12	Surge relay	Easun-MR
3.13	Cooling fans	Alstom
3.14	Rubber Diaphragm	Swastick
3.15	HV/LV NCT's	Bharti/Narayan p tec/Alpha
3.16	AVR	Emco
4	11 KV VCB	Siemens / ABB / Schneider/ L & T
5	Medium Voltage ACB	Schneider (Master Pact-NW) / Siemens (3WL)/ ABB (E-max) / L&T (U-Power)
6	Moulded case Circuit breaker	Schneider - Compact (NS) / Siemens (3VL) / L&T (DSINE)/ ABB(T Max) /
7	Switch fuse Units	Siemens / ABB / Schneider/ L&T
8	4 pole on load COS/ATS	HPL /Socomec / HH Elcon / L&T
9	MCB/ELCB/MCB DBs	HPL/Hager / Legrand (Lexic) / Schneider (Multi 9)/ ABB/Siemens.
10	Contactors/relays	Schneider / Siemens /ABB / L&T
11	Panels Cubicles	Ambit / Adlec / Advance /Milestone/Conquerent
12	HRC Fuses/Fuse Carriers	L&T / Siemens / ABB / Schneider
13	Battery Charger	System Control / Aplab / Logicstat / Voltstat
14	Battery	Rocket/ Exide / Amara Raja
15	Breaker Control Switch	Switron/kaycee
16	Toggle switch	Switron/kaycee
17	Space heater	Vileco,mumbai



18	Electronic Hooters	Alan
19	Annunciator	Alan
20	Terminal blocks	Elmex/wago
21	Limit switch	Mathura
22	Meters	
a)	Conventional	AE / Rishline / L&T
b)	Digital	Schneider / SIEMENS/ Trinity / Neptune / L&T
23	PLC	Allen Bradly/Siemens/Woodward / L&T
24	Indicating lamps (LED)	Siemens / L&T / Schneider/ ABB
25	L.T. CTS	Kappa / AE / L&T
26	Selector Switches	L&T / Kaycee / Siemens / Schneider
27	HT Cables Armoured	Universal (Satna) / Glostar / Polycab /KEI
28	LT Cables (Al/Cu)	Universal (Satna) / Glostar / Polycab /KEI
	HT Cable termination/jointing kit	Raychem/3M
29	Cable Glands	Electromag / Comet/ Grip well
30	Thimbles	Dowells/ Jain Sons
31	Capacitors (Low losses))	L & T / Schneider / Vishay/ TDK-EPC
32	Power factor correction relay	Schneider / TDK
33	Modular switches/sockets	MK (Aspect)/ Crabtree (Piccadilly) / Schneider / Legrand (Mosaic)
34	Lighting controller	Wipro/ Philips/Lutron/Schneider
35	Connectors	Phoenix / Wago
36	MS Conduit Pipe	BEC / AKG / Steel Kraft
37	PVC Conduit Pipe	BEC / Polypack
38	PVC Copper wires	Finolex / RR Kabel /Lapp/KEI
39	Telephone wires	Finolex / Delton
40	Industrial Type Sockets	
a)	Metal clad	Crompton / Legrand / L&T / Schneider
b)	Weather proof	Neptune Bals / Legrand / Schneider
c)	Flame proof (switch, socket, pushbutton etc.)	Sudhir / Bajaj Electrical/Baliga
41	Conduit accessories	BEC / AKG
42	Light fixtures	
43	LED/Fluorescent/Other Discharge lamp	Philips / Bajaj / Wipro
44	Arch lighting	Ankur / Artlite / K-lite / Spectrum
c)	Flame proof Lighting	Sudhir / Bajaj Electricals
37	a) Ceiling fan/Cabin fan	Crompton / Alstom / Usha / Bajaj

b)	Exhaust/Industrial fans	Alstom / Almonard
c)	Ventilator fans	Newtek / Gerard
45	Street Light Pole	
a)	MS Swaged Tubular Pole / GI Pole	Metal coats/ Utkarsh/Bajaj
b)	MS Decorative Pole	Metal coats/ Wipro / Bajaj/ Schreder / Data System
46	Overhead Bus trunking/ Plug in Box	
a)	Air insulated	Legrand / L&T / Schneider/GE/ C & S
b)	Sand witch type	Legrand / L&T / Schneider/GE / C & S
47	Starters	L&T / Siemens / ABB / Schneider
48	Relays	Alstom / AVK SEGC / L&T/GE
49	Junction Box	Rico/Skaber (Ace Marketing))
50	Raceway (MS powder coated/GI)	Rico/Skaber (Ace Marketing)/MEM
51	Cable tray(Perforated/Ladder type)	Indiana / Slotco / Rico/MEM
52	Lightning Protection & Chemical Earthing	NIMBUS (JEF Techno. Sol.)/ LPI/ INDELEC
53	Inverter	Sukam
	Solar Light Fixture with pole	Philips/Bajaj/Schreder

NOTE:-	
1	Please tick the make of material considered in tender.
2	Detail submittals in the form of catalogues, specification sheets and samples where called for, shall be submitted one week from the date of order and approvals shall be obtained on the type of accepted make before procurements are made.
3	Out of the approved makes of materials mentioned above, the make of materials to be used on the work shall be as decided by the Consultant/Client jointly.

