Bank of Baroda

Zonal Office, Patna
5th Floor, Anand Vihar Building
West Boring Canal Road, Patna
Bihar 800001

Construction of Building for Bank of Baroda for Establishing Swarojgar Vikas Sansthan Building (BSVS/RSETI) at Sitamarhi, Bihar

Tender For Civil/Sanitary/Plumbing/ Electrical/Furnishing

PREQUALIFICATION

CUM

TECHNICAL BID

Owner:	Consultant :
Bank of Baroda Zonal Office, Patna 5th Floor, Anand Vihar Building West Boring Canal Road, Patna Bihar 800001 Tel No : 0612-2557718 Email: pe.bojz@bankofbaroda.co.in	BURMAN ET.AL Villa No.5, LGF, Block-II, Eros Garden, Surajkund Road, Faridabad, Haryana-121009. Tel: 0129-4876589 Mob: 9811210589, 8800147589. E-mail: burmanetal2008@gmail.com burmanetal@gmail.com

NOTICE FOR INVITATION OF TENDER

Sealed tenders on item rate basis are invited from competent Civil, Electrical and Furnishing Contractors having sound Technical and financial capacity for construction of Baroda Swarozgar Vikas Sansthan (BSVS)/ RSETI at Sitamarhi. Tender Documents may be purchased from Construction of Building for Bank of Baroda for Establishing Swarojgar Vikas Sansthan Building (BSVS/RSETI) at Sitamarhi, Bihar .Tender documents may also be downloaded from Bank's website: https://www.bankofbaroda.in/zonal-regional-offices-tenders.htm

Parties who have not executed at least one similar work of Rs.192.00 Lacs, two works of Rs. 120.00 Lacs or three works of Rs.96.00 Lacs satisfactorily during last seven years need not to respond. Annual average turnover for last 3 financial years should not be less than Rs.72.00 Lacs.

Note: In case of two parts tender, specific instruction on packaging and superscription of envelopes and date of opening of parts should be also given here.

Estimated Cost of Work	**: Rs. 240.00 lacs**
Earnest Money	**:** Rs. 2,40,000/- by Demand draft / bankers Cheque from a Bank other than the Clientele, dischargeable / payable at Patna and drawn in favour of Bank of Baroda
Time of completion of work	**:** 10 calendar months
Time and date of Last submission of Tenders.	**:** Before 4:00 PM on 21.07.2022
Time and date of Opening of tender	**:** At 04:30PM on 21.07.2022

Bank will not be bound to accept the lowest tender and reserves the right to accept or reject any or all the tenders without assigning any reason whatsoever.

For further details log on to our website https://www.bankofbaroda.in/zonal-regional-offices-tenders.htm,

Corrigendum/Addendum, if any, will be issued only on our Bank's website. Bidders are requested to visit regularly our Bank's website https://www.bankofbaroda.in/zonal-regional-offices-tenders.htm **before submission of bid in their own interest.**

Note: Bidder/Contractor who have submitted/applied earlier (if any) for this site/work need to apply a fresh against this tender/notice as their **earlier submission/ appointment/ application/ tender shall be treated as cancelled/concluded.**

—SD—
(Sonam T. Bhutia)
Zonal Head
Patna Zone, Patna

PQ cum Technical bid

Notice for Tender cum Prequalification of Contractor for Construction of Baroda Swarojgar Vikas Sansthan Building at Sitamarhi, Bihar.

Bank of Baroda invites application from eligible Contractors of repute for the following work:-

Sr. No.	Name of Work	Estimated cost in Rs.(approx.)
1.	Construction of Baroda Swarojgar Vikas Sansthan Building (BSVS)/RSETI at Sitamarhi, Bihar.	240.00 Lacs

1. **Contractors desirous of tendering for above work and fulfilling the following requirements shall be eligible (Technical Bid specification)-**

(i) **Experience of having successfully completed minimum any one of the similar works (Construction of building including and other related works) from below during last –7-years ending on 31.05.2022:**

a. **Three completed works (Construction Works) each costing not less than Rs. 96.00 Lacs.**

OR

b. **Two completed works (Construction Works) each costing not less than Rs. 120.00 lacs.**

OR

c. **One completed works (Construction Works) costing not less than Rs. 192.00 lacs**

(ii)Average annual Turnover of the Firm should not be less than Rs.72.00 lacs during last three financial years ending on 31.03.2021 (if Audited Balance Sheet is available provide for FY ending on 31.03.2022).

Certificate of Financial Turn over: At the time of submission of tender, the tenderer shall submit Affidavit/Certificate from Chartered Accountant mentioning Financial Turnover of last 3 years or for the period as specified in the tender document. There is no need to submit entire voluminous balance sheet. However, one page of summarized balance sheet (Audited) and one page of summarized Profit & Loss Account (Audited) for last 03 years to be submitted in hard copy also.

2. **Contractors shall submit the Performance Certificates from the respective previous employers in support of above otherwise application is liable to be rejected. If feedback/CR/ performance report not received satisfactory, from previous client/employer, contractor shall be disqualified on pre-qualification stage and they shall be treated as technically disqualified.**

3. **They must be having adequate organizational setup and reasonable presence in the work area and nearby and be having sufficient number of experienced personnel, technical know-how, and infrastructure to complete the project well in time.**

4. **Bank reserves right to reject any or all the applications/tender without assigning any reasons or whatsoever.**

SCOPE OF WORK– The main feature of the desired scope is listed below-

1. **Construction of Ground and One upper floor building (Civil Work).**
2. **Providing Electrical, Plumbing Services, Furniture, External Development, Septic tank, Tube well etc. as per tender.**

3. **List of Make**: Refer Clauses in Technical Specifications and respective head below**.**
4. The application should be submitted in sealed envelopes super scribing Technical Bid or Financial Bid for Construction of Baroda Swarojgar Vikas Sansthan Building (BSVS)/RSETI at Sitamarhi, Bihar to **Zonal office, Bank of Baroda, 5th Floor, Anand Vihar Building, West Boring Canal Road, Patna-800001, Bihar**. Both Bids will be kept in large envelops super scribing Construction of Baroda Swarojgar Vikas Sansthan Building (BSVS)/RSETI at Sitamarhi.
5. The Tender will be issued to those contractors who will qualify in the technical bid and financial bids will be opened of only for those bidders who will qualify in technical bids.

Application completed in all respect along with relevant documents duly super scribing the name of work as per following details: -

Envelope I: Containing duly filled Technical Bid (with seal & sign of bidder), tender document (to be downloaded from bank's website) and EMD of Rs. 2,40,000/- in the form of DD in favour of "Bank of Baroda, Payable at Patna"

Envelope II: Containing Financial Bid.

Envelope-III: Containing Envelope I & II

The application/tender should be dropped/submitted in Tender Box on or before 21.07.2022 up to 04:00 PM at office of:

Zonal Manager
Zonal office
Bank of Baroda, 5th Floor
Anand Vihar Building
West Boring Canal Road
Patna-800001, Bihar.

PQ Application and technical bid will be opened at above office on same day at 04:30 PM in presence of bidders who want to be present in the opening process.

Instructions to the applicants for furnishing information as a part of application.

Intending applicants are required to submit their applications with full bio data giving details about their organization, experience, technical personnel in their organization, competence and adequate evidence of their financial and technical standing etc. in the enclosed form which will be kept confidential.

While deciding upon the technical qualification of applicant great emphasis will be given on the ability and competence of applicants to do good quality works within the specified time schedule and in close coordination with other agencies.

Each page of the application shall be signed. The application shall be signed by person(s) on behalf of the organization having necessary authorization/power of attorney to do so (certified copies to be enclosed).

If the space in the proforma is insufficient for furnishing full details, such information may be supplemented on separate sheets of paper, stating therein the part of the proforma and serial number. Separate sheets shall be used for each part. However, the format shall be as per proforma.

Any letter or document accompanying the application form shall be submitted in duplicate.

Applications containing false/ incomplete and/or inadequate information are liable to be rejected. Also, mere fulfillment of eligibility criteria does not guarantee selection.

While filling up the application with regard to the list of important projects completed or on hand, **the applicants shall include only the works as per Technical Criteria.**

Clarification, if any required, may be obtained from the office of Bank of Baroda

The Zonal Manager
5th FloorZonal Office
Anand Vihar Building
West Boring Canal Road
Patna-800001, Bihar

Contact Email id: pe.bojz@bankofbaroda.co.in
Contact person: Mr. Jatin Sinha – 0612-2557718.

Canvassing in any form in connection with pre-qualifications is strictly prohibited and the application of such persons/organizations that resort to canvassing will be liable to rejection.

The application, which is received after due date and time, are liable to be rejected.

Bank reserves the right to accept or reject any of the offers, without assigning any reasons, whatsoever thereof.

Basic information

1	Name of the applicant/organization			
1a	Address of the Registered Office (With phone numbers, fax numbers & e-mail ID)			
1b	Address of local office (with phone numbers, fax numbers & e-mail ID) (if Any)			
2	Year of establishment			
3	Type of the organization (whether sole proprietorship, partnership, Private Ltd or Ltd. Co. etc.) (Enclose certified copies of documents as evidence)			
4	Name & qualification of the proprietor/partners/Directors of the organization/Firm a) b) c) d) (Enclose certified copies of documents as evidence)			
5	Details of registration – Whether Partnership firm, company, etc. Name of Registering Authority, Date and Registration number. (Enclose certified copies of documents as evidence)			
6	Whether registered with Government/Semi-Government/Municipal authorities of any other public organization and if so, in which class and since when? (Enclose certified copies of documents as evidence)			
7	Details of registration with CPWD/PWD (if any) (Enclose certified copies of documents as evidence)	Year of Reg.	Class	Valid upto
7A	Number of years of experience in the field and details of work in any other field			
8	Address of Contractor's Service office through which the proposed work of the Bank will be handled and service call will be attended with name and designation of professional in charge.			

9	Yearly turnover of the organization during last 3 years (year-wise) and furnish audited balance sheet and Profit & Loss a/c (audited) for the last 3 years.	
10	Name and address of Bankers (Valid Solvency certificate of Rs. 72 lacs or above to be enclosed for indicating satisfactory financial capacity of the organization. Validity period of the Solvency Certificate shall be for at least 12(twelve) months from the last date of submission of tender.	
11	**PAN Number-(mandatory)**	
12	**Details of registration for payment of service tax/GSTIN No. (mandatory)**	
13	Detailed description and value of works done **(Proforma 1)** and works on hand **(Proforma 2)**	
14	Details of Key Personnel Permanently employed **(Proforma 3)**	
15	Other infrastructural information to be used/referred for this project **(Proforma 4)**	
16	Furnish the names of –3- responsible persons along with their designation. Address, tel. No. etc. for whose organization, you have completed the above-mentioned jobs and who will be in a position to certify about the performance of your organization.	
17	Whether any Civil Suit/litigation arisen in contracts executed/being executed during the last 10 years. If yes, please furnish the name of the project, employer, nature of work, contract value, work order and brief details of litigation. Give name of court, place, and status of pending litigation.	Attach, separate sheet, if rSheet if req.
18	Information relating to whether any litigation is pending before any Arbitrator for adjudication of any litigation or else any litigation was disposed off during the last ten years by an arbitrator. If so, the details of such litigation are required to be submitted.	

Proforma -1

a) LIST OF PROJECTS EXECUTED BY THE ORGANISATION DURING THE LAST 7YEARS COSTING AS PER THE TECHNICAL CRITERIA MENTIONED ABOVE.

Sl. No.	Name of Client for work /Project with address.	Name & full postal address of the owner. Specify whether Govt. undertaking along with name, address and contact numbers of –2- persons (Engineers & top officials of the organization)	Contract amount (Rs) (for execution work only) with copy of work order and completion certificate from project in charge).	Starting date of Project	Date of completion of Project	Any other Relevant information. Actual amountof project. If increased, give reasons.	Enclose client's certificate for satisfactory completion Date and No. Of Completion Certificate	No of Floors of building and Remarks
1	2	3	4	5	6	7	8	9

Notes:

1. Information has to be filled up specifically in this format. Please do not write remark "As indicated inBrochure".

2. For certificates, the issuing authority shall not be less than an Engineer /Department In charge.

Performa – 2

LIST OF IMPORTANT WORKS IN HAND, COSTING AS PER TECHNICAL CRITERIA MENTIONED ABOVE.

Sr. No.	Name of work/project with address.	Name & full postal address of the owner. Specify whether Govt. under taking along with name, address and contact nos. of – 2- persons (Engineers or top officials of the organization)	Contract Amount With copy of Work Order from project in-charge.	Stipulated time of completion (Years)	Present status of the project	Any other relevant information.
1	2	3	4	5	6	7

Notes:-
1. Information has to be filled up specifically in this format. Please do not write remark "As Indicated in Brochure".

Date :
Place :

Sign. & seal of the applicant

Proforma-3

List of personnel permanently employed in the organization.

Sr. No.	Particulars	Name and Designation	Age	Qualification	Experience	Nature of works handled	Name of the Projects handled costing as per criteria above	Date from which employed in your organization	Indicate details of experience for similar projects
1	Civil Engineer								
2.	Electrical Engineer								
3.	Mechanical Engineer								
4.	Supervisor								
5.	Others								

Date :
Place:

Sign. & seal of the applicant

Proforma-4

List of Major office Equipment/ infrastructure in possession of the firm

Sr.No.	Name of office equipment	No.	Utilization	Any other information if any
1				
2				
3				
4				
5				
6				

Date :
Place :

Sign. & seal of the applicant

LIST OF DRAWINGS

(As attached along with tender documents)

LETTER OF SUBMISSION FROM CONTRACTOR

The Zonal Manager
Bank of Baroda
Zonal office
Patna Zone
Bihar.

Sub.: Construction of Baroda Swarojgar Vikas Sansthan Building at Sitamarhi, Bihar.

Dear Sir,

We refer to the tender invited by you for the execution of above-mentioned work. Having visited the Site and examined the Drawings, Conditions of Contract, technical specifications and Bill of Quantities. We offer to carry out and complete the whole of the work in conformity with Specification included in this Tender Documents.

We undertake to complete and deliver the field test, laboratory tests & reports within the time stated in the Appendix hereto.

We agree to keep the offer open for a period of 150 days from the date fixed for receiving the same. We understand that you are not bound to accept the lowest or any tender you may receive. We send your herewith tender duly filled and hereby agree to pay all charges of whatever nature connected with preparation, stamping and execution of the said contract. We agree not to employ 'Sub-Contractors' as per tender condition. Dated this _____ day of _____ 20___

Signature

(In the capacity Partner
/ Proprietor / Director)

Duly authorized to sign tenders for and on behalf of
(IN BLOCK CAPITALS)
Witness:

Signature _____ _____

Address of Tenderer

Name _____ _____

Occupation _____

Names of the Partners of the
Firm or Directors of Contractors Company

Name(s) of the Bank(s) in which the Tenderer maintains an Account(s)

INDEX SHEET

1. NOTICE INVITING TENDER

M/s. _____
_____
_____

Name of work :- Construction of Baroda Swarojgar Vikas Sansthan Building at Sitamarhi, Bihar.

EMPLOYER: M/S BANK OF BARODA.

Sealed tenders are invited from reputed short-listed contractors on behalf of Employers, for the said above job

Construction of Baroda Swarojgar Vikas Sansthan Building at Sitamarhi, Bihar

1.1. Sealed tender - envelopes should be addressed to **The Zonal Manager, Bank of Baroda, Zonal office, 5thFloor,Anand Vihar Building, West Boring Canal Road, Patna 800001, Bihar** & should be super scribed
"**Tender for Construction of BSVS Building/ Rural Self-Employed Training Institute**" and should be sent to the office of The Zonal Manager, Bank of Baroda, Zonal office, 5th Floor Anand Vihar Building West Boring Canal Road, Patna -800001, Bihar.

1.2.Tender documents consisting specifications, General Conditions, Bill of Quantities and Architectural drawings could be **downloaded from bank's website (**www.bankofbaroda.co.in/tenders.asp) free of cost.
The tender documents shall be submitted in sealed envelopes duly super scribed as '**Technical & Price Bid**' for "Tender for Construction of BSVS Building Rural Self-Employed Training Institute for Bank of Baroda"
EMD of Rs.2,40,000.00 (Rupees Two Lacs Forty Thousand Only) in form of **Demand draft (DD)** in favour of **Bank of Baroda payable at Patna** should be kept in separate envelope**.** Tender document (to be downloaded from bank's website).

1.3.***Tender submitted without EMD will be rejected.***

Kindly note for ***firms registered with MSME under the NSIC scheme as is the notification from Government of India are applicable for Waiver of EMD and Tender Document cost.***

Micro & Small Enterprises (MSEs) registered with National Small Industries Corporation (NSIC) and having single point registration are exempt from payment of EMD & Tender document fee to the extent of Monetary Limit stated in their Registration Certificate. In case the bid value exceeds the monetary limit, the bidder shall furnish EMD & tender cost for the difference. Such MSEs should also produce documentary evidence showing that the firm is registered with NSIC for the work tendered for. The bidder must submit certified copy of valid NSIC Registration Certificate/ Renewal Certificate. Photocopy of application for registration or for Renewal of NSIC will not acceptable*. Such bidder, if Successful they have to submit security deposits (including ISD and EMD amount at the time of award of work.*

1.4.Tender should be dropped in Tender Box kept at **The Zonal Manager, Bank of Baroda, Zonal Office,5th Floor, Anand Vihar Building, West Boring Canal Road, Patna-800001, Bihar** before due date and time.

1.5. The Tenderer must obtain for himself on his own responsibility and at his own expenses all the information that may be necessary for the purpose of filling of this tender and before entering into a contract for execution of the same must scrutinize the drawings and inspect the site of work and acquaint himself with all local conditions & matter pertaining there to.
1.6. Conditional Tenders will be rejected.
1.7. Each page of the tender documents is required to be signed by the person/duly authorized persons submitting the tender in token of his/their having acquainted himself/themselves with the general conditions etc. as laid down. Any tender with any of the documents not so endorsed may be rejected.
1.8. The tender forms must be filled in English/ Hindi and all entries must be made by hand written or typed. The details filled in tender should be legible. If any of the documents is missing or unsigned, the tender shall be considered invalid. **Bank reserves the right to call for any additional/missing documents at their discretion, whatsoever thereof.**

1.8a. All erasures and alterations made while filling the tender must be attested by the initials of the tendered. Over writing of figures is not permitted. Failure to comply with either in any change in rates or conditions after submitting of the tender will not be entertained.

1.9 RATES:

The contractors should quote in figures as well as in words the rate and amount tendered by them. The amount for each item should be worked out and the requisite totals given.

Rates quoted by the contractor in item rate tender in figures and words shall be accurately filled in so that there is no discrepancy in the rates written in figures and words. If on check there are differences between the rates quoted by the Contractor in words and in figures or in the amount worked out by him, the following procedure shall be followed for comparative evaluation of BOQ for finalization of L-1 for awarding work:

A. *When there is a difference between the rates in figures and in words, whichever corresponds to the amounts worked out by the contractor, shall be taken as correct.*
B. *When the amount of an item is not worked out by the contractor or it does not correspond with the rate written either in figures or in words, then the rate quoted by the contractor in words shall be taken as correct.*
C. *When the rate quoted by the contractor in figures and in words tallies but the amount is not worked out correctly, the rate quoted by the contractor shall be taken as correct and not the amount.*

When the rate is not quoted by contractor for any item, then maximum rate quoted by others contractor for that item shall be taken for evaluation and lowest rate quoted by other contractor for that item will be taken for award of work. Rates quoted shall cover the provision of site laboratory for routine test as required by Engineer - in – Charge.

1.9.1 Rates quoted shall include that Contractor shall remove all stores, working yards, labour hutments after completion of work / instructed by Employer from time to time or before final payment. He will also clean all rubbish, debris, leveling filling if any so as to leave site in clean and tidy conditions for other works / contractors as directed by Engineer-in-charge.

Rates quoted shall include provision of all scaffolding, hoists, tackles and other planks, shuttering profiles and all other equipment generally required for proper execution of the work. Rates quoted shall also include to facilitate and arrange to fix Tang Bar/Security Gates etc. for currency Chest.(Bank will provide at their cost Tang Bars, security Gates etc. to Contractor.)

Rates shall be Exclusive of all taxes, GST , professional tax, royalties or any other taxes or levies/any cess etc. payable by the contractor and the employer will not entertain any claim whatsoever in this

respect. The Contractor will pay the Labour Cess against each Running Account Bill as per applicable Laws of Government and would submit the proof of deposit to the bank. However, if there is any change in the GST structure by the government after the date of submission of tender the same will be applied on prorate basic.

1.9.2 Trade tax, VAT, turnover tax, GST or any other tax on material in respect of this contract shall be payable by the contractor and Employer will not entertain any claim whatsoever in this respect. In the event of non-payment /defaulting in payment of any octroi, royalty, cess, Trade tax, custom, excise or any other levy / tax including Labour dues and P.F. etc. by the contractor, the Employer reserves the right to withhold the dues /payments and make payments to the Local / State /Central Govt. Authorities or to labourers as may be applicable.

1.9.3 The rates for all items of work shall, unless clearly specified otherwise, include cost of all labour, materials and other inputs involved in the execution of the items.

1.9.4 The quoted rates shall be for all heights, lifts, leads and depth except where otherwise specified in the item of work.

1.9.5 The rates quoted by the contractor shall cover the cost of all loading, transporting to site, unloading, storing under covers as required, assembling or joining the several parts together as necessary and incorporating or fixing materials in the work including all preparatory work or whatsoever description as may be required and of closing, preparing, loading, returning empty cases of containers to the place of issue

1.9.6 The contractor is bound by the rates he quotes for the various items irrespective of quantities mentioned in the tender. No extra amount will be paid due to variation; alteration, omissions, modifications of the quantities put to tender, unless it has been specifically agreed by Owner / Architect.

1.9.7 The rates quoted shall be inclusive of establishing the Labour camps outside the premises.

1.9.8 The Contractor shall construct, operate and maintain crèche for laborers' children and Sulabh Shauchalaya for laborers at his own risk and cost. Nothing extra shall be payable on this account.

The owner reserves the right to reduce or increase the scope of work and to order for any item or group of work or split the work between 2 or more sub-contractors, if necessary. Such step shall not constitute a breach of contract, and nothing extra shall be payable on this account.

1.10. Earnest money deposit (EMD):-

1.11.1. Tenderer shall deposit an amount of **Rs. 2,40,000/- (Rupees two lacs Forty thousand only)** in the form of Bank Demand Draft (DD) payable at Patna drawn on any Schedule Bank, in favour of BANK OF BARODA along with the technical papers in separate envelope along with Tender. OR Tenderer shall submit the certificate of their companies' NSIC/MSME registration for exemption of EMD.

1.11.2. Initial Security Deposit:-

The successful Tenderer to whom the contract is awarded shall deposit as Initial Security Deposit bank demand draft/FDR a sum to make up 2% of the value of accepted tender after the appropriation of the Earnest Money deposited by him along with Tender. The successful Tenderer shall pay Initial Security Deposit within 15 days after receiving the letter of acceptance of his Tender.

1.11.3. Retention Money:-

Apart from the Initial Security Deposit to be made by the contractors as aforesaid, the Retention Money shall be deducted from Progressive Running Account Bills at 8% of the gross value of the work done and claimed in each Running Account bill provided that the total Security Deposit i.e. the Initial Security

Deposit amount + the Retention amount shall both together not exceed 5% of the Contract price as determined after considering all variations as approved. FDR in name of Bank of Baroda, Patna of equivalent amount may be deposited in lieu of ISD & Retention Money by the Contractor/Bidder.

1.12. Within ten days of the receipt of intimation from the Architect/ EMPLOYER of the acceptance of tender, the successful Tenderer shall be bound to implement the contract by signing agreement in accordance with the Terms & Conditions of the contract attached therewith, on the written acceptance by the employer and the person so tendering, whether such formal contract is subsequently entered into/or not.

1.13. All the compensation of other sums of money payable by the contractor to the Employers under the terms of this contract may be deducted from the Security Deposit or from any sums that may become due to the contractor on any account whatsoever in the event of the Security Deposit being reduced by reason of any such deduction; the contractor shall within 15 days of being asked to do so make good by Demand Draft any such sums which may have been deducted from the security deposit.

1.14. Unless otherwise agreed or stipulated in this tender, Employers are not concerned with any rise or fall in the prices of any materials or labour. The rates quoted shall include all costs, allowances, excise, duties, sales tax, central taxes, VAT/GST or any other taxes/GST, octroi or any other charges including any enhanced labour rates etc. which may be enacted from time to time by the State and/or the Central Government and shall remain valid till Virtual Completion of the work. Under no circumstances shall Employer be held responsible for compensation or loss to the contractor due to any increase in the cost of labour and/or material etc.

1.15. The tenderer should thoroughly study works, conditions of contract, relevant specifications and rates quoted should cover cost of executing the items as per the relevant specification.

1.16. The tender drawings have been included in the tender document for general guidance of the contractor for basic reference and evaluation at our office. Detailed working drawings, details of construction feature etc. shall be supplied from time to time for execution of works, which shall be deemed to be with provision of contract and scope of work.

1.17. **The tender shall remain valid for acceptance for a period of 120 days from date of opening the tender.**

1.18. **Escalation for Material & Labour-** Rates and amount quoted will be firm till the handing over of completed/constructed building/site after completion of work. The decision of the Bank in this regard shall be final and binding on contractor. Contractor will not raise this issue on any forum viz Arbitration, Court, etc.

1.19. Employers do not bind themselves to accept the lowest or any tender and reserve to themselves the right to accept or reject any or all tenders, either in whole or in part, without assigning any reasons whatsoever for doing so.

1.20. **Tender document in which tender is submitted by a Tenderer shall become the property of the Employer and the Employer shall have no obligation to return the same to the Tenderer.**

1.21. Tenders not giving the full particulars as mentioned above or as called for in the special Conditions or not complying with any of the conditions set forth above or therein are liable to summary rejection. For any clarification of technical details, you may contact Project Architect. Regarding location and inspection of the project site the Tenderer / Bidder may contact: **Mr. Jatin Sinha : 0612-2557718.**

2. INSTRUCTIONS TO TENDERER

Tenders must be submitted in sealed envelopes marked **"Tender for Construction of Bank Of Baroda Swarojgar Training Institute at Sitamarhi, Bihar."** and addressed to "**The Zonal Manager, Zonal Office, Bank of Baroda, 5th Floor, Anand Vihar Building, West Boring Canal Road Patna-800001**, Bihar**"** and be submitted in the Zonal Office at the address above mentioned at or **before 04:00PM on Date 21.07.2022.**

The tenders will be opened at 04:30 PM on the same day in the presence of the available Tenderer or their authorized representatives.
Any tender delivered or sent otherwise will be at the risk of the Tenderer. The Employer reserves the right to postpone the date for presentation of tenders and will give timely notice of any such postponement to the prospective Tender.

2.1. ***The following tenders are liable to rejection: -***

a) **Tender forms containing "over written" or "erased" rate or rates and amount shown in "figures and "words" in English.**
b) **Tender quoting rates on units different from those prescribed in the schedules.**
c) **Tender containing clerical or arithmetical mistakes.**
d) **Tender which omits a quotation on one or more of the items in the schedule.**
e) **Tender which is incomplete, obscure or irregular.**
f) **Tender with rates which are obviously unbalanced.**
g) **Tender in respect of which any request from the Tenderer is received with**
h) **additions, alterations, modifications, corrections, etc., of the term conditions or rates after opening of tenders.**
i) **Tender in respect of which canvassing in any form is resorted to by the Tenderer**
j) **Tender received after the time and date specified above even if due to pay or other Delays.**

2.2 If the Tenderer deliberately gives wrong information in his tender or circumstances for the acceptance of his tender the Employer reserves the right to reject such tender at any stage.

2.3 If a Tenderer seeks to clarify his quotations or rates, this should only be done in a separate covering letter. No material modifications to the specifications, item descriptions, contract clause etc., will, however, be entertained. Other clarifications may be considered. The contents of a covering letter sent along with the tender will be considered as part of the quotation. If any of these conditions admitted for consideration has a financial bearing on the cost quoted, the additional cost arising out of this condition will be added for comparative evaluation of tenders.

2.4. By submitting a tender for the work, a Tenderer will be deemed to have satisfied himself by actual inspection of the site and locality of the work, that the rates quoted by him in the tender will be adequate to complete such work according to the specifications and conditions attached thereto and he has taken into account all conditions and difficulties that may be encountered during its progress and to have quoted labour and material rates, which shall include cost of materials with taxes, Octroi, VAT/GST and other duties, lead, lift, loading and unloading freight for materials, and all other charges including the furnishing of all plant, equipment, tools, scaffolding and other facilities and services necessary or proper for the completion and maintenance of the work, except such as may be otherwise expressly provided in the contract documents for the completion and maintenance of the work to the entire satisfaction of the Architect. The TDS amount on prevailing rate and work contract tax/VAT/GST TDS etc. shall be deducted from Contractor's Running Account / Final bills and paid to the Government. Necessary Certificates shall be issued to the Tenderer by the Bank.

2.5. The successful Tenderer shall make his own arrangements for all materials except as specified in the contract if any.

2.6. The quantities shown if any in the attached schedule are given as a guide and are approximate only and are subject to variation according to the needs of the Employer. The Employer accepts no liability for their accuracy. The Employer does not guarantee work under each item of the schedule.

2.7. **Each tender shall be signed by the Tenderer with his usual signature**. Tender by partnership or Hindu joint family firm may be signed in the firm's name by one of the partners or the Karta or Manager as the case may be or any other duly authorized representative followed by the name and designation of the persons so signing. **A tested copy of the Partnership Deed must accompany the tender of any Partnership firm**. Tenders by a Company shall be signed with the name of the Company by a person authorized in this behalf and a Power of Attorney or other satisfactory proof showing that the person signing the tender document on behalf of the Company is duly authorized to do so, shall accompany the tender. The Employer will not be bound by any Power of Attorney granted by the Tenderer contract. It may, however recognize such Power of Attorney and changes after obtaining proper legal advice, the cost of which may be chargeable to the Contractor.

2.8 With their quotations the Tenderer shall sign all schedules, specifications, special conditions, etc, in token of acceptance thereof. The signature on the tender schedule alone shall also be deemed to be taken as acceptance of all these.

2.9 **Signature of the Tenderer shall be attested by the signature and address in English of two responsible individuals who shall be persons of status, and their address, names, occupations shall be stated below their signatures.**

2.10. Tenderer must also submit with the tender, Copies of testimony also with registration, their experience, and satisfy the Design Studio / Bank regarding the following points if and when called upon to do so: -

2.10.1. His position as an independent contractor or as the properly accredited of a responsible firm, in proof of which he must produce the requisite registered Power of Attorney and the expressed authority from the same firm to accept as its agent.

2.10.2. His ability, either as Principal or Agent to undertake and carry out the satisfactorily vouched for either by a responsible firm or an official.

2.10.3. His ability to supervise his work personally, or in the event of ill-health authorized absence there from, to employ a competent and responsible agent who is specially named and approved beforehand.

2.11. If a Tenderer expires after the submission of his tender or after the acceptance of his tender the Employer may deem such tender as cancelled. If a partner of a firm expires after the submission of their tender, the Employer may deem such tender as cancelled the firm retains its character.

2.12. If the Tenderer has a relative employed in any capacity in M/s Burman ET.AL he shall inform the authority calling for tenders of the fact when submitting his tender, failing which his contract may be rescinded, if the fact subsequently comes to, he shall be liable to make good to the Employer any loss or damage from such cancellation to the like extent provided in the case of cancellation under clause of General Conditions of Contract.

2.13. No contract work, however petty, may be carried out except under or in accordance with a duly executed agreement or on a special written authority from authorized officer of the Employer.

2.14. No agreement is valid unless signed by the Contractor or his duly authorized agent and by a competent person on behalf of the Employer.

2.15. **Details of drawings will be supplied with the Tender documents for the work may be seen in the office of M/s Burman ET.AL. / Bank during office hours**.

2.16. The Form of Agreement, Form of Tender, Invitation to Tender, Instruction to Tender, General Conditions of Contract, Special Conditions of Contract, Specifications, Drawings, Time Schedule and the rates and amounts accepted against the items of the Tender Schedule together with the Tender covering letter, and all correspondence entered into between the Employer and the Tenderer prior to the issue of the Letter of intent and the Letter of Intent awarding the work shall form the contract.

2.17. If there is any conflict between any of the provisions in the Special Conditions and those in any of the other documents referred, the provisions in the Special Conditions shall prevail.

2.18. If there be any difference between the description in the Specification, drawings and the works items in the Tender Schedule, the order of precedence shall be as under: a) B.O.Q. b) Tender Drawings c) Technical Specifications. Relevant IS Code/ NBC shall be followed wherever not specified/covered in this tender.

2.19.1. Acceptance of the tender will be intimated to the successful Tenderer through a letter of acceptance. The Contractor shall then be required to execute an Agreement within the time specified in the letter acceptance. In the event of failure on the part of the Contractor to sign the Agreement within the specified time, the amount of Earnest Money shall be forfeited and the acceptance of his tender shall be considered as withdrawn.

2.19.2. The forfeiture of Earnest Money is to be considered as covering all losses, and liquidated damages notwithstanding any other provisions envisaged for losses, or penalties implied in the provisions of the contract.

2. MODEL ARTICLES OF AGREEMENT

Articles of Agreement made this ----------day between Bank of Baroda (hereinafter called 'The Employer') of the one part and M/s---------- (hereinafter called 'The Contractor') of the other part.

1.1 Whereas the Employer' desires to engage one contracting agency for Civil and Sanitary works for construction, as per Drawings /Designs, BOQ etc.

1.2 The term 'Architect' in the said conditions shall mean the said **M/s Burman ET.AL, Kolkata/Delhi** and shall include their successors and assignees or in the event of its being wound up/dissolved/liquidated or ceasing to be the architect for the purpose by the employer, such other person as shall be nominated for that purpose by the Employer, not being a person to whom the contractor shall object for reasons considered to be sufficient by the Arbitrator, mentioned in the said conditions provided always that no person subsequently appointed to be entitled to disregard or overrule any previous decisions or approvals or directions given or expressed by the Architect for the time being.

1.3 In response to the tenders invited by Employer / Architect, the Contractor have inspected the site and surroundings of the works specified in the tender documents and have before accepting the Contract, satisfied themselves by careful examination about the nature of the work and nature of the site and local conditions, quantities nature and magnitude of work, the availability of labour and material necessary for the execution of work, the means of access to work site, the supply of power and water thereto and the accommodation they may require and have made local and independent enquiries and obtained complete information as to the matters and things referred to or implied in the Contract or having any connection therewith and have considered the nature and extent of all probable and possible situations, delays, hindrances or interferences to or with the execution and completion of work to be carried out under the Contract being awarded hereunder and have examined and considered all other matters, conditions and things and probable and possible contingencies thereto affecting the execution and completion of work and which might have influenced them in accepting the Contract.

1.4 The following documents annexed hereto shall form the integral part of this agreement as if these were fully incorporated herein and this Agreement together with all its Annexure are hereinafter referred to as the Contract.

1.4.1 Executed Tender copy
1.4.2 Initial Security Deposit of 2% of Contract Amount including EMD of Rs.2,40,000/-
1.4.3 Performance bank guarantee of 3% of Contract Amount
1.4.4 Minutes of Meeting dated ____ bearing no _____
1.4.5 Letter of Intent no. and W.O./LOI

1.5 The Employer has accepted the offer of the Contractor and the Contractor has agreed to execute the said works, subject to the terms and conditions contained herein and those referred in para 1.5 above for the provision and the execution of the works mentioned in the Contract to an amount of Rs _____ (inclusive of all Taxes)

NOW THESE PRESENTS WITNESSETH AND IS HEREBY AGREED AND DECLARED AS FOLLOWS

1.6 The Contractors shall provide, execute and complete all the works mentioned in the Contract and shall do and perform all other acts and things mentioned or described in the Contract or which are to be implied there from or may be reasonably necessary for the completion of the said works and the times and in the manner and subject to the terms and conditions or stipulations mentioned in the Contract. Rates are firmed up to handing over of completed building from date of commencement of work. If any delay in completion of works due to any reason then no escalation will be paid by Bank on work done and measured.

1.7 It has been understood by the parties hereto that the Employer will have right to make reasonable changes in the drawings and designs during the progress of the works without prejudice to the Contract. Notwithstanding anything to the contrary contained in any of the Annexure hereto the Contractors shall commence the work as per point of letter of intent dated and shall complete the same on or before 06 months and the time shall be the

essence of the Contract. In consideration of the due provision, execution and completion of all the works, in terms of the Contract the Employer does hereby agree with the Contractors that the Employer will pay to the Contractors the respective amounts for the work actually done by them and approved by the Employer. Such payments shall be made at such time and in such a manner as provided for in the Contract.

1.8.1 The Contractors do hereby agree to pay such sums as may be due to the Employer for the service rendered or material supplied by the Employer to the Contractors as set out in the Contract.
1.8.2 The contractors do hereby agree that the amount of liquidated damages specified conditions of contract/special conditions of contract represents a genuine and fair estimate of the loss likely to be suffered by the Employer in the event of the works not being completed in time.

1.9 It is specifically and distinctly understood and agreed between the Employer and the Contractors that the Contractors shall have no right, title or interest in the site made available by the Employer for the execution of the work or in the building, structures or works executed on the said site by the Contractors in the goods articles, materials etc brought on the said site (Unless the same specifically belongs to the Contractors) and the Contractors shall not have or deemed to have any lien or charge whatsoever for unpaid bills and it will not be entitled to assume or retain possession or control of the site or structure and the Employer shall have an absolute and unfettered right to take full possession of the site and to remove the Contractors, their servants, agents and materials belonging to the Contractors lying in the site.

1.10 The Contractors and its agent/servants/workers/employees shall be allowed to enter upon the site for execution of the works only for the purpose of executing the contract work and shall not have any claim, right title or interest in the site or the structures erected thereon and shall not enter upon the site of construction for any other purpose without assigning any reason thereof.

In Witness WHEREOF the parties have executed these presents of the day and the year first above written.

Signed and delivered for and on Behalf of Employer	Signed and delivered for and on behalf of Contractor
Witnesses	Witnesses
1. _____	1.
_____	
2. _____	2.
_____	

3. **FORM OF OFFER - ANNEXURE 1**

Zonal Manager

Bank of Baroda
Zonal Office Patna
5th Floor, Anand Vihar Building
West Boring Canal Road, Patna 800001, Bihar.

Subject :	Tender For Construction of Baroda Swarojgar Vikas Sansthan Building at Sitamarhi, Bihar.

Sir,

2.1. Having visited the site and examined the Drawings, format bank guarantee for bid offer security, form bank guarantee for advance payment, technical specifications for Construction of Regional Office Building, bill of quantities / schedule of rates, for the construction of the above named works, we offer to construct, complete and maintain the whole of the said works in conformity with the said Drawings in this tender Document or such other sum as may be ascertained in accordance with the said Conditions of Contract.

2.2. We undertake to complete and deliver all the works comprised in the contract within the time stated in the Appendix and Annexure1 here to.

2.3. We have independently considered the amount of liquidated damages shown in the Appendix hereto and agree that it represents a fair estimate of the loss likely to be suffered by you in the event of the works not being completed in time.

2.4. If our Tender is accepted, we will, when required, obtain the guarantees in approved format from a Bank (to be approved by you) to be jointly and severally bound with us in the sum named in the Appendix hereto for the due performance of the Contract under the terms of a Bond to be approved by you.

2.5. We agree to abide by this Tender for the period of Four months from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expire of the period or any extended period thereof.

2.6. Unless and until a formal Agreement is prepared and executed this Tender together with your written Acceptance thereof shall constitute a binding Contract between us.

2.7. We agree and that if our Tender is accepted, we are to be jointly and severally responsible for the due performance of the Contract.

2.8. We reserve stand that you are not bound to accept the lowest or any tender you may receive, or you may regret on your tender without assuring any terms.

Dated _____ day of _____ 20___

Signature ..... in the capacity of ..... duly authorized to sign tenders for an on behalf of .....

(IN BLOCK CAPITALS)

WITNESS:

Signature ..... Address of .....
Tender

Name ..... Occupation

.....

4. APPENDIX TO FORM OF OFFER - ANNEXURE 1

Sr. No.	Description of Work:	Construction of Baroda Swarojgar Vikas Sansthan Building admeasuring built up area 9500sq.ft.Approxat Sitamarhi, Bihar. (Civil, Sanitary, Electric and Allied works)
1.	**Name of Employer**	BANK OF BARODA
2.	**Time allowed for execution of work**	**10 Months**
3.	**Cost of Tender Document**	Can be downloaded from bank's website www.bankofbaroda.co.in/tenders.asp. No tender cost is required to be submitted.
4.	**Availability of Tender Document on Bank's website**	23.06.2022 to 21.07.2022 up to 04:00 PM to be downloaded from Bank's website free of cost.
4A	**Pre-Bid Meeting**	**30.06.2022 at 11:00 AM** at Zonal Office, Patna or MS Teams. After that no clarification will be entertained.
5	Last date and time of receipt of Tender Document (in Tender Box kept at Zonal Office, 5th Floor Anand Vihar Building, West Boring Canal Road, Patna-800001, Bihar)	**21.07.2022 till 04:00 PM**
6.	**Date and time of opening of Tender Documents (Technical Part)**	**21.07.2022 @ 4:30 PM** at Zonal Office, Bank of Baroda, Zonal Office, 5th Floor Anand Vihar Building West Boring Canal Road, Patna-800001, Bihar.
7.	**Earnest Money**	**Rs. 2,40,000/-** in the **form of DD/BC in favour of Bank of Baroda payable at Patna.** **Companies registered under NSIC/MSME shall be considered for exemption of the same**, they must attach their valid registration certificate for the same.
8.	**Validity of the Tender**	**120 days** from the date of submission / as may be extended
9.	**Retention Money**	**8% of gross value of work** in Running bills to a maximum of Balance Security Deposit.
10.	**Period of Commencement**	**30 days from the date of work order** or the date of instruction for taking possession of site, whichever is later
11.	**Amount of liquidated damages for delay.**	**0.50 % of the Contract value** per week subject to maximum of 7.5% of contract value.
12.	**Defects liability period.**	**12 months from the date of virtual completion certificate** issued by Architect/Bank. Other guarantee/warrantee etc. shall be as per tender terms and conditions.
13.	**Interval of interim bills.**	**Every 2.0 month**/ as per minimum bill amount whichever is later
14.	**Minimum Gross Amount of Interim Bill.**	**Rs.30.00 Lakhs**
15.	**Period of certification of interim bills by Architect**	**15 working days after submission of Bill** along with measurement sheets by Contractor.
16.	**Time within which payment to be made after certificate.**	**75% of the net payment to be released within 20 working days** from date of receipt of Architect's certificatealong with R.A. Bill Certificate (Annexure-I) jointly signed by (Contractor, Architect and Bank's Engineer/P&E officer for respective Zonal/Regional Office) and Bills, Measurement Sheet/M.B. Balance 25% to be released after 25 working days from date of receipt of Architect's certificate and R.A. Bill certificate jointly signed by Contractor, Architect and Bank's

		Engineer/P&E officer for respective Zonal/Regional Office. No interest is payable on any delayed payment in any circumstances by Bank whatsoever reason.
17.	**Secured Advance against supply of material on site**	75% of basic cost or 60% of item rate whichever is less. Secured advance will be given over cement, steel tile and non-perishable items only.
18.	**Performance Guarantee (Bank Guarantee - Non Perishable)**	Performance Guarantee: **3%** of Contract Amount to be submitted as Bank Guarantee/ FDR (in joint name with Bank as the first party) within 20 days of receipt of Letter of Award (valid up to completion period of the contract/extended period if permitted). No extra charge is payable on extension of BG by Bank. This Performance Guarantee shall be refunded within 21 days of the issue of Virtual completion Certificate (Taking Over Certificate with a list of Defects) as per tender terms and conditions.
19.	**Escalation for Material &Labour& work**	No escalation/PVA is applicable. The Rates will be remain firm till handing over the site/completed building from date of commencement of work.
20.	**Release of Total Security Deposit (EMD, ISD & Retention Money): -**	"50% of the Total Security Deposit (EMD, ISD& Retention Money) shall be refunded to the contractor on": i)Issue of Virtual Completion Certificate by the Architects as per tender terms & condition ii) Contractor's removal of his materials, equipment, labour force, temporary sheds/ stores etc. from the site, (excepting for a small presence required if any for the Defect Liability Period and approved by the Bank.). The remaining 50% of the amount shall be refunded **21 (twenty-one)** days after the end of defects liability period provided, he has satisfactorily carried out all the works and attended to all defects in accordance with the conditions of the contract, including site clearance.
21.	**Insurance**	CAR Policy (in joint name with Bank as the first party) **within 20 days** of receipt of Letter of Award (valid up to completion period of the contract/extended period if permitted). Details of Policies is given in annexure. No extra charge is payable on extension of Insurance by Bank.
22	**Test certificate/reports of materials & Mix Design**	Contractor has to submit: i) Satisfactory Test certificates/reports (as per relevant IS code) of materials (including cement, coarse aggregates, fine aggregates, steel etc. of makes mentioned in tender) are to be used at site have to be submitted to our office from a reputed (govt./govt. university) authorized testing lab **before its utilization/consumption** at site. ii)Design Mix: Design Mix of concrete as per tender requirement is to be submitted to our office from a reputed (govt./govt. university) authorized testing lab at least **35 days in advance** from the actual pouring of concrete at site in the permanent works. iii) All other test/manufacturer's certificates are to be submitted as per tender terms and conditions. Failing which, Bank may take strict action as per tender terms & condition.

SPECIAL NOTE & CONDITIONS OF CONTRACT – ANNEXURE 2

Name of Work: Baroda Swarojgar Vikas Sansthan Building at Sitamarhi, Bihar.

EMPLOYER: BANK OF BARODA.

2.9.General:

Address: Scope of Work at Ward no. 3Thana no. 163 Khata no. 2311Khesara No 2086Block Campus Sitamarhi - 843301, Bihar

2.9.1. M/s Burman Et.Al is engaged as an Architect and PMC.

1. Civil Structural work for buildings including compound wall consisting following major trades forms part of Contract.

- Earth work including Dewatering and Anti-termite Treatment. Demolition of Existing structure and disposal and dumping of malba etc. from the compound at contractor cost
- PCC, RCC work with foundation including Form Work
- Reinforcement Work
- Masonry Work- Internal walls, work in compound wall
- Plaster Work, Interior works
- Sub frames for Windows – Aluminum glazed doors windows.
- Structural Aluminum glazing & cladding on exterior surfaces.
- Water proofing, sanitary, plumbing, sewerage etc. work.

Electric work- Transformer Work, Fire-fighting Work etc. as per tender

Interior finishing and furnishing works

External Development works

Any other work not listed above but is part of the tender BOQ

2. The other agencies if appointed for other trade during the progress of work, the contractor shall work in close coordination and co-operation to complete the project under the guidance / instruction of in charge/Architect.

3. Program shall be well coordinated through In-charge/Architect for various activities in completing the work on schedule.

The payment shall be made as per actual execution of works.

All works are to be completed in 10(Ten) Months' time.

2.9.2 ***All or any extra work involved shall be got approved in writing from the Architect/EMPLOYER before executing the same.***

2.9.3 The contracted rate shall be inclusive of State/Central Sales Tax, Turnover Tax, Works Contract Tax, VAT and other Taxes, levies applicable during construction period and completion of the work.

2.9.4. Contractor shall extend all sorts of help within his purview including scaffolding materials (free of cost) and laborers (chargeable basis) to other agencies working simultaneously in the same project.

2.9.5. The contractor shall at his own cost arrange to obtain temporary electric supply from local electricity board authorities and shall bear all cost (deposit for temporary supply) miscellaneous charges & consumption charges during the construction period and up to the stage of handing over the site, it shall be borne by the contractor. If electricity is available and supplied by Bank then it will be charged @ 0.50% on work and shall be recovered from RA Bills.

2.9.6. Water connection shall be arranged by contractor at his own cost. Consumption charges during the construction and up to the stage of handing over of the site shall be borne by the contractor. If it is available and supplied by Bank then @ 0.50% on work shall be recovered from Bill.

In the event of necessity of water by tankers, electricity by generators, the same shall be arranged by the contractor at his cost for the purpose of construction and consumption etc. and the same shall not be payable by the EMPLOYER.

2.9.7. Contractor shall at his own cost construct temporary cement and material storage godown, site office and temporary separate bath/WC for Architect's/PMC'S staff and for his site laborers' use at his cost, including demolition and clearance after completion of work. Contractor shall restrict his facilities within the said area.

2.10. **Insurance**: - On commencement for the work.

The contractor shall take out Insurance policy as per Annexure covering entire scope of the works under this contract for the value of work as per contract tender conditions and arrange to keep the policy valid till the virtual completion and defect liability period is over. For electric work EAR Policy, be considered.

The contractor shall take out and submit to the Architect and EMPLOYER, a suitable insurance policy against third party risks. The limit of liability of this insurance shall be as per terms given in relevant annexure in respect of any one accident or series of accidents arising out of one even or Rs. 35 Lakh in respect of any persons or Rs.15 Lakh in respect of any passer-by (The policy shall be kept valid, till completion/handing over to the Employers whichever is later). ***Bank will not pay any sum for renewal of Insurance on account of extension of completion time in any circumstances.***

The contractor shall take out and submit to Employer a suitable Insurance Policy against Workmen's compensation / Janata Policy as per requirements. The policy shall be kept valid till final completion of work.

Necessary PF & ESI contribution of contractor's labours will have to be paid by contractor as per statutory authority's regulations and EMPLOYER shall be absolved of all the risk. (Also refer clause no.23 of GCC)

In Respect of Damage to Person and Property:-

From Commencement to Completion, the Contractor shall be responsible for all injury to persons, animal or things and for all structural and decorative damage to property which may arise from operation or neglect of himself or any subcontractor or of any of his or a sub-contractor's employee whether such injury or damage may arise from carelessness, accident or any other cause whether in any way connected with the carrying out of this contract. This clause shall be held to include inter-alia any damage to building, whether immediately adjacent or otherwise, any damages to roads, streets, footpaths, bridges, or ways as well as all damage to the buildings and works forming the subject of this contract by first or other inclemency weather. The contractor shall indemnify the Employer and hold him harmless in respect of all and

Any expenses arising from any such injury or damage to persons or property as aforesaid and also in respect of any claim made in respect of any award of compensation or damages consequent upon such claim.

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

Against third party risks:-
On commencement of the work, the contractor shall take out and submit to the Employers a suitable insurance policy against third party risks. The limits of liability of this insurance shall be as follows:

Rs. 15 Lakhs in respect of any one accident or series of accidents arising out of one event. Contractor shall take-out third-party insurance for 3 no. of such accidents and repetition of the same after three occurrence including visitors like Local Authority, Vendors etc.

CONTRACTOR'S LIABILITY AND INSURANCE SUMMARY

Sr. No	Nature and Scope of Risk	Value of Insurance	Validity Period of Insurance	Name of the Insurer	Insurance Policy No. and
1.	Loss of damage to works or any part thereof and all materials at site from any cause whatsoever. **CAR Policy**	100 % of Contract Amount	The policy shall be valid till completion of defect Liability period.	The policy shall be in the joint names of the Employer /Bank	
2.	Damage, Loss or Injury to any Property of the Employer or Consultant to any person including the Employer or Consultant for his Agents and Servants.	Rs. 35.00 Lakhs per claim up to 3 claims	- DO -	- DO -	
3.	Claims under the Workmen's Compensation Act, 1923	As per Govt. Rules	- DO -	- DO -	
4.	Third party insurance	Rs.15 Lakhs in respect of any one accident or series of accidents arising out of one event. Contractor shall take-out third-party insurance for 3 no. of such accidents and repetition of the same after three occurrence including visitors like Local Authority, Vendors etc.	- DO -	- DO -	

2.11.The defect liability period shall be as mentioned in appendix to condition of contract, annexed to this document.

2.12.Contractor shall appoint as approved by the Architect and maintain a full time, qualified and experienced Civil Engineer(minimum experience 2yrs.) or Civil Diploma Engineer(minimum experience 4yrs.) also having some exposure to electric works for building construction/others" on site of works.

Contractor has to submit the details of appointed/engaged Civil Engineer for this particular site within 45 days from the work order date who will supervise the whole construction work.

2.13.EMPLOYER and Architect have got right to appoint separate contracting agencies for (1) Civil Work, (2) Plumbing, Water supply, Sanitary and drainage works.

2.14.In the event of work being split between the agencies like Civil/Plumbing/ Works etc. The Contractor for civil work shall provide all co-operation, liaison / coordination and relevant scaffolding etc. to the other sub agencies appointed like lift, installation, by the Employers and the rate of the civil contractor shall be covered to be inclusive of such co-ordination, assistance etc. to be provided to the other agencies.

2.15.Total security deposit
The total Security Deposit shall comprise
a) Earnest Money Deposit.
b) Initial Security Deposit.
c) Retention Money

Earnest money deposit (EMD):-

Tenderer shall deposit an amount of Rs**.2,40,000/- (Two lacs forty thousand only)** in the form of Bank Demand Draft drawn on any nationalized Bank, in favour of M/S **BANK OF BARODA** payable at **Patna** along with the Technical bid. No interest on Earnest Money Deposited by the renderer shall be paid. Tenders submitted without Earnest Money Deposit along with the technical bid shall not be considered. The EMD of the unsuccessful Tenderer will be refunded within a reasonable period of time after the decision to award the work is taken. The EMD shall stand absolutely forfeited if the tenderer revokes his tender at any time during the period when he is required to keep his tender open for acceptance by the Employer, or if, the tender is accepted, the Contractor fails to pay the security deposit as stipulated/or if he fails to commence the work within stipulated time.

Initial Security Deposit

The successful tenderer to whom the contract is awarded shall deposit as Initial Security Deposit by bank demand draft/FDR a sum to make up 2% of the value of accepted tender after the appropriation of the Earnest Money deposited by him. The successful Tenderer shall pay Initial Security Deposit within 15 days after receiving the letter of acceptance of his Tender. The Security deposit, either in whole or in part thereof, shall be forfeited in the event of the Contractor's failure to observe any terms of this Contract/ or noncompliance with the conditions of the Contract.

Retention Money

Apart from the Initial Security Deposit to be made by the contractors as aforesaid, the Retention Money shall be deducted from Progressive Running Account Bills at 8% of the gross value of the work done and claimed in each Running Account bill. Provided that the total Security Deposit i.e. the Initial Security Deposit amount + the Retention amount shall both together not exceed 5% of the Contract price as determined after considering all variations as approved. On Virtual Completion of the job and on the contractors submitting to the PMC, the as-built drawings, the PMC shall declare the job to be virtually complete, endorsed by the Project Architects and accepted by the Employer and upon this an amount equivalent to 50% of the total security deposit will be refunded to the contractors and balance shall be retained by the Employers till the end of the Defects Liability Period and the contractors shall have option to have the balance Retention Money replaced by Bank Guarantee which shall be valid till the end of Defects Liability Period and the same shall be released only upon successful completion of the Defects Liability Period and on finalizing the Final bill. Performance Bank Guarantee of 3% amount should be valid till completion of project with 30 days grace Period. Any extension required due to delay in completion, contractor will bear all expenses and Bank will not entertain any claim in this regard. If the Contractors do not carry out the rectification work during the Defects Liability Period, the Employer shall have the right to get such defective work rectified after giving due notice in writing to the Contractors and recover the cost of repairs from the money so retained.

2.16. Value of all interim bills shall be minimum Rs. 30 Lakhs (Rs. Thirty Lakhs) and will be processed as per Annexure-I on page 24.

2.17. The Architect/PMC shall have power to withhold any certificate, if the works or any parts thereof are not carried out to the satisfaction. The Architect/PMC may revise any certificate; make any correction in any previous certificates, which have been issued by him.

2.18.All respective contract rates under various works include rents, deposits, premiums and other cost of transport, hiring loading and unloading, of all material including all type of taxes, testing charges, Octroi charges, wastages and damages etc and the same shall be borne by the contractors only.

2.19. The contractor shall appoint/retain at their own cost, licensed plumbers who shall work out and prepare and submit to Architect through PMC if any necessary shop drawing details for all plumbing, sanitation, drainage, works and shall take approval of the architect/PMC before execution of all such works.

2.20. The Employers reserve their right of adding, altering or deleting any items form the scope of the contractor works for which no compensation of whatsoever type will be paid to the contractor. This shall also include the profits and over heads or any other claims by the contractors.

2.21. Time shall be the essence of the contract and the decision of the architect/PMC and/or the employer in the matter of date of start, suspension and completion of the work shall be final and binding upon the contractor.

2.22.Security/Watchman:-The Contractor shall maintain at his cost at least two persons, 24 hours/watchman/security system or watch and ward of materials/property works and shall not allow any unauthorized persons to encounter the premises/building and failure of the same, the contractor shall be held liable for all costs & damages.

2.23.Contractor will obtain NOC for electric installation (Viz-Transformer, DG Set, etc if applicable), required electric load sanction for Building from Govt. Authorities. Contractor will also obtain Fire/statutory NOC from Govt Fire Deptt. , etc. The statuary fee/receipt will be reimbursed by Bank to Contractor on production of Govt receipt copies. The other expenditure, if any, on part of liaisoning etc with Govt Authorities shall be borne by Contractor them self.

2.24. Contractor will also assist Architect in obtaining Pre-Construction Approvals and Completion Certificate from local Authorities.

2.25. Addenda

Addenda to the tender document may be issued if required to clarify documents or to reflect modifications to the design or contract terms.

Each addendum issued by the Architect will be distributed to the bidders who have been issued the tender documents for bidding. Each bidder shall submit the same along with his tender. All addenda issued by the Architects shall become part of Tender Document.

2.26. Bank reserve's right to keep on hold the release of running account bill for non-submission of compliances/document/certificate/report (like Performance Bank Guarantee, CAR & other policies, Test reports of the materials as soon as it is delivered at site or casted at site (whatever may be the case) as per tender terms & conditions, Guarantee certificate etc.) as per tender schedule. If, Bank keeps release of running account bill on hold due to non-submission/non-fulfilment of such tender conditions, contractor cannot stop work at site. If, contractor still stop the work at site on this account, delay in completion of work will be considered on contractor' part.

3. **Technical audit**- The work is liable to be technically audited by the chief technical examiner of the Central Vigilance Commission, GOI, from time to time. Any defects, improvements or testing etc., pointed out by the CTEO, CVC, should be carried out by the contractor at his/their own cost and any deduction suggested by the CTEO shall be affected. The employer shall have right to cause technical examination and audit of works and the final bills of the contractor/s including all the supporting vouchers, abstract, etc. to be made at the time of payment of the final bill. If as result of this examination or otherwise any sum is found to have been overpaid in respect of any work done by contractor under the contract the contractor shall liable to return the amount of over payment and it will be due to him/them and in any other manner legally permissible and it is found that contractor was paid less than what was due to him/them under the contract in respect of any work, executed by him/them under the contract, the amount of such under payment shall be duly paid by employer.

GENERAL CONDITIONS OF CONTRACT – ANNEXURE 3

Name of Work: Construction of Baroda Swarojgar Vikas Sansthan Building at Sitamarhi, Bihar.

Employer: M/s BANK OF BARODA

1. Definitions and Interpretations:

In the contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise required: -

"EMPLOYER/CLIENT" means M/S. **BANK OF BARODA**, Patna and shall include his/their heirs, legal representatives, assignees and successors.

"CONTRACTOR" shall mean the individual or firm or company, whether incorporated or not, undertaking the works and shall include the legal personal representative or such individual or the persons, comprising such firm or company or the successors of such firm or company and the permitted assigns of such individual or firm or company.

"ARCHITECT" shall mean M/s Burman Et.Al.(having their office at Villa No -5, Block II, Eros Garden, Charmwood Village, Faridabad, Haryana -121001.) engaged by the Bank Of Baroda to act as Architect for the purpose of the contract and shall include his/their heirs, legal representatives, assignees and successors.

"CONSULTING ENGINEER" means Sub-Consultant retained by the Architect or Employer for designing of Structural /ELECTRICAL/MECHANICAL /Sanitary and Plumbing works includes his/their heirs, legal representatives, assignees and successors.

"CONTRACT" means the documents forming the tender and acceptance thereof together with documents referred to therein or individual works orders in the case of terms of contracts including the General Conditions of Contract, Special Conditions, the Appendix, Bill of Quantities, Schedule of rates and prices or the rates quoted on lump sum basis, scope of work in case of lump sum contract, Specifications, Drawings and the Contract Agreement if completed and all these documents correspondence prior or letter of intent awarding the work as applicable taken together shall be deemed to form to Contract and shall be complementary to one another.

"CONTRACT PRICE" means the sum named in the letter of acceptance or the contract subject to such additions thereto or deductions there from as may be made under the provisions hereinafter contained in the contract.

i) "WORK" Works means all the works specified or set forth and required in and by the said specifications, drawings and schedule hereto annexed or to be implied there from and shall include both permanent works and temporary works, whether original, altered, substituted or additional, to be executed in accordance with the contract.

ii) "PERMANENT WORKS" means the permanent works to be executed and maintained in accordance with the contract.

(iii) "TEMPORARY WORKS" means all temporary works of every kind (other than Contractor's Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.

"SPECIFICATION" means the specification referred to the tender and any modification thereof or addition thereto as may from time to time be furnished or approved in writing by the Architect.

"DRAWINGS" means the drawings, maps, plans & tracings or prints there of or referred in the contract, any modification of such drawings approved in writing by the Architect and such other drawings as may from time to time be furnished or approved in writing by the Architect.

"SITE" shall mean the land and/or other places on, into or through which work is to be executed under the contract or any adjacent land, path or street through which work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the contract.

"NOTICE" in writing or written notice means a notice in writing typed or printed characters sent (unless delivered personally or otherwise proved to have been received) by registered post to the last known private or business address or registered office of the addresses and shall be deemed to have been received when in the ordinary course of post it would have been delivered.

"APPROVED" means approved in writing including subsequent written confirmation of previous verbal approval and "Approval" means approved in writing including as aforesaid.

"MONTH" means month according to Gregorian calendar.

"SCHEDULE BANK" means bank included in the second schedule to the Reserve Bank of India Act, 1934.

"SUB CONTRACTOR" means any person, firm or corporation having a contract for the execution of a part or parts of the work included in the contract and a person, firm or corporation furnishing materials called for in the contract and worked to a special design according to the specifications.

"VIRTUAL COMPLETION" means that the constructions of works specified are of the works is sufficiently completed in accordance with the contract, as modified by any changed or variation orders agreed to by the parties so that the Employer can occupy the same for the use it was intended.

"CONTRACT PERIOD" means the accepted period of consecutive days stated on the Form of Tender starting from the Architect or Employer's order to commence the work.

"ACT OF INSOLVENCY" means any act of Insolvency defined by the Presidency Towns Insolvency Act, or the Provincial Insolvency Act or any Act amending such original act/s.

"THE DATE OF COMPLETION" is the date or dates for completion of the work or works or any part of the works set out or ascertained in accordance with the individual works orders and the tender documents or any subsequent amendments thereto

"SINGULAR AND PLURAL" words importing persons include firms and corporations, words importing the singular party only also include the plural and vice versa where the context requires.

2. Project Management Consultant (PMC): -

The Project Management Consultant appointed by the Employer shall supervise the works and to test any materials to be used in the works. The contractor shall afford the Project Management Consultants every facility and assistance for examining the works and materials and checking and measuring works and materials. Contractor will provide space at his site office and necessary infrastructure for performing duties of PMC job to PMC. **Architect M/s Burman ET.AL is PMC for the Project.**

3. Duties and Powers of Project Management consultant: -

PMC duties are to watch and supervise the works of and to test any materials to be used or workmanship employed in connection with the works, quality control, Project Scheduling and monitoring and coordinating with all other Agencies and Civil Contractor, recording of measurements, certification of bills, preparing extra/deviation items, excess/ scoring statement, preparing Minutes of Meeting etc. They shall have no authority either to relieve the Contractor of any of his duties or obligations under the contract or except those expressly provided hereunder, to order any work involving delay or any extra payment by the Employer or any variation of or in the works.

Wherever it is mandatory by law, that the PMC appointed by the Employers shall be registered with the Local Municipal Corporation as Supervisor, the incumbent so selected shall so forthwith show his registration with Municipal Corporation.

The Contractor shall afford and provide every facility and assistance for examining the works and materials and checking and measuring time and materials etc to PMC. The PMC shall have no power to revoke, alter, enlarge or relax any requirements of this contract or to sanction any day work, additions, alterations, deviations or omissions unless such an authority may be confirmed by written order of the employer.

The PMC shall act in consultation with the Structural Consultant/Architect in regard to the quality of all structural aspects of work and in consultation with the Architect, will finalize the selection of finishing materials. The PMC shall jointly record the measurements with Contractor's representative for all items of works and on completion hand over the records to the Employer.

The PMC shall have the power to give notice to the Contractor or his Engineer-In-Charge, about the no approval of any work or materials and such works shall be suspended or the use of such materials should be discontinued until the decision of the Architects/ Structural Consultant/ Employer but such examination shall not in any way exonerate the Contractor form the obligation to remedy any defects which may be found to exist at any stage of the work or after the same is completed. Subject to the limitations of this clause, the Contractor shall take instructions only from the Architects/ PMC/ Structural Consultant as the case may be.

The PMC shall have such other power and discharge other functions as are specifically provided in this contract included such incidental or consequential powers or duties, subject always to such specific instructions or directions of the Employer, which shall be duly notified to the Contractors.

4.Scope of Contract:

The contractor shall carry out and complete the said work in every respect in accordance with this contract and with the directions of and to the satisfaction of the Architect/Employer. The Architect may in his absolute discretion and from time to time, issue further drawings and/or written instructions, details, directions and explanations which are hereafter collectively referred to as "Instructions" reflected either in the minutes or in any other form in regard to:

The variation or modification of the design, quality or quantity of works or the additions or omissions or substitutions of any work.

Any discrepancy in the drawings and/or drawings and/or specifications.

The removal from the site of any material brought thereon by the contractor and the substitution of any other material thereafter.

The removal and/or re-execution of any works executed by the Contractor.

The dismissal from the works of any person employed thereupon.

The opening up for inspection of any work covered up.

The amending and making good of any defects.

Removal of improper works and materials.

Assignment and subletting.

The Employer shall have a right to delete or reduce any scope of work or any item from the contract and contractor shall not make any extra claim on this count Postponement of any work to be executed under the provision of the contract. The contractor shall forthwith comply with and duly execute any work comprised in such Architect's/Employer's Instructions, directions and explanations given to the Contractor or his representative. If instructions, directions upon the works by the Architect/Employer shall, if involving a variation be confirmed in writing by the Contractor, within 7 days and if not dissented in writing within a further 7 days by the Architect/Employer, such instructions shall be deemed to be the "Employer/Architect's Instructions" within the scope of the contract. If compliance with these instructions as aforesaid involves work and/or expenses and/or loss beyond that contemplated by the contract, then, unless the same were issued. If the Contractor fails to comply with the Employer/Architect's instructions within a fortnight after the receipt of written notice from the Employer/Architect requiring compliance with such instructions, the Employer, through the Architects, may

employ some other agency to execute any work whatsoever which may be necessary to give effect to such instructions. For the purpose of entering day to day instructions by the Employer/Architect/PMC, the Contractor shall maintain at his own cost, a 'Site Instructions Book' in quadruplicate in which the instructions shall be entered by Employer/Architect/PMC. 'Instructions' to the Contractor shall be generally issued through PMC/Architect. However Employer, for the sake of urgency as a result of inspection, may issue instructions directly with the knowledge of the Architects who should ratify the same promptly.

5. Drawings and Specifications:

The Work shall be carried out to the entire satisfaction of the Employer/ Architects or their Consultants and in accordance with the signed drawings, specifications, preambles and such further drawings and details as may be provided by the Architect/ Structural Consultant and in accordance with such written instructions, directions and explanation as may from time to be given by the Employer/ Architect/ Structural Consultant whose decisions as to sufficiency and quality of the work and materials shall be final and binding upon all parties. No drawing shall be taken as in itself an order for execution unless, in addition to the Architect /Structural Consultant's signature, it bears express words stating remark "VALID FOR CONSTRUCTION". No claim for payment for extra works shall be allowed unless the said work shall have been executed under the provisions of clause 9 (Authorities, Notices, Patent Rights and Royalties) or by the authorities' directions in writing of the Consultant as herein mentioned. One complete set of the drawings, certified copy of tender document together with Specifications shall be furnished by the Architects to the Contractor. The Architect/ Structural Consultant shall furnish, within such time, as he may; consider reasonable, one copy of additional drawings, which in his opinion are necessary for the execution of any work. Such copies shall be kept on the works, and the Architect/Structural Consultant or his representatives shall at all reasonable times have access to the same. The Contractor before the issue of the Final Certificate shall return all drawings, certified copy of tender document together with specifications to the Architects. The Original Contract documents shall remain in the custody of the Employer and shall be produced by him at his office as and when required. Any additional prints of drawings in any, required by the Contractors may be supplied by the Architect /Structural Consultant but on the payments of charges.

6. Discrepancy in Various Documents:

The Contractor shall provide everything necessary for the proper execution of the works according to the true intent of and meaning of the Drawings, Specifications etc. taken together whether the same may or may not be particularly shown or described therein, provided that the same can be inferred there from. If the Contractor finds any discrepancy in the Drawings or between the drawings, Specifications etc., he shall immediately refer the same in writing to the Architect who shall decide which shall be followed, and his decision shall be final and binding on all parties.

7. Authorities, Notices, Patent Rights & Royalties: -

The Contractor shall conform to the provisions of the statutes relating to the works and to the Regulations and Bye Laws of any Local Authority and of any Water, Lighting or other Companies or Authorities with whose systems the Structure is proposed to be connected and shall before making any variation from the Drawings and Specifications that may be necessitated by so conforming, give to the Architect/Employer/PMC written notice, specifying the variations proposed to be made and the reason for making it, and apply for instructions thereon. The Contractor shall bring to the attention of the Architect/PMC/Employer, all notices required by the said Acts, Regulations or bye laws to be given to any authority and pay to such authority or to any public offices, all fees that may be properly chargeable, in respect of the works and lodge the receipts with the Architect/Employer. The Contractor shall indemnify the Employer against all claims in respect of patent rights, design, trademarks or name or other protected rights in respect of any constructional plant machine, work or material used for or in connection with the works or temporary works from and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. The Contractor shall defend all actions arising from such claims, unless he has informed the Architect before any such infringement and received their permission to proceed and shall himself pay all royalties, license fees, damages, costs and charges of all and every part that may be legally incurred in respect thereof.

8. Contract Price:

The Contract Price shall not be adjusted or altered in any way whatsoever otherwise than in accordance with the express provisions of these conditions and subject to Clause 48 of these conditions.

9. Contract Bills:

The Contract Bills for certificate of payment shall be described in mode of payment. Contractor along with RA Bills submit photographs of work, copy of measurement, cement, steel consumption etc to Bank/architect.

Any error in description or omission of items from the Contract bills shall not vitiate this contract but shall be corrected and deemed to be a variation required by the Architect.

10. General Obligations:

Contractor's General Responsibilities

The Contractor shall subject to the provisions of the Contract and with due care and diligence, execute and maintain the works and provide all labour including the supervision thereof, materials, Constructional Plant and all other things whether of a temporary or permanent nature, required in and for such execution and maintenance so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

The Contractor shall take full responsibility for the adequacy, stability and safety of all site operations and methods of construction, provided that the Contractor shall not be responsible except as may be expressly provided in the Contract for the design or specification of the Permanent Works or for the design or specification of any Temporary works prepared by the Architect.

11. Contract Agreement:

The Contractor shall when called upon to do so enter into and execute a Contract Agreement to be prepared and completed at the cost of the Contractor in the form annexed with such modifications as may be necessary.

12. Performance Bond/Security Deposit:

The Contractor shall, (if the tender so provides) at his own expense provide or obtain a Bank Guarantee from nationalized Bank in the format approved by the Employer to be jointly or severally bound to together with him to the Employer in the sum provided in the tender for the due performance of the Contract. (Refer Appendix to form of Offer – Annexure-1)

13. Inspection of Site:

The Contractor shall inspect and examine the site and its surroundings and information available in connection therewith and shall satisfy himself so far as is practicable before submitting his tender as to the form and nature of the ground, including the subsurface conditions, the hydrological and estimate conditions, the extent and nature of work and materials necessary for the completion of the works, the means of access to the site and accommodation he may require and in general shall himself obtain all necessary information subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Tender.

Nature of Ground: -

The Employer does not guarantee or warranty in any way that the material to be found in the excavations will be similar in nature to that of any samples, which may have been exhibited or indicated on the drawings or in any other Contract Documents, or to material obtained from borings or trial holes.

The Contractor shall be deemed to have made local and independent enquiries as to and shall take the whole risk of the nature of the ground subsoil or material to be excavated or penetrated and the Contractor shall not be entitled to receive any extra payment nor to rescind from the Contract nor to be relieved from any of his obligations there under by reason of the nature of such ground subsoil of material being other than that indicated on the Drawings or in any other Contract Documents or by any sample exhibited or deducted from the information provided by borings or trial holes.

14. 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 Schedule of Quantities/Scope of work and/or the Schedule of Rates and Prices, which rates and prices shall cover all his obligations under the Contract, and all matters and things necessary for the completion of the works.

Contractor not entitled to Extra Payment

Except as otherwise as specifically provided in the Contract, the Contractor shall not be entitled to any extra payment nor to resale from the Contract nor to be relieved from any of his obligation for reasons of his misunderstanding, or his failure to obtain correct information or his inability to foresee any matter which may affect the execution or maintenance of the works.

15. Work to be to the Satisfaction of the Architect

The Contractor shall execute and maintain the works in strict accordance with the contract to the satisfaction of the Architect/Employer/PMC and shall comply with and adhere strictly to the instructions and directions from them or their representative/s.

16. Programmer to be furnished:

Within a reasonable time after the acceptance of his Tender, the Contractor shall submit to the Project Management Consultant/Architect/Bank for his approval and/or information a BAR Chart/chart showing the order of procurement and method in which he proposes to carry out the works, a general description of the arrangements and methods which he proposes to adopt for the execution of the Works, the Constructional Plant and Temporary Works which he intends to supply, use or construct as the case may be, the scheduling of samples, Shop Drawings and approvals from concerned authorities as required under the contract.

If the actual progress of the works does not conform to the approved chart, the Contractor shall be required to submit a revised programme and implement the same for the completion of the works within the stipulated time for completion.

List of personnel

I. Authorized representative
II. Technical & non-technical staff
III. Skilled & unskilled labours
IV. Security staff, deployed at site for on schedule completion of this contract.

The submission to and approval by the Architect/Project Management Consultant/Bank of such programs shall not relieve the Contractor of any of his duties or responsibilities under the contract.

17. Contractor's Superintendence:

The Contractor shall give or provide all necessary superintendence during the execution of the works and as long thereafter as the Architect/PMC/Employer may consider necessary. The Contractor or one of his competent and authorized agent or representatives is to be constantly on the works and shall give his whole time to the superintendence of the same. Such authorized agent or representative shall receive on behalf of the Contractor the directions and instructions from the Architect /PMC /Employer.

18. Contractor's Employees:

The Contractor shall provide and employ on the site skilled and experienced technical assistants, foremen and leading hands to give proper supervision and such skilled, semi-skilled and unskilled labour for the proper and timely execution and maintenance of the works. The Contractor shall be required to remove forthwith from the works any person employed by the Contractor in or about the execution or maintenance of the works who in the opinion of the Architect/PMC/Employer misconducts himself or incompetent or negligent and thus considered to be undesirable and shall be replaced as soon as possible by a competent substitute approved by the Architect/PMC/Employer.

19. Setting Out:

The Contractor at his own expenses set out the works accurately in accordance with the plans and to the complete satisfaction of the Architect. The Contractor shall be solely responsible for the true and perfect setting out of the works in relation to original points lines and levels of reference and for the correctness of the position's levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection therewith. The responsibility for the true and proper setting out rests with the Contractor who shall rectify any error at his own cost to the satisfaction of the Architect, unless such error is based on incorrect data supplied in writing by the Architect or his Representative, in which case the expenses of rectifying shall be borne by 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

and the Contractor shall carefully protect and preserve all benchmarks sight rails pegs and other things used in setting out the works.

20. Bore Holes and Exploratory Excavation:

If the Architect shall require the Contractor to make bore holes or to carry out exploratory excavation such requirement shall be an addition ordered under the provision of clause 42 hereof and such anticipated works shall have been included in the scope of work.

21. Security and maintenance of Premises Lighting:

The Contractor shall in connection with the works provide and maintain at his own cost all lights/ guards facing and watching when and where necessary or required by the Architect or his Representative or by any duly constituted authority for the protection of the works or for the safety and convenience of the public of others.

22. a) Care of Works:

From the commencement to the completion of the works, the Contractor shall take full responsibility for the care thereof and of all temporary works, and in case any damage, loss or injury shall happen to the works or to any part thereof or to any temporary works from any cause whatsoever, save and except risks as defined in sub-clause (b). In this clause, shall at his own cost, repair and make good the same, so that at completion, the permanent works shall be in good order and condition and in conformity in every respect with the requirements of the contract and the Architect's instructions. In the event of any such damage, loss or injury happening from any of the excepted risks, the contractor shall, if and to the extent required by the Architect and subject always to the provision of Clause mentioned elsewhere in the conditions hereof, repair and make good the same as aforesaid at the cost of the Employer. The Contractor shall also be liable for any damage to the works occasioned by him in the course of any operations carried out by him for the purpose of complying with his obligations under Clause 40 and 42 thereof.

b) Expected Risks:

The "Excepted Risks" are Force majeure, exceptionally incremental weather, fire, earthquake, civil commotion, riot, lockout, strike, war, hostilities (whether war be declared or not), invasion act of foreign enemies rebellion, revolution in correction or military or usurped power civil war or a cause solely due to or use or occupation by the Employer of any portion of the works in respect of which a Certificate of Completion has been issued all of which are herein collectively referred to as "Expected Risks".

23. Insurance in Respect of Damage to Person and Property:

From Commencement to Completion, the Contractor shall be responsible for all injury to persons, animal or things and for all structural and decorative damage to property which may arise from operation or neglect of himself or any subcontractor or of any of his or a sub-contractor's employee whether such injury or damage may arise from carelessness, accident or any other cause whether in any way connected with the carrying out of this contract. This clause shall be held to include interlaid any damage to building, whether immediately adjacent or otherwise, any damages to roads, streets, footpaths, bridges, or ways as well as all damage to the buildings and works forming the subject of this contract by first or other inclemency weather. The contractor shall indemnify the Employer and hold him harmless in respect of all and any expenses arising from any such injury or damage to persons or property as aforesaid and also in respect of any claim made in respect of any award of compensation or damages consequent upon such claim. The Contractor shall reinstate all damage of every spot mentioned in this clause so as to deliver up the whole of the contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property of third parties.

The Contractor shall indemnify the Employer against all claims which may be made against the Employer by any member of the public or other party in respect of anything which may arise in respect of the works or in consequence thereof and shall at his own expense effect and maintain until the virtual completion of the contract with an approved office a policy of insurance in the joint names of the Employer and the Contractor against such risks and deposit such policy or policies with the Employer on the signing of the contract. The Contractor shall also indemnify the Employer against all claims which may be made upon the Employer whether under the Workmen's Compensation Act or any other statute in force during the currency of this contract or at common law in respect of any employee of the Contractor or of any sub- contractor and shall at his own expense effect and maintain until the virtual completion of the contract, with an approved office a Policy of Insurance in the joint names of the Employer and the Contractor against such risks and deposit such policy or policies with the Employer from time to time during the currency of the contract.

The Contractor shall be responsible for anything, which may be excluded from the Insurance Policies above referred to, and also for all other damages to any property arising out of and incidental to the negligent or defective carrying out of the contract; however, such damage shall be caused.

The Contractor shall at all times indemnify the Employer and keep indemnified in respect of any costs, charges for expenses arising out of any claim that may arise on account of the Contractor's operation at the site or proceedings and also in respect of any award of or compensation of damages arising there from. It shall also be the Contractor's responsibility to file and pursue with the Insurance Company for a claim if any.

The Employer with the concurrence of the Architect shall be at liberty and is hereby empowered to deduct the amount of any damages, compensations, costs, charges and expenses arising or acquiring from or in respect of any such claim or damages from any sums due or to become due to the Contractor.

Before commencing the work, the Contractor shall without limiting his obligations and responsibilities under the condition, obtain the necessary insurances. If he shall fail to effect and keep in force the insurances referred to in this clause hereof or any other insurances which he may be required to effect under the terms of contract then the contractor shall be fully responsible for the consequences of such a default. In any such case the Employer may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for the purpose and from time to time deduct the amount so paid by the Employer as aforesaid from any monies due or which may become due to the Contractor or recover the same as a debt due from the Contractor.

The Contractor shall provide the Employer with documentary evidence from time to time that he has taken all the insurance policies mentioned in the foregoing paragraphs and that he has paid the necessary premium for keeping the policy valid till the works are completed and handed over to the employer.

The Architect/PMC shall ensure the validity of the insurance policies on behalf of the Employer. If extension of time limit is granted by Employer, he shall have to ensure that the insurance policies are progressively extended.

24. Compliance with Statutes, Regulations etc.

The Contractor shall comply with the provision of Payment of Wages ACT 1936, Minimum Wages Act 1948, Employees Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maternity Benefits Act 1961 and the Contractor's Labour (Regulation and Abolition) Act 1970 or any such statutes ordinance or have and the modification thereof and the regulation or Bye-Laws of any local or other duly constituted authority and rules and regulations of public bodies and companies which may be applicable to the works or to any temporary works as aforesaid and shall keep the Employer indemnified of every kind for breach of any such statute, ordinance or Law Regulation or Bye-Laws.

Contractor, as required, will pay necessary P.F. and E.S.I contribution for the contractor's workers and employer shall be absolved of all these risks.

25. Fire Insurance:

The Contractor shall at the time of signing of the contract insure until the virtual completion of the contract against loss or damage by fire in an office/company .Insurance against fire may be taken in CAR Policy if not covered in CAR Policy then separate Fire Insurance to be submitted by Contractor and to be approved by the Architect/Employer in the joint names of the Employer and Contractor (the name of the former being placed first in the policy) for the full amount of the contract and for any further sum if called upon to do so by Architect the premium of such further sum being allowed in the contract shall be authorized extra. Such a policy shall cover the property of the Employer only and the Architect and Surveyors' fees for assessing the claim and in connection with his services generally in the reinstatement and shall not cover any property of the Contractor or any sub-contractor or employee. The Contractor shall deposit the policy and receipt for the premium with the Employer within twenty-one days from the date of signing the contract unless otherwise instructed. In default of the contractor insuring as provided above the Employer or the Architect on his behalf may so insurance and may deduct the premium from any moneys due or which may become due to the contractor. The Contractor shall as soon as the claim under the policy is settled or the work reinstated by the Insurance Office should they elect to do so, proceed with all the completion of the works in the same manner as though the fire had not occurred and in all respects under the same conditions of contract. The Contractor in case of rebuilding or reinstatement after fire shall be entitled to such extension of time for completion as the Architect may deem fit but shall however not be entitled to reimbursement by the Employer of any short fall or deficiency in the amount finally paid by the insurer in settlement of any claim arising as set out herein.

26. Giving of Notices and Payment of Fees

The Contractor shall give all notices and pay all fees required to be given or paid by any National or State Statute Ordinance or other Law or any Regulation or Bye-Law of any local or other duly constituted authority in relation to the execution of the works or of any temporary works and by the rules and regulations of all public bodies and companies whose property or rights are affected or a may be affected in any way by the works.

27. Returns of Labour etc.:

The Contractor shall furnish all such information regarding the supervisory staff, the numbers of the several classes of labour from time to time employed on the site, constructional plant etc. as the Architect may require.

28. Materials and Workmanship:

a) Quality of Material and Workmanship and Tests:

All materials and workmanship shall be of the respective kinds described in the contract and in accordance with the Architect's/PMC instructions and the contractor shall upon the request of the Architect/PMC furnish to them all invoices, accounts, receipts and other vouchers to prove the materials comply therewith and shall be subjected from time to time to such tests as the Architect may direct at the place of manufacture or fabrication or on the site or at all or any of such places. The Contractor shall at his own cost 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 incorporation in the works for testing as may be selected and required by the Architect.

b) Cost of Samples and Shop Drawings:

All samples for the fittings and fixtures, wood, hardware etc. should be submitted for approval before using in the work. The Contractor at his own cost as directed by the Architect shall supply all Samples and Shop Drawings, Test report etc.

c) Cost of Tests

The cost of making any test shall and Design Mix etc. is to be borne by the Contractor, if such test is clearly intended by or provided for in the contract and in the cases only for a test under load or of a test to ascertain whether the construction of any finished or partially finished work is appropriate for the purposes which it was intended to fulfil is particularized in the contract in sufficient detail to enable the Contractor to price or allow for the same in tender.

d) Cost of Test not provided for etc.

If any test is ordered by the Architect which is either: Not so intended by or provided for or, (In the case above mentioned) is not so particularized or, Though so intended or provided for is ordered by the Architect to be carried out by an independent person at any place other than the site or the place of manufacture or fabrication of the materials tested, then the cost of such test shall be borne by the Contractor if the test shows the workmanship or materials not to be in accordance with the provisions of the contract or the Architect's instructions but otherwise by the Employer.

29.

a) Examination of Work Before Covering Up:

No work shall be covered up or put out of view without the approval of the Architect/PMC/Employer and the Contractor shall afford full opportunity for the Architect/PMC/Employer 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 Architect whenever any such work or foundations is or are ready or about to be ready for examination and the Architect shall without unreasonable delay unless he considers it necessary and advises the contractor accordingly attend for the purpose of examining and measuring such work or of examining such foundations.

b) Uncovering and Making Openings:

If the Contractor puts any part of the foundations or covers up or puts out of view before he has notified the Architect/PMC and received instructions, he shall be liable to reinstate all work that may subsequently be, at any time, damaged on account of any defect in or insufficiency of the foundation. The Contractor shall at the request of the Architect, open up for inspection any work, and should the Contractor refuse or neglect to comply with such requests, the Employer through the Architect, may employ other agency to open up the same. If the said

work has been covered up in contravention of the Architect's instructions, or if on being opened up, if he found not in accordance with the drawings and the specifications or the instructions of the Architect, the expenses of opening it again, whether done by the Contractor, or such other agency, shall be borne by the Contractor, and shall be recoverable from him by the Employer or may be deducted by the Employer from any monies due or which may become due to the Contractor. If the work has not been covered in contravention of such instructions and found to be in accordance with the said drawings and specifications or instructions than the expenses aforesaid shall be borne by the Employer and be added to the contract sum; provided always that in the case of foundation or any other urgent work so open up and required immediate attention, the Architect shall within 7 days after receipt of written notice from the Contractor that the work has been opened make or cause the inspection thereof to be made at the expiration of such time, if such inspection shall not have been made. The contractor may cover up the same and shall not be required to open it up again except at the expenses of the Employer.

30.

a) Removal of Improper Work and Materials:

The Architect shall during the progress of the works have power to order in writing from time to time. The substitution of proper and suitable material and,

The removal and proper re-execution notwithstanding any previous test thereof or interim payment therefore of any work which in respect of materials or workmanship is not in accordance with the contract in the opinion of the Architect.

b) Default of Contractor in Compliance:

In case of default on the part of the Contractor in carrying out such order the Employer shall be entitled to employ and pay other agency to carry out the same and all expenses consequent thereon or incidental thereto shall be borne by the Contractor and shall be recoverable from him by the Employer or may be deducted by the Employer from any amount due or which may become due to the Contractor.

31. Suspension of Work:

The Contractor, shall on the written order of the Architect/Employer suspend the progress of the works or any part thereof for such time or times and in such manner as the Architect may consider necessary and shall during such suspension properly protect against threats or damage and secure the work, so far as is necessary in the opinion of the Architect. The cost, if any, incurred by the Contractor in giving effect to the Architect's instructions and PMC's recommendations, if any, under this clause shall be borne and paid by the Employer unless such suspension is:

Otherwise provided for in the contract or

Necessary by reason of some default on the part of the Contractor or Provided that Contractor shall not be entitled to recover any such extra cost unless he gives written notice of his intention to claim to the Architect on receipt of the Architect's order. The Architect shall settle and determine the payment and/or extension of the time under Clause 42 hereof to be made to the Contractor in respect of such claim as shall, in the opinion of the Architect, be fair and reasonable.

32. Commencement of Works:

The Contractor shall commence the works on site after the receipt by him of an order in writing to this effect from the Employer and shall proceed with the same with due expedition and without delay except as may be expressly sanctioned or ordered by the Architect/Employer or be wholly beyond the Contractor's control.

33. Possession of Site:

a) Save in so far as the contract may prescribe and with the Architect's/PMC/Employer written order to commence the works, the Contractor shall be given possession of the whole of the site or part by part progressively enabling him to commence and proceed with the execution of the works in accordance with the programme referred to in Clause 16 hereof. If the Contractor suffers delay on account of the Employer's failure to give possession of site in accordance with the terms of this clause, necessary extension of time (without any financial implications) shall be granted by the Employer for the completion of the entire works, on recommendations of Architect/PMC.

b) The Contractor shall bear all costs and charges for special or temporary way leaves required by him in connection with access to the site. The Contractor shall also provide at his own cost any additional accommodation outside the site required by him for the purposes of the works.

34. Time for Completion

Subject to any requirement in the contract as to completion of any section of the works before completion of the whole, the whole of the works shall be completed within the time stated in the contract calculated from the date of the Employer's written order to commence the works or such extended time as may be allowed under Clause 35 hereof.

34.1. Certification of Virtual Completion of Works

The contractor shall report in writing to the PMC when the works are completed in all respects. The PMC shall after the verification of works and in consultation with Architects issue to the contractor a certificate to be called "Virtual Completion Certificate" a copy whereof shall be submitted to the employer to enable it to take possession of the completed works. The Defects liability period shall commence only from the date of issue of such Virtual Completion certificate.

35. Delays and Extension of Time for Completion

In the opinion of the Architect/PMC, the works be delayed (a) by force majored (b) by reason of any exceptionally incremental weather or (c) by reasons of proceedings taken or threatened by or dispute with adjoining or neighbors of adjoining properties or public authorities arising otherwise than through the Contractor's own default or (d) by the works or delays of the other Contractors or Tradesman engaged or nominated by the Employer or the Architect and not referred to in the Schedule of Quantities and/or specifications or (e) be reason of the Architect's instruction or (f) by reason of civil commotion, local commotion of workmen or strike or lockout affecting any of the building trades or (g) due to extra or additional work or other circumstances provided the Contractor has intimated to the Architect full and detailed particulars soon after such work has been commenced or (h) in consequence of the Contractor, not having in due time necessary instructions from the Architect for which he shall have specifically applied in writing ahead of time, giving the Architect reasonable time to prepare such instructions, the Employer shall make a fair and reasonable extension of time for completion of work. In case of such strike or lockout, the Contractor shall, as soon as may be, give written notice thereof to the Architect/PMC but the Contractor shall nevertheless constantly use his endeavors to prevent delay and do all that may reasonably be required to the satisfaction of the Architect/PMC to proceed with the work.

35.01 Escalation for Material & Labour- *No escalation/PVA is applicable. The Rates will be remain firm handing over the site/completed building from date of commencement of work. Contractor will not raise this issue on any forum viz. Arbitration, Court, etc.*

Rate of Progress:

The whole of the material plant and labour to be provided by the Contractor under Clause 13 hereof and the mode, manner and speed of execution and maintenance of the works are to be of a kind and constructed in a manner approved of by the Project Management Consultant. Should the rate or progress of the works or any part thereof, be at any time in the opinion of the Project Management Consultant too slow to ensure the completion of the works by the prescribed time or extended time for completion, the Project Management Consultant shall so notify the Contractor in writing and the Contractor shall there upon take such steps as the Contractor may think necessary and the Project Management Consultant may approve to expedite progress so as to complete the works by the prescribed time or extended time for completion. If the work is not being carried on by day and night the Contractor shall request permission to work by night as well as by day then if the Architect/Employer shall grant such permission the Contractor shall not be entitled to any additional payment for so doing but if such permission shall be refused and there shall be no equivalent practicable method of expediting the progress of works, the time of completion of the works shall be extended by the Employer by such period as is solely attributable to such refusal. All work at night shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify the Employer from and against any liability for damage on account of noise or other disturbance created while or in carrying out the work and from and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in regard or in relation to such liability.

36. Liquidated Damages for Delay

If the Contractor shall fail to complete the works within the time prescribed by Clause 34 hereof or extended time then the Contractor shall pay to the Employer the sum stated in the Tender as Liquidated Damages for such default and not as a penalty for every day or part of a day which shall elapse between the time prescribed by Clause 41 hereof or extended time as the case may be and the default certified completion of the works. The Employer may deduct without prejudice to any other method of recovery deductible amount of such extent from the money that stands due or which may become due to the Contractor. The payments or deduction of such damages shall not relieve the Contractor from his obligations and liabilities under the contract.

37. Certificate of Completion of Works:

When the whole of the works have been substantially completed and have satisfactorily passed any final test that may be prescribed by the contract, the Contractor may give a notice to the effect to the Project Management Consultant accompanied by an undertaking to finalize any outstanding work during the period of maintenance. Such notice and undertaking shall be in writing and shall be deemed to be a request by the Contractor for the Project Management Consultant to issue a Certificate of Completion in respect of the works. The Architect, shall within twenty eight days of the date of delivery of such notice either issue to the Contractor, with a copy to the Employer, a Certificate of Completion stating the date on which, in his opinion, the works were substantially/virtually completed in accordance with the contract or give instructions in writing to the Contractor specifying all the work which, in the Project Management Consultant's opinion, requires to be done by the Contractor before the issue of such Certificate. The Architect/PMC shall also notify the Contractor of any defects in the works affecting substantial completion that may appear after instructions and before completion of the Works specified therein. The Contractor shall be entitled to receive such certificate of completion within twenty-eight days of completion to the satisfaction of the Architect/PMC of the Works so specified and making good any defects so notified.

Certification of Completion by Stages

Similarly, in accordance with the procedure set out in sub clause (a) of this Clause, the Contractor may request and the Project Management Consultant shall issue a Certificate in respect of:

i) Any section of the Permanent Works in respect of which a separate time for completion is provided in the contract, and

ii) Any substantial part of the Permanent Works, which has been completed to the satisfaction of the Architect/PMC and occupied or used by the Employer.

If any part of the Permanent Works shall have been substantially completed and shall have satisfactorily passed any final test that may be prescribed by the contract, the Architect, on recommendations of PMC, may issue a Certificate of Completion in respect of that part of Permanent Works before completion of the whole of the works and upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete any outstanding work in that part of the Work during the period of maintenance. Provided always that Certificate of Completion given in respect of any section or part of the Permanent Works before Completion of the whole shall not be deemed to certify completion of any ground or surfaces regarding reinstatement, unless such Certificate shall expressly so state.

38. Defects:

a) Definition of "Defects Liability Period":

In these conditions, the expression "Period of Defects Liability" shall mean the period of Defects Liability named in the Tender, calculated from the date of completion of the Works, certified by the Architect/PMC in accordance with item no.13 of Annexure-1 (appendix to form of offer) and mentioned elsewhere in the tender, or in the event of more than one certificate having been issued by the Project Management Consultant/Architect under the said Clause from the respective dates so-certified. In general, the Defects Liability Period shall be one year after the virtual completion of the works (except for all Water Proofing Works for which the period shall be 10 years).

b) Defects:

The Contractor shall make good at his own cost and to the satisfaction of the PMC/Architect, all defects, shrinkage, settlement, or other faults and all damages, loss and expenses consequent thereon or incidental thereto, and such damage, loss and expenses shall be recoverable from him by the Employer or may be

deducted by the Employer upon the PMC/ Architect's Certificate in writing from any money due or that become due to the Contractor.

c) Entry to the Premises for Attending Defects:

The premises shall have/remain in exclusive physical possession of the Employer and the Contractor is given only a temporary permission to enter the said premises with his workman, agents for attending the defects, during the defects liability period. If the Contractor or his workman whether negligently or otherwise causes any damage or loss to the property, fixtures of the Employer lying in the premises, the Contractor shall be bound to reimburse such loss to the Employer. The Employer always is entitled to deduct any amount of sum loss from the amounts payable to the Contractor.

d) Execution of Work of Repair etc.:

To the intent that the Works shall at or as soon as practicable after the expiration of the Defects Liability Period be delivered to the Employer in the condition required by the Contractor, fair wear and tear excepted, to the satisfaction of the Architect/PMC, as that in which they were at the commencement of the DLP, the Contractor shall finish the Work, if any, outstanding at the date of completion, as certified under Clause 39 hereof, as soon as practicable after such date and shall execute all such work of repair, amendment, reconstruction, rectification and making good defects, imperfections, shrinkages or other faults as may be required of the Contractor in writing by the Architect/PMC during the DLP within fourteen days after its expiration, as a result of an inspection made by Architect/Employer/PMC prior to its expiration.

e) Cost of Execution of Work of Repair etc.:

All such work shall be carried out by the Contractor at his own expenses if the necessity thereof shall, in the opinion of the Architect/PMC, be due to the use of materials or workmanship not in accordance with the contract or to neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract. If, in the opinion of the Architect/PMC/Employer, such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it were additional work.

f) Remedy on Contractor's Failure to Carry Out Work Required:

If the Contractor shall fail to do any such work as aforesaid required by the Architect/PMC, the Employer shall be entitled to employ and pay other persons to carry out the same and if such works which is in the opinion of the Architect/PMC, the Contractor was liable to do at his own expense under the Contract, then all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Employer or may be deducted by the Employer from any money due or which may become due to the Contractor.

39.Alterations, Additions and Omissions:

a) The term "Variation" as used under this clause means the alteration or modification of the design, quality or quantity of work as shown upon the drawings, scope of works, specification or included in the priced schedule of quantities and desired by or referred to in the schedule of quantities and includes the addition, omission or substitution of any work, the alteration of the kind of standard or any of the materials or goods to be used in the work, and removal from the site of any works materials or goods executed or brought thereon by the Contractor for the purpose of work other than work materials or goods which are not in accordance with this contract. The Architect/Employer shall have power to order the Contractor to do any of the following:

i) Increase or decrease the quantity of any work included in the contract.
ii) Omit any such work.
iii) iii)Change the character or quality or kind of any such work.
iv) Change the levels, lines, position and dimensions of any part of the Works and
v) Execute additional work of any kind necessary for the completion of the works and no such variation shall in any way validate 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.

b) Orders for Variation to be in Writing:

The Contractor shall make no such variations without an order in writing of the Architect/Employer. Provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or

decrease is not the result of an order given under this Clause, but is the result of the quantities exceeding or being less than those stated in the scope of works.

40. Contractor to Search:

The Contractor shall, if required by the Architect/PMC in writing, search under the directions of the Architect/PMC for the cause of any defect, imperfection or fault appearing during the progress of the works or in the Period of DLP. Unless such defects, imperfection or fault shall be one for which the Contractor is liable under the contract, the cost of the work carried out by the Contractor in searching as aforesaid shall be borne by the Employer. If such defect, imperfection or fault shall be one for which the Contractor is liable as aforesaid, the cost of work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case repair, rectify and make good such defect, imperfection or fault at his own expense in accordance with the provisions of Clause 39 and 40 hereof.

41. Extra Item of Work:

a) Work or material At Sitamarhi of nature not included under the Schedule of items which has to be executed or supported, insurance of any of the Provisions of this contract shall be considered as on extra item. When alterations/additions or omissions made to any work or material shall be such that the cost of the resulting work cannot be estimated according to the tendered items the same shall also be considered extra item. The Contractor shall carry out the extra items as may be directed by the Architect/Employer. However, extra charges or claims in respect of any work will not be allowed unless the works they relate are clearly outside the spirit and meaning of the tender item/specifications and such works are ordered by the Architect/Employer and claimed for specified manner before the particular work is actually commenced. The extra item rate shall be approved by Architect/Bank on basis of rate analysis submitted by Contractor after duly verification and recommendation by Architect/Bank's Engineer.

b) **Prices for Extras, Ascertainment of:**

If any of the extra item is approved by Bank, then rates shall be paid as per CPWD DSR 2016/Latest version without any escalation at time of approval of extra items. If it is not available in DSR then it will be derived from the quoted rates of the Contractor for comparable items of similar nature/scope/description under Schedule of Quantities of the Tender, making allowance for variations only. However if no comparable items are available in the unit rates and the quantity of work is to be executed can conveniently be derived / measured; the same shall be arrived at based on the prevailing rates in the original tender. However, where the work is so disjointing the unit rates or the quantity of work done cannot be conveniently be derived/measured then it will be within the purview of the Architect/Employer to derive the rates either from Tender item or other extra items or by rate analysis showing clearly the fair market cost of material, cost of labour, plus 15% to cover overheads, profit etc. The actual cost shall be determined for the above purpose, as the cost of: -

i) Materials supplied or used at site on items forming part of completed item of work as determined by the Architect/PMC by inquiry of the prevailing market rate at the time of procurement.

ii) Materials (non-consumable) which are used temporarily and not forming a part of the completed item of main work, provided the same are solely meant for the particular and this cost would be determined by the Architect/PMC by inquiry of prevailing market rate.

iii) The actual cost of transport if solely transported for the execution of the particular extra work and running charge of equipment if any used for the execution of the particular extra item of work.

iv)Skilled and unskilled labour charges for the actual strength of labour employed and petty supervision charges as certified by the Architect/PMC.

Other relevant applicable costs viz. water, electricity, sundries etc as per CPWD guidelines may be considered on satisfactory production of documentary evidence to the PMC/Architect/Employer.

No escalation shall be entertained on such extra items.

c) If qty. of any item exceeded more than 25% of tender quantity than the exceeded quantities shall be treated as extra items .The Rate for exceeded qty. will be worked out as per above procedure, if quoted rate is not as per prevailing market/reasonable rate . if quantity of any item is increasing or likely to be increased more than BOQ quantity, contractor must obtain prior approval of Bank in writing, else Bank shall not be liable for payment of excess(more than BOQ quantity) quantity.

d) Claims: -

The Contractor shall send to the employer's representative/ PMC prior to submission of Interim Bill/Running Bill giving particulars of all claims for any additional payment to which the Contractor may consider himself entitled and of all extra or additional work ordered by the Architect/Employer, which he has executed. No final or interim claim for payment for any such work or expense will be considered which has not been included in such particulars. Provided always that the Architect shall be entitled to authorize payment to be made for any such work or expense, notwithstanding the Contractor's failure to comply with this condition, if the Contractor, has at the earliest practicable opportunity, notified the Architect/PMC/Employer in writing such claims along with required particulars. Claim if any should be submitted along with Final bill by Contractor to Bank/Architect. No Claim shall be considered by Bank/Architect after submission of Final Bill to Bank/Architect by Contractor.

Plant Temporary Works and Materials: -

a) **Plant etc. Exclusive use for the Works**:

All Constructional Plant, Temporary Works and materials provided by the Contractor shall when brought on to the site immediately be deemed to be exclusively intended for the construction and completion of the Works and be deemed to become the property of the Employer and the Contractor shall not remove the same or any part thereof (Save for the purpose of moving it from one part of the site to another without the consent in writing of the Employer which shall not be unreasonably withheld. But the Employer will permit the Contractor the exclusive use of all such Constructional plant, Temporary works and materials in and for the completion of the works until the happening of any event which gives right to the Employer to exclude the Contractor from the site and proceed with the completion of the works.

b) **Revesting of Plant Etc.: -**

Upon the removal of any such Constructional Plant, Temporary works of materials with consent as aforesaid the same shall be deemed to revert in and become the property of the Contractor and upon completion of the Works the remainder of the said Constructional Plant and Temporary Works and any unused materials provided by the Contractor shall be deemed to rivets in and become the property of the Contractor who shall remove the same. If the Contractor fails to remove any of the said Constructional Plant, Temporary Works of unused materials within such reasonable times after the completion of Works as may be allowed by the Architect/PMC then the Employer may sell the same and shall after deducting from the proceeds the charges and expenses and in connection with such sale pay the balance (if any) to the Contractor.

c) **Employer not Liable for Damage to Plant etc.: -**

The employer shall not at any time be liable for the loss of or injury to any or the said Constructional Plant, Temporary Works or materials save as mentioned in Clause 22 hereof.

42. Approval of Materials, Etc.:

The Architect/PMC/Employer is at a liberty to reject any materials, if in his opinion they are of sub-standard quality or not as per the tender specifications.

43. Works to be measured: -

The Project Management Consultant shall, except as otherwise stated, ascertain and determine by measurement the value in terms of the contract of work done in accordance with the contract. It shall, when it required any part or parts of the works to be measured, give notice to the Contractor's authorized agent or representative, who shall forthwith attend or send a qualified agent to assist the PMC/Architect 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 PMC or approved by him shall be taken to be the correct measurement of the work. For the purpose of measuring such Permanent Work as is to be measured by records and drawings, the PMC shall prepare records and drawings month by month of such work and the Contractor as and when called upon to do so writing, shall, within fourteen days, attend to examine and agree such records and drawings with the employer's representative/PMC and shall sign the same when so agreed. 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 with the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor shall, within fourteen days of such examination, lodge with the employer's representative/PMC for decision by the Architect/Employer, notice in writing of the respects in which such records and drawings are claimed by him to be incorrect.

44. Method of Measurements: -

a) Measurements shall be taken in accordance with the method stipulated in the specification. In case it is not stated the following shall be the method of measurements:

i) As per Indian Standard method of measurements of building works (I S 1200 - 1958).

ii) The measurement for certificate of payment shall be as described in mode of payment.

b)Quantity Surveying: -

The Contractor will himself undertake the quantity surveying work and submit his bills supported by reconciliation statements as directed. In case he fails to submit his bills in proper order, the Employer reserves for himself the right to employ an expert who will also be employed, if the bills stated by the Contractor show inaccuracies frequently indicating that the Contractor is not capable of taking the required measurements and producing a proper bill. The Contractor (or the expert) will make the measurements on the basis of the drawings as far as it is practicable. The billing procedure and formats shall be as approved by the Architect/PMC.

45. Assignment or Sub-Letting: -

The Contractor shall not assign or sub-let any portion of the work, except as expressly provided elsewhere in these documents.

46. Certificates and Payments:

a) Certificates and Payments: -

i) The Contractor shall submit to the Project Management Consultant/Architect after the end of each month statements and voucher and documents etc. as directed and signed by the Contractor showing the quantities and value of the materials, equipments etc. ordered, work done on the site and of the stock of equipments and unused materials on the site intended to form part of the permanent work or such other items as directed.

ii) The rates of prices in such monthly statements shall be in accordance with stipulations in the contract.

iii) If any rates or prices in the said contract are in the opinion of the Architect/Project Management Consultant not applicable to some or any part of the work executed or materials supplied and the Architect/PMC has not fixed a rate or price at the time when the monthly statement is prepared then temporary/provisional rates or prices shall be assigned by the Project Management Consultant's Representative.

iv) Neither the temporary rates or prices assigned under sub- clause (iii) of this clause nor the quantities mentioned in the statements submitted under sub-clause (i) of this clause shall be binding on the Employer or on the Contractor.

v) The Contractor shall when required by the Architect/PMC furnish all proper documents vouchers, returns etc. as to values to assist the Architect/PMC in the preparation of certificate.

b) Interim Payment:

The Contractor will be paid interim payment on the certificate of the Architect/Project Management Consultant's contract value of the Permanent Works executed up to date together with such amount (if any) that the Architect/Project Management Consultant may consider proper on account of materials delivered by the Contractor on the site and in addition such amount that the Architect/Project Management Consultant may consider fair and reasonable for any Temporary Works subject to a retention of the percentage named in the Contract until the amount retained shall reach the "Limit of Retention Money" named in the Contract (hereinafter called "the retention money") after which time no further deduction of retention will be made.

The issue of interim payment certificate by the Project Management Consultant/Architect for the value of work done and period of honoring such certificates by the Employer shall be as indicated in special condition of Contract hereto.

c) Final Bill:

Contractor will submit final bill to Architect along with MB, all MTC/Test Certificate, as built drawings, variation, all guarantee, all NOC's (Fire NOC, Electric Safety Certificate, Required Electric Load Sanction etc.) mentioned in Tender Document. The time of honoring final bill will be within 6 months from the date of receiving of final bill after addressing clarification sought by Bank/Architect of all queries by Contractors. When the Architect has granted a certificate or certificates of completion for the whole of the works under clause 38 hereof and when the Architect/PMC has ascertained (excluding in so doing unsettled or disputed claims of the Contract) the final sum (that is to say the gross payment for the completion of the whole of the works) due to the Contractor, the

Project Management Consultant shall after allowing for the amount of all previous certificate and after determining and allowing for any sum due to the Employer from the Contractor for delay and after allowing for all other payments due from the Contractor to such a sum out of the balance so calculated as remaining due to the Contractor as will leave to be retained by the Employer a sum equal to retention money for defects liability period . The issue of Final payment certificate by the Project Management Consultant/Architect for the value of work done and period of honoring such certificates by the Employer shall be as indicated in special condition of Contract hereto.

As soon as possible after the Certificate or Certificates of completion for the whole of the works have been issued, the Contractor shall furnish a final account for the works in the form and manner prescribed by the Architect/PMC.

d) **Payment after Defects Liability Period:**
The said retention money retained under sub-clause (c) of this clause and the amount if and by which the final sum exceeds the final sum ascertained under the said sub-clause (c) will not be paid by the Employer until after the expiration of defects liability period and then (subject to the deduction of such sums if any as the Project Management Consultant shall determine to be due from the Contractor to the Employer) only upon the Architect/PMC/Employer being satisfied that all the Contractor's obligations under the Contract have been satisfactorily performed.

e) **Time of Payment: -** Payment upon each of the Project Management Consultant's Certificates shall be made by the "Employer within the specified time as mentioned in Appendix to Form of Offer Page-24 of the Contract".

f) **Correction/ Withholding of Certificates: -**
The Project Management Consultant may by any certificate make any correction or modification in any previous certificate, which shall have been issued and shall have power to withhold approval of any certificate if the works of any part thereof are not being carried out to satisfaction.

47. Remedies and Powers:
a) Default of Contractor: -
If the Contractor shall become bankrupt, or have a receiving order made against him, or shall present his petition in bankruptcy, or shall agree to carry out the Contract under a committee of inspection of his creditors or, being a corporation, shall go into liquidation (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), if the contractor shall assign the Contract, without the consent in writing of the Employer first obtained, or shall have an execution levied on his goods, or if the Architect/PMC shall certify in writing to the Employer that in his opinion the Contractor :-

i) Has abandoned the Contract, or

ii) Without reasonable excuse has failed to commence the works or has suspended the progress of the works for twenty eight days after receiving from the Architect/Employer written notice to proceed, or Has failed to remove materials from the site or to pull down and replace work for twenty eight days after receiving from the PMC's written notice that the said materials or work had been condemned and rejected by the Architect's under these conditions, or

iii) Despite previous warnings by the Architect/PMC in writing, is not executing the works in accordance with the Contract, or is persistently or flagrantly neglecting to carry out his obligations under the Contract, or has, to the detriment of good workmanship, or in defiance of the Architect's instructions to the contrary, sub-let any part of the contract then the Employer may, after giving fourteen days' notice in writing to the Contractor, enter upon the site and the works and expel the Contractor there from without thereby avoiding the contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the Employer or the Architect by the Contract, and may himself complete the works or may employ any other Contractor to complete the works. The Employer or such contractor may use for such completion so much of the Constructional plant, temporary works and materials, which have been deemed to be reserved exclusively for the execution of the works, under the provisions of the contract, as he or they may think proper, and the Employer may, at any time, sell any of the said constructional plant, temporary works and unused

materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the Contractor under the Contract.

b) **Valuation at Date of Forfeiture: -**

The Architect shall, as soon as may be practicable after any such entry and expulsion by the Employer, fix and determine expiate, or after reference to the parties, or after such investigation or enquiries as he may think fit to make or institute, and shall certify that amount, if any, had at the time of such entry and expulsion been reasonably earned by or would reasonably accuse to the Contractor in respect of work then actually done by him under the Contract and the value of any of the said unused or partially used materials, any Nonstructural Plant and any temporary works.

c) **Payment after Forfeiture: -**

If the Employer shall enter and expel the Contractor under this Clause, he shall not be liable to pay to the Contractor any money on account of the Contract until the expiration of the Defects Liability Period and thereafter until the costs of execution and maintenance, damages for delay in completion, if any, and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the PMC/Architect. The Contractor shall then be entitled to receive only such sum or sums, if any, as the Architect may certify would have been payable to him upon due completion by him after deducting the said amount, if such amount shall exceed the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

48. Urgent Repairs: -

If, by reason of any accident of failure, or other event occurring or connection with the works, or any part thereof, either during the execution of the works, or during the DLP, any remedial or other work or repair shall in the opinion of the Architect/PMC, be urgently necessary for the safety of the works and the Contractor is unable or unwilling at once to do such work or repair, the Employer may employ and pay other persons to carry out such work or repair as the PMC/Architect may consider necessary.

If the work of repair so done by the Employer is the work which in the opinion of the Architect, the Contractor was liable to do at his own expense under the Contract, all expenses incurred by the Employer in so doing shall be recoverable from the Contractor by the Employer, or may be deducted by the Employer from any monies due or which may become due to the Contractor. Provided always that the Architect/PMC as the case may be, shall as soon after the occurrence of any such emergency as may be reasonably practicable notify the Contractor thereof in writing.

49. Matters to be finally Determined by the Architect: -

The decision, opinion, direction certificate (except for payment) with respect to all or any of the matters under Clauses hereof (which matters are hereinafter referred to as excepted matter) shall be only on PMC's scrutiny and recommendations to the Bank and shall be final and conclusive and binding on the parties hereto and shall be without appeal: -

Clause 5 - Architect's interpretation of drawings and further drawings and instructions.
Clause 15 - Work to the satisfaction of the Architect.
Clause 28 - Quality of material and workmanship and tests.
Clause 30(a) -Removal of improper work and materials.
Clause 35 – except 35(e)
Clause 40 - Variations
Any other decision, opinion, direction, certificate or valuation of the Architect to give any of the same shall be subject to the right or arbitration.

50. Settlement of Disputes and Arbitration Act 1996: -

Except where otherwise provided in the contract all questions and disputes relating to the meaning of the specifications, design, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, manner or thing whatsoever in any way arising out of or relating to the contract,designs,drawings,specifications,estimates,instructions,orders or these conditions or otherwise concerning the work or the execution or failure to execute the same whether arising

during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned herein after.

i) If the contractor considers that he is entitled to any extra payment or compensation in respect of the works over and above the amounts admitted as payable by the Architect or in case the contractor wants to dispute the validity of any deductions or recoveries made or proposed to be made from the contract or raise any dispute, the contractor shall forthwith give notice in writing of his claim, or dispute to the **General Manager, Patna, Bank of Baroda** and endorse a copy of the same to the Architect, within 30 days from the date Of disallowance thereof or the date of deduction or recovery. The said notice shall give full particulars of the claim, grounds on which it is based and detailed calculations of the amount claimed and the contractor shall not be entitled to raise any claim nor shall the Bank be in any way liable in respect of any claim by the contractor unless notice of such claim shall have been given by the contractor to the General Manager, **Bank of Baroda, Patna**in the manner and within the time as aforesaid. The contractor shall be deemed to have waived and extinguished all his rights in respect of any claim not notified to the General Manager, **Bank of Baroda Patna**in writing in the manner and within the time as aforesaid.

ii) The AGM/Chief Manager, Bank of Baroda shall givehis decision in writing on the claims notified by the contractor. The contractor may within 30 days of the receipt of the decision of **The ZM, Bank Of Baroda** submit his claims to the conciliating authority namely **The Zonal Manager Bank of Baroda ,**for conciliation along with all details and copies of correspondence exchanged between him and **The ZM, Bank Of Baroda.**

iii) If the conciliation proceedings are terminated without settlement of the disputes, the contractor shall, within a period of 30 days of termination thereof shall give a notice to the concerned **Zonal General Manager** of the Bank for appointment of an Arbitrator to adjudicate the notified claims failing which the claims of the contractor shall be deemed to have been considered absolutely barred and waived.

iv) Except where the decision has become final, binding and conclusive in terms of the contract, all disputes or differences arising out of the notified claims of the contractor as aforesaid and all claims of the Bank shall be referred for adjudication through arbitration by the sole Arbitrator appointed by **The Zonal Manager, Bank Of Baroda.** It will also be no objection to any such appointment that the Arbitrator so appointed is a Bank office and that he had to deal with matter to which the contract relates in the course of his duties as Bank officer. If the Arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever another sole Arbitrator shall be appointed in the manner aforesaid by the said **The Zonal Manager, Bank of Baroda.** Such person shall be entitled to proceed with the reference from the stage be entitled to proceed with the reference from the stage at which it was left by his Predecessor.

It is a term of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed in respect of each dispute along with the notice for appointment of arbitrator. It is also a term of this contract that no person other than a person appointed by such General Manager, Bank of Baroda as aforesaid should act as Arbitrator.

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

It is also a term of the contract that fees, Travelling, lodging, etc, or any such expenses on account of Arbitration, payable to the arbitrator, shall be paid equally by both the parties. However, no fees will be payable to the arbitrator if he is a Bank officer.
It is also a term of the contract that the arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties calling them to submit their statement of claims and counter statement of claims. The venue of the arbitration shall be such place as may be fixed by the arbitrator in his sole discretion. The fees, if any, of the arbitrator shall, if required to be paid before the award is made and published, be paid half and half by each of the parties. The cost of the reference and of the award (including the fees, if any of the arbitrator) shall be in the discretion of the arbitrator who may direct to any by whom and in what manner, such costs or any part thereof, shall be paid and fix or settle the amount of costs to be so paid.

SPECIAL CONDITIONS OF CONTRACT (ANNEXURE 4)

7.1.Location of Site:- ……Sitamarhi District -843301, Bihar.

7.2**. Dimensions and Levels**
All dimensions and levels shown on the Drawings shall be verified by the Contractor on the site and he will be held responsible for the accuracy and maintenance of all dimensions and levels.

7.3. Notice of Operation:
a) The Contractor shall not carry out important operation without the consent in writing of the Employer/ Project Management Consultant.

b) If it is found that the two or more persons who are connected with one another either financially or as principal and agent or master and servant have tendered separately under different names, for the same worked without disclosing their relation, the tender will be cancelled. Any contract if entered into, under such conditions, will also be cancelled at any time during its currency and earnest money will be forfeited.

7.4. Programme of Works and Method of Construction:
In pursuance of General Condition of Contract, the contractor on starting the work shall furnish to the Architect/PMC a program for carrying out the work stage by stage in the stipulated time. Bar chart etc. on individual work shall be maintained showing the progress week by week. The contractor shall submit to the Project Management Consultant a weekly progress report stating the number of skilled and unskilled labours employed on the works, working hours done, quality of cement used, place, type and quality/quantity of work done during the period.

7.5. Assistance for Employer/Architect/ Project Management Consultant:
The Contractor shall provide for the Employer/Architect at all times during the Contract including Defects Liability Period a PMC and/or all such other men as he may require to assist him in carrying out or checking any measurements, levels, setting out or measuring up of work. The Contractor is also to provide ladders, gangways, etc., and the necessary attendance to move and adopt as directed for inspection or measurement of the works by the Architect.

7.6. Construction Records
The Contractor shall keep and supply to the Employer/ Project Management Consultant full and accurate records of the dimensions and positions of all new work and any other information necessary for the Project Management Consultant to be able to prepare complete drawings recording details of the works as constructed. Test/Registers/Record, etc to be maintained at Site as per works manual 2007 of Bank of Baroda.

7.7. Safety of adjacent Structures of Works:
a) The Contractor shall provide and erect to the approval of the Employer/Architect/ Project Management Consultant such supports as may be required to protect efficiently all structures or works which may be endangered by the execution of the works or otherwise take such permanent measures as may be required by the Project Management Consultant to protect the structures or Works. The Contractor will be allocated an area for his plant, stores, and compound workshop and site offices and within the site.

b) **Work at Night**: If the contractor is required to work at night and/or on Sundays and holidays in order to complete the work within the time schedule the contractor shall provide and maintain at his own cost sufficient lights to enable the work to proceed satisfactorily without danger. Approaches to the site also shall be sufficiently lighted by the contractor. No extra payments will be made for night work. Prior intimation and approval should be taken from Employer through Architects/ PMC in this regard. c) Reporting of accidents to labour. The contractor shall be responsible for the safety of persons employed by him on the works and shall report accidents to any of them whenever and wherever occurring on the works, to the employer who shall make every arrangement to render all possible assistance. This shall be without prejudice to the responsibility of the contractor under the insurance clause of the general conditions of contract.

7.8. Requisition of Materials:

The Bills of Quantities shall not be used as a basis for quantities of materials and the Contractor is entirely responsible for assessing the quantities of materials to be ordered. The employer is not bound to supply of any materials and EMPLOYER may reset the requisition of materials.

7.9. Power, Water & Other facilities:

The Contractor shall be responsible to provide within the scope of work all facilities necessary for performance of the work including (but not limited to) water, power, transportation, labour, tools, construction and testing equipment and machinery and land at or about the job site (s) for the Contractor's field offices, go downs, workshops and residential accommodation for Contractor's staff, quarry rights for raw material, borrow areas, access roads, and right (S) of way to or about the job site (s)and Contractor's office, go down, workshop accommodation, quarries and/or borrow area.

The EMPLOYER does not warranty or undertake the provision of any facility aforesaid or otherwise whatever to the Contractor, or assistance in obtaining/procuring the same or other assistance whatever for or in the performance or testing of the work and the Contractor shall not imply by conduct, expression or assurance or by any other means, any promise or obligations on the part of the EMPLOYER contrary to the provision hereof and any such promise or obligation understood by the Contractor shall not be binding upon the EMPLOYER.

Any assistance which the EMPLOYER renders to the Contractor in terms hereof or otherwise relative to the work by provision of any facility, water, power etc. as above shall not for any cause afford a basis or defence to the Contractor for any of his obligations under the contract, nor ground for extension of time for completion.

7.10. Procurement of materials:

a) The Contractor shall procure all materials by his efforts and at his own cost.

The Contractor shall not remove any cement from the site without a written authority of the Project Management Consultant on completion of the works. The contractor shall obtain the instructions of the controlling Authorities as to how the surplus materials if any, is to be disposed off. b)Cement storage: The Contractor shall at his own cost erect and maintain a cement storage shed on the site having water tight walls and roof. The shed should be capable of storing twenty tones (400 bags) of cement.

7.11. Temporary Services:

The Contractor shall provide and maintain all temporary services on or about the site including providing Tower cranes; hoists for material movements required for the execution of the works and shall remove them on completion as decided by Architect/ Project Management Consultant.

7.12. Unauthorized Persons:

No unauthorized persons are to be allowed on the site. The Contractor shall instruct all such persons to keep out and shall take steps to prevent trespass.

7.13. Keeping Site Clean and clearer:

During the progress of the works and when directed by the Architect/ Project Management Consultant the Contractor shall keep the site clear of all rubbish and debris including that which may be deposited on the site by any sub-contractors until the date of issue of certificate of Completion. The cost of keeping the site clean shall be deemed to have been included for in the rates.

On completion of the works, the Contractor shall at his own expense clear away and remove from the site not later than 7 days from the date of completion of works all constructional plant, surplus material, rubbish and temporary works of every kind and leave the entire site and works clean and in a workman like condition. In case of failure by the contractor, the employer under the advice of Architect/ Project Management Consultant will have the right to get the site cleared at the risk and cost of the contractor to the satisfaction of the Architect/ PMC/Employer.

7.14. Office Accommodation store for Contractor, Employer and Project Management Consultant on the site.

a) The Contractor shall erect and maintain entirely at his own expense offices for the Project Management

Consultant, the Architect's representatives and for his own staff respectively at such places as the Architect shall indicate. These offices shall be provided by the contractor with furniture and light, toilet facilities etc.

b) The Contractor shall provide for all necessary storage on the site in a specified area for all materials such as timber, cement, lime and such other material, which are likely to deteriorate by exposure to sun or rain. All such stores shall be cleared away and the ground left in good and proper order on completion of this contract; unless otherwise expressly mentioned herein.

c) All materials which are stored on the site such as bricks, metal, sand etc. shall be stacked in such a manner as to facilitate rapid and easy checking of quantities of such materials.

7.15. Lighting for Works

The Contractor shall at all times provide approved lighting as required for the proper execution and supervision of the works at his own cost.

7.16. Labour Hutments

The contractor shall not be allowed to put up any hutments/temporary structures for accommodating his labour/staff. He shall be required to make his own arrangement elsewhere at his own cost. However, if local authorities so permit and subject to the Contractor arranging for such permission, some space at site which will not come in the way of the permanent construction, temporary construction facilities and offices may be provided to the Contractor at the discretion of the Employer for purely temporary bachelor accommodation or essential/core staff engaged on Emergency or essential services round the clock like security, fire fighting, concrete laying and curing with proper sanitary facilities.

7.17. Works Diary

The Employer shall keep a diary/Register on the site in which all his remarks, instructions, decisions and the essential details, of the work shall be recorded. The Contractor shall assist in keeping the diary by supplying daily information on the works as required by Employer/Architect/ Project Management Consultant.

7.18. Progress Report:

The Contractor shall submit regular weekly progress reports to the Employer/Architect / Project Management Consultant in a form as required by him which shall also include progress photographs of the works.

In addition, the contractors shall maintain site records/registers etc. as required and directed by the Architect/PMC/Employer.

7.19. Site Meetings: Progress and quality evaluation meetings will be held at the site every week. The Contractors' senior representative-in-charge of the project along with his site-in-charge and other staff as required participating in these meetings and ensuring all follow up actions.

7.20. Return of Plant:

The Contractor shall supply to the Employer a monthly return showing full particulars on a form, to be approved by him of the items of plant including location and state of each and the sections of the works on which they are employed. This return is to be presented on the 10th day of each month.

7.21. Contractor to Verify Site Measurements:

a) The Contractor shall check and verify all site measurements whenever requested by other specialists, Contractors or by nominated or other sub-contractor to enable them to prepare their own shop drawings and pass on the information with sufficient promptness as will not in any way delay the works. A copy of all such information passed on shall be given to the Project Management Consultant.

b) Measurement to be recorded before work is covered up: The contractor shall take joint measurements with the PMC's representative before covering up or otherwise placing beyond the reach of measurement any item of work. Should the contractor neglect to do so, the same will be uncovered at the contractor's expense or in default thereof, no payment or allowance shall be made for such work or the materials with which the same was executed. No claim for interim bill payment will be entertained unless the bill is accompanied with detailed measurements. c)Typographic or clerical errors

The Architect's clarifications regarding partially omitted particulars or typographical or clerical errors shall be final and binding on the Contractor.

7.22. Items not covered

a) If any item of work is ordered to execute which is not covered in the contract it will be paid for through deriving from analogous item of the contract and if such item is not available then as per valuation that would be derived on the basis of the actual cost of the materials and labour incurred in carrying out the said work, as specified and directed by Employer/Architect/PMC and as determined by the Employer, plus **15%** (Fifteen percent) to allow for Contractor's profit and overhead and other related costs.

b) Any work not carried out as per drawings issued for Execution and Specification and/or instructions or is defective in the opinion of the Architect/PMC shall be demolished and replaced by new work by the contractor to the satisfaction of the architect and/or consulting Engineer. If the Architect may allow such work to remain the contractor shall accept a reduction in the rate quoted by him and/or reduction in the total cost of such works as will be assessed and decided upon by the architect. The architect's decision in this matter shall be final and binding to parties, contractor and employer.

7.23. Contract Rates:

The Contract prices and variation rates shall remain firm till final completion of the work and shall be deemed to include all labour, materials, use of plant tools, temporary works and buildings, etc. insurance, trade tax, works contract tax, VAT, local taxes and duties establishment charges, overhead, profit, supervision, transport, sampling, testing, shop drawing and other charges and every expense incurred in the proper and due execution, completion and maintenance of the works, and shall be in full satisfaction and discharge of every obligation and imposed upon him by the contract and nothing extra shall be payable unless so specifically stated in this contract.

7.24. Time of Completion & Progress of Works:

The whole of the work as stipulated shall be completed within the stipulated time period starting from the date of the written order by the Employer to commence the work. The work shall generally be preceded in accordance to agreed program of works. Time is the essence of the contract and the works must be completed within the time schedule as indicated in the appendix to the Tender. Any tender which disagrees with time schedule of construction and stipulates a longer period is liable to be rejected.

The Contractor shall take all special steps he thinks might be necessary to complete the work in the stipulated time including any special plant, equipment, additional quantity of shuttering and other materials, labour etc. and give detailed and specific indication of the same in his tender submission and include the cost thereof in his quoted rates.

7.25. Statutory Obligations, Notice, Fees and Charges:

i)

a) The Contractor shall comply with and give all notices required by any act, any instrument rule or order made under any Act, or of any regulation or bylaw of Municipal Corporation and other any local body or authority or of any agency which has any jurisdiction with regard to the works or with whose systems the same we are or will be connected (all requirements to be complied with being referred to in these
Conditions as the statutory requirements)

b) If the Contractor shall find any divergence between the statutory requirements and all or any of the contract documents or any variation instruction issued in accordance with these Conditions, he shall immediately give to the Employer/Architect a written notice specifying the divergence.

c) If the Contractor gives notice under paragraph (b) of this sub-clause or of Employer /Architect shall otherwise discover or receive notice of a Divergence between the statutory requirements and all or any of the contract documents or any variation instructions issued in accordance with these conditions, the Employer shall within 7 days of discovery or on receipt of a notice issue instructions in relation to the divergence.

d) If in any emergency compliance with paragraph (a) of this sub-clause requires the Contractor to supply materials or execute work before receiving instruction under paragraph (c) of this sub-clause the Contractor shall supply such limited materials and execute such limited work as are reasonably necessary to secure the statutory requirements.

e) The Contractor shall forthwith inform the Employer/ Architect/ Project Management Consultant of the emergency and of the steps that he is taking under this paragraph of these conditions.

f) Work executed and materials supplied by the Contractor under sub-paragraph (i) of this paragraph shall be deemed to have been executed and supplied pursuant to Employer instruction in accordance with these Conditions provided that the emergency arose because of a divergence between the statutory requirements and all or any of the documents referred to in these Conditions or any variations, instructions issued in accordance with these Conditions.

g) Provided that the contractor complies with paragraph (b) of this sub-clause, the Contractor shall not be liable to the Employer under this Contract if the works do not comply with the statutory requirements from the Contractor having carried out work in accordance with the documents referred to these Conditions.

ii)The Contractor shall pay and indemnify the Employer against liability in respect of any fees or charges (including any rates or taxes) legally demandable under any Act, any instrument rule or order made under any Act, law or any regulation or below of any local authority or of any statutory or agency in respect of works.

iii)It will be the contractor's sole responsibility and obligation to arrange for blasting license from the relevant authorities, if the excavation requires blasting. The contractor will have to store the blasting powder in a suitably constructed store as per regulation of the explosive department and local bodies.

7.26. Materials and Workmanship to be best of the respective kind

i) All materials, goods and workmanship shall as far as procurable be the best of the respective kinds and standards described in the Contract.

ii) The Contractor shall upon the request of the Employer/ Architect/ Project Management Consultant furnish him with documentation to prove that the materials and goods comply with sub clause (1) of this condition. iii)The Employer may issue instructions in regard to the removal from the site of any work, materials or goods which are not in accordance with this Contract. In case the Contractor fails to do so in accordance with the time schedule laid down by the Employer, then the Employer will be at liberty to have these material moved out at the expense of Contractor. Ruling of Employer in this regard will be final and binding under the advice of the Architect.

7.27.Samples:

a) Apart from adhering to any special provision made in the specifications regarding submission of samples, the Contractor shall within 10 days of his receipt of Letter of Intent, provide to the Employer samples along with the detailed literature of all materials he proposes to use in the building irrespective of the fact that a specific make/material might have been stipulated. If certain items proposed to be used are of such nature that samples cannot be presented or prepared at the site, detailed literature/test certificate of the same shall be provided instead. Before submitting the samples/literature the Contractor shall satisfy himself that the material/equipment for which he is submitting the samples/literature meet with the requirement of the specification . The Employer/ Project Management Consultant shall check the samples and give his comments and/or approval to the same. Only when the samples are approved in writing by Employer he shall proceed with the procurement and installation of the same. The approved samples shall be signed by the Architect for identification and shall be kept on record at his office until the completion and acceptance of the work and shall be available at the site for inspection/comparison at any time. The Contractor shall keep with him a duplicate of such samples to enable him to process the matter. For items of work where the samples are to be made at the site, the same procedure shall be followed. All such samples shall be prepared at a place where it can be left undisturbed until the completion of the project.

The Architect shall give his comments/approval to the samples at his earliest convenience. Any delay that might occur in approving of the samples for reasons of its not meeting with the specifications shall be to the account of the Contractor.

b) **Testing of concrete:**

The Contractor shall make his own arrangement for testing of the concrete cubes from time to time as required by the PMC/Architect and all the cost of testing and conveyance shall be borne by the Contractor. At least 6 cubes of 6" x 6" x 6" per 1000 Cft. of R.C.C. work must be taken as directed and tested. The PMC/Architect/Employer reserves the right to test the concrete at the cost of the contractor in the event of the contractor failing to do so.
All the testing of materials/works shall be as per CPWD frequency and contractor to bear all expenses in such regards. The MTC from manufacture will be submitted by Contractor for major items/materials to Bank.

c) **Testing of work and materials:**
The Contractor shall arrange to test materials/proportions of the material/works at his own cost in order to prove their soundness and quality. If after any such test the work is found, in the opinion of the Architect, to be defective or unsound, the contractor shall pull down and re-erect the same at his own cost.

d) Contractor will maintain all the Registers/Documents as per Bank's work manual and facilitate all cooperation to Architect to perform their duty to check/scrutiny etc for the same.

e) **Treasure trove:**
Should any treasure, fossils, minerals, or works of art of antiquarian interest be found during excavation or while carrying out works, the same shall be the property of the employer. The contractor shall give immediate notice to the Architect of any such discovery and shall hand over any such treasure to the employer on demand.

7.28. Approved Makes:
The specifications provide a list of approved makes of some materials specified. The tender price quoted shall cover for this aspect. Only when it is not possible to use any of the approved makes, either due to non-availability or due to technical reasons and the Contractor shall propose alternative materials and if found suitable these shall be approved by the Employer for construction.

7.29. Dismissal of Undesirable Persons:
The Employer may issue instructions requiring the dismissal from the works of any person employed thereon without assigning any reason. The decision of Employer in this regard will be final and binding.

7.30.
a) **Access to the Works**
The Employer/Employer's representative, Architect /Architect's Representative, Project Management Consultant/representatives and their nominees shall at all reasonable times have access to the works and to the workshops or other places of the Contractor or his sub-contractors/suppliers where work is being carried out for the Contract. When work is to be so carried out in workshops or other places of a sub-contractor the Contractor shall by a term in the sub-contract incorporate a similar right of access to those workshops or places for the Employer and their nominees and shall do all things reasonably necessary to make such right effective.

b) **Facilities to other contractors:**
The Contractor shall give full facilities and cooperation to all other contractors working on site such as, plumbing, electrical, lift erection etc. as directed by the Architect/ Project Management Consultant and shall arrange his program of work so as not to hinder the progress of other works. The decision of the architect/ Project Management Consultant on any point of dispute between the various contractors shall be final and binding on all parties concerned.

7.31. Employer/Architect's Instruction:

i)The Contractor shall forthwith comply with all instructions issued to him by the Employer/Architect/ Project Management Consultant in regard to any matter in respect of which the Employer/Engineer expressly empowered by these Conditions to issue instructions. If within seven days after receipt of a written notice from the Employer/Architect/ Project Management Consultant requiring compliance with an instruction the Contractor does not comply therewith, then the Employer may employ and pay other persons to execute any work whatsoever which may be necessary to give effect to such instruction and all cost incurred in connection with such action shall be recoverable from the Contractor by the Employer as a debt or may be deducted by him from any monies due or to become due to the Contractor under this Contract. ii)All instructions issued by the

Employer/Architect/ Project Management Consultant shall be issued in writing. However any instruction issued orally shall be given immediate effect and shall be confirmed in writing by the Architect within three days.

7.32. Liquidated Damages:
If the Contractor shall fail to complete the works within the stipulated period of completion mentioned herein above, the Contractor shall be liable and shall pay to the Employer as pre-estimated damages at the rate indicated in the APPENDIX TO FORM OF TENDER. In case the non-completion is limited to certain items disciplines/sections which is not preventing the Employers to occupy and use the building effectively s decided by the Employer then the damages shall be limited to 200% of the cost of the particular item/discipline/section subject to the ceiling as indicated before.

7.33. Termination:
In the event of the Contractor failing to complete the works within the stipulated period of completion as mentioned hereof, the Employer may, notwithstanding anything contained to the contrary in the contract, terminate at any time the contract without being liable in any manner whatsoever to the Contractor, by giving 30 days' notice in writing to the Contractor and proceed to complete or get completed the works which have remained incomplete/not done at the time of such termination at the risk and cost of the Contractor.

7.34. Contract Price
The contract prices as indicated in accepted tender value and as detailed in priced bill of quantities shall govern this aspect of the contract.

7.35. Preparation of building works for occupation and use on completion:
On completion of the work, the contractor shall inform the PMC/Architect in writing that he has finished the work and it is ready for the inspection. He will leave the entire possession of site neat and clean and ready and to the satisfaction of the Architect.

7.36. Insurance against third party risks:
On commencement of the work, the contractor shall take out and submit to the Employers a suitable insurance policy against third party risks. The limits of liability of this insurance shall be as follows:

a) Contractor's all risk - 'CAR' policy for the value of contract price and necessary workmen compensation policy valued for the duration of work.
b) Rs.35 Lakhs in respect of any one accident or series of accidents arising out of one event. Contractor shall take out third party insurance for 3 no. of such accidents.
c) Rs.5,00,000/- in respect of any person.

7.37. All the work shall be carried out as per the detailed drawings and architect's instruction and in stages as desired by the architect. However, if quantities increase or likely to be increased beyond tender/BOQ quantity/ies, contractor must obtain prior approval of the Bank in writing along with recommendation of Architect, else Bank shall not be liable to pay for more than (excess) BOQ quantity of any items.

CONTRACTORS LABOUR RULES – REGULATION (ANNEXURE 5)

8.1. Labour Rules
The Contractor shall at all times during the continuance of the Contract, comply fully with all existing Acts, regulations and bylaws including all statutory amendments and re-enactment of State or Central Government and other local authorities and any other enactments, notifications and acts that may be passed in future either by the State or the Central Government or local authority, including Indian Workmen's Compensation Act. Contract
Labour (Regulation and Abolition) Act 1970 and Equal Remuneration Act 1976, Factories Act, Minimum Wages Act, Provident Fund Regulations, Employees Provident Fund Act, schemes made under the same Act and also Labour Regulations mentioned in Annexure A-I. Health and Sanitary Arrangement for Workmen, Insurance and other benefits and shall keep Employer indemnified in case any action is commenced by competent authorities for contravention by the Contractor. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated henceforth on the part of the Contractor, the Architect/Employer shall have the right to deduct from any money due to the Contractor, his

amount of Performance Security or recover from the Contractor personally any sum required or estimated to be required for making good the loss or damage suffered by the Employer, responsibility in connection with the employees of the contractor, who shall, in no case, be treated as the employees of the Employer at any point of time.

8.2. Fair Wages:

8.2.1. The Contractor shall pay the labourers engaged by him on the work not less than fair wage which expression shall mean, whether for time of piecework, the respective rates of wages fixed by the local authorities as fair wages for the area payable to the different categories of labourers or those notified under the Minimum Wages Act for corresponding employees of the Employer, whichever may be higher.

8.2.2.The Contractor shall, notwithstanding the provisions of a contract to the contrary, cause to be paid a fair wage to labourers indirectly engaged on the Works, including any labour engaged by sub/contractors in connection with the said works as if the labourers had been directly employed by him.

8.3.Notices:

8.3.1.The Contractor shall before he commences the work, display, and correctly maintain in a clean and legible condition at a conspicuous place on the Site, notices in English and in a language spoken by the majority of the workers, stating therein the rate of wages which have been fixed as fair wages and the hours of work for which such wages are earned and send a copy of such notices to the Architect.

8.4.Record of wages etc.

The contractor shall maintain records of wages and other remuneration paid to his employees in such form as may be convenient and as per the requirements of the Employer/ Architect and the Conciliation Officer (central), Ministry of Labour Government of India, or such other authorized person appointed by the central or State Government and the same shall include the following particulars of each worker :

8.4.1.Name, worker's number and grade;
8.4.2.Rate of daily or monthly wage;
8.4.3.Nature of work on which employed;
8.4.4.Total number of days worked during each wage period;
8.4.5.Total, amount payable for the work during each wage period; All deductions made from the wage with details in each case of the ground for which the deduction is made;
8.4.6.Wage actually paid for each wage period.
8.4.7.The Contractor shall provide a Wage Slip for each worker, employed on the Works.
8.4.8.The Wage records and Wage Slips shall be preserved for at least 12 months after the last entry for Inspection of Wage Records.
8.4.9.The Contractor shall allow inspection of the aforesaid Wage Records and Wage Slips to the Architect/PMC and to any of his workers or to his agent at a convenient time and place after due notice is received, or to the Employer or any other person authorized by him on his behalf.
8.4.10.The Employer/Architect or any other person authorized by them on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the Fair Wages Clause. He shall also have the Power to investigate into any complaint regarding any default made by the Contractor or sub-contractor in regard to such provision.
8.4.11.No party shall be represented by a legal practitioner in any investigation or inquiry under this Clause, unless Architect/Employer agree otherwise.

8.5.Safety Provisions:

The Contractor shall comply with all the precautions as required for the safety of the workmen by the I.L.O. Convention No. 62 as far as they are applicable to the Contract. The Contractor shall provide all necessary safety appliances, gears like goggles, helmets, masks, etc. to the workmen and the staff.

A.SCAFFOLDS

i) Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration work which can be done safely from

ladders. When a ladder is used, it shall be of rigid construction made either of good quality of wood or steel. The steps shall have a minimum width of 450mm and a maximum rise of 300 mm. Suitable hand holds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than ¼ to 1(1/4 horizontal and 1 vertical)

ii) Scaffolding or staging more than 4m. above the ground floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly bolted, braced or otherwise secured, at least 1 m. above the floor or platform of such scaffolding or staging and extending along the entire length of he outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

iii) Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform, gangway or stairway is more than 4 m. above ground level or floor level, they shall be closely boarded and shall have adequate width and be suitably fenced as described in (ii) above.

iv) Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1m.

Wherever there are open excavations in ground, they shall be fenced of by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.

v) Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9m. in length while the width between side rails in rung ladder shall in no case, be less than 290mm. for ladder up to and including 3m. in length. For longer ladders this width shall be increased at least 20mm for each additional meter of length.

vi) A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to construction.

OTHER SAFETY MEASURES

vii) All personnel of the contractor working within the plant site shall be provided with safety helmets. All welders shall wear welding goggles while doing welding work and all metal workers shall be provided with safety gloves. Persons employed on metal cutting and grinding shall wear safety glasses.

viii) Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.

EXCAVATION & TRENCHING

ix) All trenches, 1.25m. or more in depth shall at all times be supplied with at least one ladder for each 30m. in length or fraction thereof. The ladder shall be extended from bottoms of the trench to at least 1m. above the surface of the ground. Sides of trenches which are 1.5m or more in depth shall be stepped back to give suitable slope or securely held by timber bracing so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5m of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.

x) The contractor shall take all measures on the site of the work to protect the public from accidents and shall be bound to bear the expenses of defense of every suit, action or other proceedings at law that may be brought by any persons for injury sustained owing to neglect of the above precautions and to pay any such persons or which may with the consent of the contractor, be paid to compromise any claim by any such person.

DEMOLITION

xi) Before any demolition work is commenced and also during the process of the work:

a) All roads and open areas adjacent to the work site shall either be closed or suitably protected.

b) No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged.

c) All practical steps shall be taken to prevent danger to persons employed from the risk of fire or explosion or flooding. No flood, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

PERSONAL SAFETY EQUIPMENTS

xii) All necessary personal safety equipment as considered adequate by the Engineer should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned.

a) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.

b) Those engaged in white washing and mixing or stacking of cement bags or any material which is injuries to the eyes shall be provided with protective goggles.

c) Those engaged in welding works shall be provided with welder's protective eyesight lids.

d) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

e) When workers are employed in sewers and manholes, which are in use, the contractor shall ensure that the manhole covers are opened and are ventilated at least for an hour before the workers are allowed to get into manholes and the manholes so. Opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public.

f) The contractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead or any toxic material in any form. Wherever men above the age of 18 are employed on the work of such painting the following precautions should be taken:

g) No paint containing lead or lead products shall be used except in the form of paste or readymade paint. Paints like vinyl and epoxies having toxic fumes should be applied after following all precautions laid down by manufacturers.

i) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

ii) Overalls shall be supplied by the contractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work. xiii)When the work is done near any public place where there is risk of drowning all necessary equipments should be provided and kept 'ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

HOISTING MACHINES

xiv) Use of hoisting machines and. tackle including their attachments anchorage and supports shall conform to the following standards or conditions:

1.

a) These shall be of good mechanical constructions sound material and adequate strength and free from patent defect and shall be kept in good repair and in good working order.

b) Every rope used in hoisting or lowering materials or as means of suspension shall be of durable quality and adequate strength and free from patent defects.

2. Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in charge of any hoisting machine including any scaffolding winch or give signals to operator.

3. In case of every hoisting machine and of every chain ring hook, shackle shovel and pulley block used in hoisting or as means of suspension the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load, each safe working load and the. Conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

4. In case of departmental machines, the safe working load shall be notified by the Engineer. As regards contractor's machines, the contractor shall notify the safe working load of the machine to the Engineer whenever he brings any machinery to site of work and get it verified by the Engineer concerned.

xv)Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum of the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulated mats, wearing apparel, such as gloves, sleeves and boots as may be necessary, should be provided. The workers should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

xvi) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use.

Adequate washing facilities should be provided at or near p-laces of work.

xvii) These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.

xviii) To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Lab our Officer, Engineers of the Department or their representatives.

xix) Notwithstanding the above clause from (i) to (xviii), there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force in the Republic of India.

8.6. First Aid:

At every workplace, there shall be maintained in a readily accessible place first aid appliances including an adequate supply of sterilized dressings and sterilized cotton wool as prescribed in the Factory Rules of the State in which the work is carried on. The appliances shall be kept in good order and, in large workplaces; they shall be placed under the charge of a responsible person who shall be readily available during working hours.

At large workplace, where hospital facilities are not available within easy distance of the works, First Aid Posts shall be established and be run by a trained compounder. Where large workplaces are remotely situated and far away from regular hospitals, an indoor ward shall be provided with one bed for every 250 employees.

Where large work place are situated in cities, towns or in their suburbs and no beds are considered necessary owing to proximity of city or town hospitals, suitable transport shall be provided to facilitate removal of urgent cases to these hospitals. At other workplaces, some conveyance facilities shall be kept readily available to take injured person or persons suddenly taken seriously ill, to the nearest hospital. At large workplace, there shall be provided and maintained an ambulance room containing the prescribed equipment and in the charge of such medical and nursing staff as may be prescribed. For this purpose, the relevant provisions of the Factory Rules of the State Government of the area, where the work is carried on, may be taken as the prescribed standard.

8.7. Accommodation for Labour:

The Contractor shall during the progress of the Work provide, erect and maintain necessary temporary living accommodation and ancillary for labour at his own expenses to the standards and scales as approved by the Engineer.

8.8.Drinking Water:

In every workplace, there shall be provided and maintained at suitable places, easily accessible to lab our, a sufficient supply of cold water fit for drinking. Where drinking water is obtained from an intermittent public water supply, each workplace shall be provided with storage where drinking water shall be stored. Every water supply storage shall be at a distance of not less than 15 meters from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well, which is within such proximity of latrine, drain or any other source of pollution, well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with a trap door which shall be dust-proof and water-proof. A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection which shall be done at least once a month.

8.9. Washing and Bathing Places:

Adequate washing and bathing places shall be provided separately for men and women. Such places shall be kept in clean and drained condition.

8.10. Latrines and Urinals:

Except in workplaces provided with water/flushed latrines connected with a water borne sewage system, all latrines shall be provided with receptacles on dry-earth system which shall be cleaned at least four times daily and at least twice during working hours and kept in a strictly sanitary condition. Receptacles shall be tarred inside and outside at least once a year.

Regulation 6 - Payment of Wages

i) Wages due to every worker shall be paid to him direct. All wages should by paid in current coins or currency or in both preferably in electronic form.

ii) Wages of every worker employed on the Contract shall be paid where the wage period is one week, within THREE days from the end of the Wage period, and in any other case before the expiry of the 7th day or 10th day from the end of the wage period according as the number of workers does not exceed 1,000 or exceeds 1,000.

NOTE: The term “Working Day” here means a day on which the work on which the labour is employed is in progress.

Regulation 7 - Register of Workmen:
A register of workmen shall be maintained in the Form appended to the regulations and kept at the work site or as near to it as possible, and relevant particulars of every workman shall be entered therein within THREE days of his employment.

Regulation 8 - Employment Card:
The Contractor shall issue an employment card in the Form appended to these regulations to each worker on the day of work or entry into his employment. If a worker already has any such card with him issued by the previous employer, the Contractor shall merely endorse that Employment Card with relevant entries. On termination of employment, the Employment Card shall again be endorsed by the Contractor and returned to the worker.

Regulations 9 - Register of Wages, etc.:
i) A Register of Wages cum Muster Roll in the Form appended to these regulations shall be maintained and kept at the Work Site or as near to it as possible.
ii) A wage slip in the form appended to these regulations shall be issued to every worker employed by the Contractor at least a day prior to disbursement of wages.

TECHNICAL SPECIFICATIONS

I. CIVIL WORKS

SECTION – I

EARTH WORK

1.0 INDIAN STANDARD

Work shall be carried out to Indian Standards and Code of Practices, in absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be directed to the officer in charge /Architect for his direction /approval. However as a general rule more stringent specification shall take precedence.

(1) IS 1200 Method of measurement of Building and Civil Engineering works.

(2) IS 1498 Classification and Identification of soils for general engineering purpose

(3) IS 2720 Method of test of soil

(4) IS 3764 Safety code for excavation work

(5) IS 4081 Safety code for blasting and related drilling operation

(6) IS 6313 Part 1 Code of practice for anti-termite measures in buildings: constructional measures.

Part 2 Code of practice for anti-termite measures in buildings: Pre constructional chemical treatment measures

(7) SP 27 Hand book of method of measurement of building works

(8) Explosive Rule 1940

2.0 SITE CLEARANCE

2.1 Prior to the start of any activity of earthwork, the area under construction shall be cleared of shrubs, vegetation, grass, brushwood, trees and saplings of girth upto 30 cm measured at a height of 1 metre above ground level. All rubbish must be removed and stacked at a distance of 50m outside the periphery of the area under clearances or location as decided by the officer Incharge / Architect.

2.2 The rate of such clearance is to be included in the rate of other earthwork items and no separate rate shall be paid.

3.0 SETTING OUT

3.1 The contractor shall prepare detailed setting out drawings based on the layout of Architectural drawings and those shall be submitted to the Incharge / Architect prior to commencement of work. Bench Marks and Reference Lines shall be established, by the contractor with approval of the Incharge / Architect

3.2 The contractor shall do the setting out with the use of the odolite and like instruments at site, based on details given to him. He shall erect timber profiles, masonry pillars, burjis, etc. for his use. All markings on these shall be painted with red colour and they shall be maintained for the entire duration of the project. Setting out shall be approved by the Incharge / Architect before the commencement of any work.

3.3 The rate for the earthwork items shall include expenses for all such work including labour, material and equipment/ instruments, etc. No additional payment shall be eligible on this account.

4.0 EXCAVATION IN SOILS

4.1 Excavation over area

Excavation exceeding 1 m in width as well as 10 sq.metres in plan and 30 cm in depth shall be considered as excavation over area.

4.2 Surface dressing

Trimming of natural ground, excavated surfaces, and filled up areas to remove vegetation and/or small inequalities not exceeding 15 cm in depth shall be described as surface dressing.

4.3 Rough excavation

Excavation not requiring dressing of sides and bottom and reduction to exact levels, such as winning earth from borrow pits, hill side cuttings, etc. shall be described as rough excavation.

4.4 Surface excavation

Excavation exceeding 1 m in width as well as 10 sq m on plan but not exceeding 30 cm in depth shall be considered as surface excavation.

4.5 Trenches for pipes/cables

It shall be detailed with nominal die of pipe/cable. Required bottom width, allowance for concrete foundation for laying pipes, working area, grip required for docketed pipe, return fill, ramming and removal of surplus soil shall be part of this item unless otherwise specified. It shall generally be measured in cubic meters unless specified specifically as running meter in the BOQ.

4.6 Post holes

Independent post holes (or similar holes) each not exceeding 0.5cum shall generally be enumerated. Rate shall include return fill, ramming and removal of surplus soil. However this shall be in cubic meters as part of excavation items.

General

4.7

4.7.1 The excavated earth, shall be thrown or disposed off beyond 50 m periphery of the Building. Earth suitable for backfilling shall be stacked separately.

Subsequent disposal of the surplus and unsuitable material shall be as per the respective items. Foundations, trenches shall be dug out to the exact dimensions as shown in the drawings or as directed by the-in-charge/Architect.

4.7.2 In firm soil, the sides of the trench shall be kept vertical up to a depth of 2 m. If the trench is to be deeper, it shall be in the form of steps of 50 cm, at every 2 m depth. This shall be suitably increased or decreased as per site conditions and type of soil met with. This shall be to the approval of the in-charge/Architect. Sloping of sides also may be adopted.

4.7.3 The bed of trenches shall be firmly consolidated and leveled by watering and ramming of the soft soil. Defective spots shall be dug out and filled with concrete of the same mix as of PCC or as directed by the

incharge/Architect. Cost of digging and filling with concrete shall be paid extra if excavation and PCC is measured separately. If excavation is done to a depth greater than that required, excess depth shall be back filled with the same mix as of PCC or as directed. Cost of such concrete shall be to the contractor's account.
Excavated trenches shall have to be approved by the INCHARGE/ARCHITECT prior to laying of PCC or any other Permanent Work.

4.7.4 Excavation for drains shall be carried out with extra care to cut the sides and bottom exactly to the required shape, slope and gradient.

4.7.5 Filling for excess deeper excavation shall be done at the contractor's cost in consultation with the In-charge /Architect Excavated materials shall not be placed within 1 m of the edge of the trench or half the depth of the trench, whichever is more.

4.7.6Excavations for column footings shall be carried to depths indicated in the drawings. Safe bearing capacity at such depth shall be verified to comply design requirements. If ordered by the In-charge /Architect, appropriate tests shall be carried out by the contractor.

4.8 Protection
Fencing and/or other suitable measures for protection against risk of accidents due to open 4.8 excavation shall be provided by the contractor at his cost.

4.8.1 Where excavation is to be carried out below the foundation level of an adjacent structure, and to avoid underpinning, precautions such as shoring and strutting, etc. must be taken.

4.8.2 No excavation should start till such measures are taken to the satisfaction of the Incharge/Architect. Payments for such work shall not be made separately unless specified otherwise.

EXCAVATION IN SOFT ROCK

5.0 This shall be carried out by crowbars, pickaxes or pneumatic drills or any other suitable means.

5.1 Blasting may be permitted if the contractor so desires but no extra money shall be paid for blasting.

Measurements shall be in cubic meter.

5.2 Other general details same as clause 4.7. and its sub clauses.

6.0 EXCAVATION IN HARD ROCK

6.1 General

6.1.1 On meeting hard rock that requires blasting, the contractor shall inform the Incharge/Architect On approval in writing, blasting operation shall start if the contractor feels it necessary and so desires.

6.1.2 The contractor shall obtain the necessary license from the District Authorities for undertaking blasting work and explosive storing as per Explosives Rules 1940, and as updated. Explosives shall only be procured from an authorized dealer. He shall be responsible for the safe custody and proper accounting of explosives. The In-charge/Architect shall have access to the store.
The contractor shall be responsible for any accident to those working on the site, to the public or to property due to blasting operations.

6.1.3 Measurements shall be in cubic meter by stacking rock and applying predetermined deduction for voids.

6.1.4 Precautions

6.2 Safety measures to be adhered to shall be as detailed in IS 4081, Safety Code of Blasting (as amended from time to time, and to related drilling operations). Also digest No.37 of C.R.R.I and I.R.C.A. Road tariff No.18 shall be adhered to.

6.2.1 Blasting operation shall be carried out under the supervision of a responsible authorized agent of the contractor. Timings shall be as approved by the In-charge/Architect in writing.

6.2.2 Lunch break will be preferred. The authorized agent of the contractor should be well conversant with the rules and regulations of blasting operations. Further the contractor shall employ licensed blasters for actual operation.

6.2.3 All proper precautions for safety shall be taken. All persons shall be moved away to a distance not less than 200 m. All entries shall be sealed and red flags displayed at prominent places.

6.2.4 Blasting shall be done only with gunpowder. Dynamite, gelignite, or any other high explosive shall be used only with written permission of the In-charge/Architect.

6.2.5 The number of charges to be fired and the actual number of shots heard shall be counted and the contractor's agent shall satisfy himself by examining that all charges have exploded. Only then shall workmen be allowed to start work. Unexploded charges shall be flooded with water, a new hole drilled and exploded again.

6.2.6The In-charge/architect shall be informed about all misfires, their causes and the remedial Steps taken.

CLASSIFICATION

7.0 All soils comprising any of the following :

7.1 (a) Vegetable or organic soil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose murrum.

(b) Any mixture of soils in (a).

(c) Mud concrete below ground level.

(d) Generally any material which yields to the ordinary application of a pickax and shovel or to phawra, rake or
Their ordinary digging implement and not affording resistance to digging greater than mentioned in (a) to (c).

(e) Stiff heavy clay, hard shale, or compacted murrum requiring close application of a grafting tool or pick or both
and shovel.

(f) Gravel and cobblestone (cobblestone is a rock fragment), usually rounded, having maximum dia in one direction
of 75-300 mm.

7.2 Soft rock comprising any of the following

(a) Soling of roads, paths, etc. and hard core.

(b) Macadam surfaces of any description (water bound, grouted, tarmac, etc.)

(c) Lime concrete, stone masonry, in lime mortar and brick work in lime or cement mortar, below ground level.

(d) Soft conglomerate, where the stones may be detached from the matrix with picks, crow bars, wedges, etc.

(e) Limestone, sandstone, laterite, hard conglomerate or other soft or disintegrated rock which may be quarried or split with a crowbar.

Unreinforced cement concrete which may be broken up with crowbars or pickaxes and stone masonry in cement mortar, below ground level.

(f) Boulders not requiring blasting, rock fragments usually rounded by weathering, disintegration and exfoliation or abrasion by water or ice, having maximum dia.

(g) length in any direction of 500 mm, found loose, embedded, etc.

Other varieties of rock which would normally be removed with pick, crowbars, wedges and hammerwith only alittle difficulty.

7.3 Hard rock comprising any of the following

(a) Any rock or cement concrete in excavation for which the use of mechanical equipment or blasting is required.

(b) Reinforced cement concrete.

(c) Boulders bigger than ½ cubic meter requiring blasting.

(d) Hard rock as in (a) to (c) requiring blasting but prohibited from doing so for any reason and excavation has to be carried out by chiseling, wedging or any other agreed method.

8.0 FILLING

8.1 Filling shall be done where required with approved quality of earth. It may be from excavation and, where possible, cutting and filling shall be done simultaneously to avoid double handling.

8.2 Filling shall be done in layers not exceeding 15 cm in depth. Earth used shall be free from roots, grass and rubbish and all lumps and clods exceeding 8 cm in any direction shall be broken down. Each layer shall be watered with optimum moisture content to achieve 95% Proctor density. Consolidation shall be done by mechanical roller of minimum 12 tonnes weight. The roller shall pass a minimum of 10 runs evenly to achieve dense consolidation.

All undulation made up and final layer re-rolled.

Measurement shall be for compacted volume in Cubic Meter.

8.3 Sand filling

The sand shall be free from any organic and deleterious materials as detailed in IS. It should be suitable for compaction. Filling shall be in layers of 15 to 20 cm watered with optimum moisture content and mechanical rammers. Measurement shall be for compacted volume in Cubic Meter.

8.4 Rubble soling

Good quality 150 mm to 230 mm thick rubble soling shall be carried out depending upon the grade of soil. Rubble used shall be at least 100 mm for 150 mm thick soling and 150 mm for 230 mm thick soling. Stone shall be hand packed as close as possible and bedded firmly with the broadest face downwards and the greatest length across, voids filled with chips and small stones. These shall be hammered down to achieve packing and the complete filling of interstices. To achieve the desired levels and slopes, pegs at suitable intervals (about 12m) shall be fixed.

Soling shall be watered and again packed with sand or murrum to fill interstice's created by watering. Then it shall be rolled with 10 (on roller or vibratory compactor. Filling sand or murrum, watering and rolling shall continue till full compactness is achieved to satisfaction of the In-charge/Architect.

Measurement shall be in Square Meter.

9.0 PLANKING AND STRUTTING

In case of deep trenches where the soil is soft and not capable of being retained without the help of support, planking and strutting as required shall be carried out. It shall be the responsibility of the contractor to take steps to prevent slide/collapse. Method of planking/strutting will be largely influenced by the type of soil encountered and as approved by the In-charge/Architect.

10.0 DISPOSAL OF SURPLUS EARTH

10.1 Surplus earth shall be used to the maximum extent in the compound. Earth useful for filling shall be separately stacked as directed by the In-charge/Architect from time to time. Approved quality earth shall be used in the filling. It shall be consolidated as detailed and approved by the In-charge/Architect.

10.2 Rate for excavation shall include sorting out of useful materials.

10.3 All surplus and unusable earth shall be disposed off outside the plot but at a location approved by local authority and conforming to their specification. The contractor shall quote his rate for disposing off or carting away the items considering requirements and standards of the local authority with whose permission surplus and unusable earth shall have to be disposed off.

11.0 DEWATERING

Bailing or pumping out of water that may have accumulated due to rains, subsoil seepage, or any other means shall be carried on continuously and the area shall be kept dry for the following operations:

(a) Measurements
(b) Concreting or masonry work
(c) Shuttering and reinforcement
(d) Backfilling
(e) Line out
(f) Any other reason deemed fit by the In-charge/Architect

12.0 **MEASUREMENT**

12.1 The following shall not be measured separately and allowance for the same shall be deemed to have been made

in description of the main item.

(a) Setting out works, erecting profiles, etc,
(b) Site clearance such as clearing of shrubs, brushwood, small trees not exceeding 30 cm in girth measured at one

meter above ground.

(c) Unauthorized battering or benching of excavations.
(d) Forming (or leaving) DEAD MEN or TELL-TALES in borrow pits and their removal after measurements.
(e) Forming or leaving steps in the sides of deep excavations and their removal after measurements.
(f) Excavations for insertion of planking and strutting.
(g) Removing slips or falls in excavations.

(h) Dewatering by bailing or pumping out water in excavations from rains, sub- soil water, tides, undercurrents, etc.

(i) Slinging or supporting pipes, electric cables, etc. met during excavation or while carrying out any other item of

work.

(j) Dressing, trimming of sides, leveling, or grading and ramming of bottoms.

Soils, soft rocks, hard rocks shall be measured as per SP 27 Part I except for the followings:

12.2 (a) Filling shall be in cubic meter for consolidated volume. The lift shall be considered from made-up

ground level.

(b) Planking and strutting required to be left in position shall be measured separately. The In-charge/Architect's permission in writing shall have to be obtained for this. In no other case shall payment be made for planking and strutting, if carried out.

(c) Lead and lifts shall be as per the BOQ.

(d) Post holes, trenches for cables and pipes shall be measured as detailed in clause 4.5 and clause 4.6 and shall be part of the respective piping, cabling item.

(e) Excavation shall be paid for in the PCC area, and level shown in drawings or excavation drawing (if issued) for construction or as approved by the In charge/Architect. Working space shall not be considered.

(f) Back filling of foundation is part of excavation and not paid separately. Removal of surplus earth also is part of the excavation item only.

(g) In mass excavation all types of soils including soft rock shall be measured under one item only. Backfilling around mass excavated basements shall be measured and paid separately, where specified in BOQ.

(h) Void percentage considered for computing net quantities to stack measurement shall be

- Loose Earth 20%
- Hard Rock 40%

These deductions shall be made from actual measurements. The Incharge/Architect may at his discretion conform at start of work other predetermined percentage for deduction for particular project.

ANTI-TERMITE TREATMENT

13.0 Indian Standards

13.1 Indian Standards to be followed are

1)	IS 4015 (Part-I & II)	-	Guide for handling cases of pesticide poisoning.
2)	IS 6313 (Part-I)	-	Code of practice for Anti- termite measures in buildings (constructional measures)
3)	IS 6313 (Part-II)	-	Code of practice for anti-termite measures in Building (pre constructional chemical treatment)
4)	IS 8944 Materials	-	Specification for Chloropyriphos Emulsified concentrates.

13.2 One of the following chemicals in water emulsion shall be used for mound treatment

13.2.1 Chemical Concentration by weight, percent

Chloropyriphos As per manufacturer's instructions

Lindane As per manufacturer's instructions

For soil treatment

13.2.2 Chemical Concentration by weight, percent

Chloropyriphos As per manufacturer's instructions

Lindane As per manufacturer's instructions

Workmanship

13.3.0 Conditions of formation

13.3.1 Barrier shall be complete and continuous under the whole of the structure to be protected. All foundation shall be fully surrounded by and in close contact with the barrier of treated soil. Each part of the area treated shall receive the prescribed dosage of chemical.

13.3.2 Time of application

Soil treatment should start when foundation trenches and pits are ready to take mass concrete in foundations. Laying of mass concrete should start when the chemical emulsion has been absorbed by the soil and the surface is quite dry. Treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water. The foregoing applies also in the case of treatment to the filled earth surface within the plinth area before laying the sub-grade for the floor.

13.3.3 Disturbance

Once formed, treated soil barriers shall not be disturbed. If, by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barriers- system.

13.4.0 Termite mound treatment

If termite mounds are found within the plinth area, these shall be destroyed by pouring into the mounds at several places, after breaking open the earthen structure, and making holes with crow- bars, at the rate of approximately 4 litres of emulsion per cubic meter of mound.

Soil Treatment

13.5.0 Treatment of column pits foundation, trenches and basement excavations:

13.5.1 The bottom surface and the sides (upto a height of 300 mm above concrete foundation level) of the excavations made for column pits, wall trenches and basements shall be treated with the chemical at the rate of 5 liters per sq m. of surface area, After the column foundation and retaining walls of the basement come up, the back fill in immediate contact with the foundation structure shall be treated at the rate of 15 liters per sq m. of the vertical surface of the sub-structure for each side. If water is used for ramming the earth fill, the chemical treatment shall be carried out after ramming operation is done by rodding the earth at 150 mm centers close to wall surface and spraying the chemical with the above dose. As earth isfilled in layers the treatment shall be carried out in similar stages. The chemical emulsion shall be directed towards the concrete or masonry surfaces of the columns and walls so that earth in contact with these surfaces is well treated with the chemicals. In the case of RCC framed structure with columns and plinth beams and RCC basements, the treatment shall start at the depth of 500 mm below ground level. From this depth the back fill around the columns beams and RCC

basement wall shall be treated at the rate of 15 liters per sq. m. of vertical surface. The other details of treatment shall be as described below:

13.5.2 Treatment to top surface of plinth filling:

a) After the earth filling is completed In the plinth area and before the rubble packing or sub grade is laid, the entire surface of the filled earth shall be treated with the chemical emulsion at the rate of 5 liters per sq m.

Light rodding may be carried out in the soil surface to facilitate absorption saturation of the soil with chemical emulsion.

b) For buildings where construction has advanced already for facility of construction, the treatment could also be done effectively, over the base concrete (lean mix) under the floor taking care that the emulsion, at the rate of 5 liters per sq m. soak fully into the concrete.

c) The above application effectively prevents entry of termites through the floor structure.

13.5.3 Treatment of soil along external perimeter:

Finally the earth around the external perimeter of the building upto a depth of 30 cm shall be treated at the rate of 5.0 liters per running meter of the external wall. To facilitate this treatment solid MS rods should be driven into the soil as close possible to the plinth wall at intervals of 15 cm, and upto a depth of 30 cm, and the rods moved backwards and forwards in a direction parallel to the wall to break up the earth so that the emulsion mixes intimately with the soil.

13.5.4 Treatment of soil surrounding pipes, wastes and conduits:

When pipes, wastes and conduits enter the soil inside the area of the foundation, the soil surrounding the points of entry shall be loosened around each such pipe, waste or conduits for a distance of 15 cm, and upto a depth of 7.5 cm before the treatment is commenced. When they enter the soil external to the foundations, they shall be similarly treated unless they stand clear of the walls of the building by about 7.5 cm for a distance over 30 cm.

13.5.5 Treatment for expansion joints

Expansion joints at ground floor level are one of the biggest hazards for termite infestation. The soil beneath these joints should receive special attention when the treatment under para 13.5.4 is carried out. This treatment should be supplemented by treating through the expansion joint after the sub-grade has been laid at the rate .of 2 liters per linear meter.

13.6.0 Spraying Equipment

A pressure pump shall be used to carry out spraying operations to facilitate uniform spraying and penetration of chemical into the earth. The chemicals, concentration and dosage for horizontal and vertical surfaces are based on the IS code of practice for Anti- termite measures in Buildings. IS 6313 (Part-ll).

13.7.0 Safety

Work shall be carried out as per safety measures instructions of manufacturer of approved pesticide& direction of Incharge/Architect. Also IS 4015 part I and II shall be followed.

13.8.0 Measurement

Measurement for payment in case of pre-construction treatment as detailed above shall be for actual carpet area covered by building at ground level in plan in sqm.

13.9.0 Free Service Guarantee

The contractor shall note that termite proofing work, is subject to a free service guarantee from the date of completion of the treatment. The contractor shall give an undertaking in writing to the effect that during the guarantee period any infestation of subterranean termites will be eradicated and necessary treatment carried out to prevent re-infestation, free of cost to the employer. The guarantee shall allow a minimum period of -10 (ten) years for preconstruction treatment.

Tenderer must ensure that the work will be done through the professional Pest Control operator. They should be members of National Pest Control Association of USA, or Indian Pest Control Association or any other recognized professional body. They should furnish a list of Termite Control jobs carried out by them successfully for Government Department, Statutory bodies or large private organizations to prove that they are capable of handling anti termite work.

SECTION-II A

CONCRETE WORK

GENERAL

1.1Standard

Work shall be carried out to Indian Standards and Code of Practices, in absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies /conflict noticed shall be directed to the Incharge / Architect for his direction / approval. However as a general rule more stringent specification shall take precedence.
Specification for Ordinary and low heat, Portland cement Specification for 43 grade ordinary Portland cement Specification for 53 grade ordinary Portland cement

(1) IS 269 Specification for Ordinary and low heat, Portland cement
(2) IS 8112 Specification for 43 grade ordinary Portland cement
(3) IS 12269 Specification for 53 grade ordinary Portland cement
(4) IS 383 Specification for Coarse and fine aggregates from natural sources for concrete
(5) IS 456 Code of practice for plain and reinforced concrete
(6) IS 460 Specification for test sieves (Part I, II & III)
i) Wire cloth test sieve
ii) Perforated plate test sieve
ii) Method of examination of test sieves
(7) IS 515 Specification for natural and manufactured aggregates from natural sources for concrete.
(8) IS 516 Method of test for strength of concrete
(9) IS 875 Design loads for building structure. (Part I, II & III)
(10) IS 1199 Method of Sampling and analysis of concrete
(11) IS 1791 Batch type concrete mixers.
(12) IS 1893 Earthquake resistant design.
(13) IS 2386 Method of test for aggregate for concrete (Part I, II & III)
i) Particle size and shape
ii) Estimation of deleterious materials and organic impurities
iii) Specific gravity, density, voids,absorption and bulking.
(14) IS 2505 General requirements for concrete vibrators.
(15) IS 2645 Specification for Integral cement water proofing compound.
(16) IS 3025 Method of Sampling and test (Physical and Chemical for water)
(17) IS 4326 Code of practice for earthquake resistant design and construction of building.
(18) IS 4926 Specification for ready mixed concrete.
(19) IS 7861 Code of practice for extreme weather concreting
i) Recommended practice for cold weather concreting
(20) IS 9103 Specification for admixture for concrete
(21) IS 12118 (Part I)
Specification for two parts polysulphide based sealant: general requirements
(22) SP 23 Handbook on concrete mix
(23) SP 24 Explanatory handbook on Indian Standards code for plain and reinforced concrete (IS 456)

(24) SP 27 Handbook of method of measurement of building works.

1.2 Quality Assurance

1.2.1 Concrete used on site shall comply to relevant parts of Standards, Codes of practices, technical specification given in particular or approved, designed mixes as prepared, approved and adopted for works to give designed strength, serviceability, long term durability etc.

1.2.2 Provide and monitor quality control over materials received from suppliers / manufacturers to ensure that materials comply with standard specified and are as approved.

1.2.3 Provide experienced supervision and work force to ensure that workmanship is of specified quality.

1.2.4 Work shall not be subjected to harmful, dangerous, damaging or deleterious exposures while it is in progress or on completion during contract period.

1.2.5 Contractor to undertake quality assurance by documenting.

- Test report for material used in producing concrete.
- Mix design details with laboratory test report, actual site trial mix test and accepted modified design if any
- Pour cards with approval of the Incharge/Architect prior to placement
- Control charts
- Non conformance reports, changes, orders etc.

1.3 Submittals

1.3.1 Submit samples of all materials such as cement, sand, aggregate, admixtures, water etc to 1.3.1 be incorporated into concrete along with test certificates from recognized laboratories for the Incharge/Architect's approval.

1.3.2 Samples

During construction, the materials shall be sampled and tested as often as directed by the Incharge/Architect to the contractor. Samples shall be taken and tested in accordance with latest revisions of Indian standard specifications and the cost thereof shall be borne by the Contractor.

1.3.3 Shop Drawings

Contractor shall prepare and submit method, mode of casting of slabs, beams with details of construction and expansion joint for approval of the in charge/architect.

1.4.0 Examination of conditions.

Contractor shall inspect and examine sub strata and confirm prior to start that.

- Substrate is acceptable and approved by in charge/architect.
- Conditions are satisfactory.
- Setting out/Layout is verified.
- Corrective measures needed if any are within reach and contractor proceeds with full responsibility for work.

2.0 MATERIALS

2.1 Cement

Cement shall be ordinary Portland Cement conforming to IS and shall be of grade 53/43 or PPC for structural use or as specified in drawing.

It shall be received in bags of 50 kg or loose in tankers and each batch shall be accompanied with a test certificate of the factory. Also it shall be tested before use to ascertain its strength, setting time, etc. In case cement has been stored for over 3 months or for any reasons the stored cement shows signs of deterioration or contamination, it shall be tested as per the direction of the Incharge/Architect prior to use in the works.

2.2 Coarse aggregate

2.2.1 Coarse aggregate shall be obtained from natural sources such as stone, gravel, etc., crushed or uncrushed or a combination thereof from approved quarries. Aggregate shall be hard, strong, dense, durable, clean and free from veins andadherent coatings. It shall be free from soft, feeble, thin, elongated or laminated pieces and shall be roughly cubical in shape. It shall consist of coarse material, most of which is retained on 4.75 mm IS sieve.

2.2.2 Coarse aggregate shall not contain any harmful material such as iron, pyrites, coal, mica, shale or similar laminated material; neither shall it contain clay, alkali, soft fragments, sea shells, organic impurities, etc. in such quantities that adversely affects the strength and durability of the concrete. In addition to the above, in reinforced concrete the aggregate shall not contain any material which might attack the reinforcement. The maximum quantities of deleterious materials in the coarse aggregate, when determined in accordance with IS 2386 Part I and Part II "Method of test for aggregates for concrete" shall not exceed the limits laid down in table 1 of IS 383.

Aggregate crushing value, impact value, abrasion value and soundness of aggregate shall respectively be in accordance with para 3.3, 3.4, 3.5 and 3.6 of IS 383.

2.2.3 Grading of coarse aggregate shall be in conformity with the requirements laid down in IS 383.

See table 2 and table 3.

The grading of coarse aggregate shall be such that not more than 5% shall be larger than the maximum size and not more than 10% shall be smaller than the smallest size. Between these sizes the coarse aggregates shall be well graded.

For heavily reinforced concrete the aggregate shall be subjected to tests in accordance with IS 2386 or and directed by the Incharge/Architect.

The maximum size of coarse aggregate should not be greater than one fourth of the minimum thickness of the member and it should be restricted to 5 mm less than the minimum clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement.

2.2.4 Source of aggregate shall be from an approved Government location. It shall be tested prior to the approval of the In charge/Architect from an approved testing laboratory. In case available aggregates do not meet certain requirements of IS 383 or any other specification, required processing shall be carried out by the contractor at his cost. No extra cost towards these processes, treatment or combination of both shall be paid. It shall be the duty of the contractor to make sure that aggregate material received by him is from Government approved quarries and with fully paid royalties, taxes, duties, etc. as may be in force from time to time for respective locations.

2.2.5 Coarse aggregate shall have a minimum specific gravity of 2.6. (Saturated surface dry basis).

Aggregate below this specific gravity shall not be used without the special permission of the In charge/Architect.

2.2.6 Once a specific source of supply of coarse aggregate is approved, the source shall not be changed without the prior approval of the Incharge/Architect.

2.3 Fine aggregate

2.3.1 Natural sand deposited by stream or glacial agencies as a result of disintegration of rock shall be used as fine aggregate. Fine aggregate shall pass through 4.75mm sieve in total. Crushed sand may be added to natural sand in approved proportions to achieve required grading. The fine aggregate (coarse sand FM above 2.25 & Fine sand F M more than 1.25) shall conform to following standards.

(i) For plain and reinforced concrete IS 383 Specification for coarse and fine aggregates from natural sources for concrete.

(ii) Mortar and grout IS 2116 Specification for sand for masonry mortars.

2.3.2 Sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain any appreciable amount of clay. Sand shall not contain harmful impurities such as iron, pyrites, coal particles, lignite, mica shale or similar laminated material, alkali, and organic impurities in such form or quantities as to affect the strength or durability of concrete or mortar. Also it should not contain any material liable to attack the steel reinforcement.

2.3.3 When tested as per IS 2386 Part I and Part II, fine aggregate shall not exceed permissible quantities of deleterious materials as given in table 1 of IS 383.

2.3.4 Fine aggregate shall be thoroughly washed at site with clean fresh water such that the Percentage of all deleterious material is within the permissible limits laid down.

2.3.5 Grading of fine aggregate shall conform to IS and shall fall within limits of one of the four zones given in table 4 of IS 383.

2.3.6 Due allowance for bulking due to damp and moist sand shall be made while preparing the mixes based on volume measurements. It shall be determined as per IS 2386 Part III Appendix A.

2.4 Water

2.4.1 Water used for mixing and curing shall be clean, reasonably clear and free from objectionable quantities of silt, oils, alkalis, acids, salts so as not to weaken mortar, or Concrete or cause efflorescence or attack the steel in RCC while curing. It shall be free of elements, which significantly affects the hydration reaction or otherwise interferes with hardening of concrete during curing or those elements which produce objectionable stains or deposits. Potable water is generally satisfactory but it shall be tested prior to use in the works.

2.4.2 Water tested shall be in accordance with IS 3025. Maximum permissible limits of deleterious materials in water as given in IS 456.

2.4.3 Suitability of water shall be ascertained by the compressive strength and initial setting time test as specified under:

a) Average 28 days compressive strength of at least three 15 cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. Preparation and testing to be in accordance with IS 516.

b) The initial setting time of test blocks made with proposed cement and water to be used shall not be less than 30 minutes and shall not differ by ± 30 minutes from the initial setting time of control test block prepared with the same cement and distilled water. Preparation and testing of block shall be in accordance with IS 4031.

2.4.4 The PH value of water shall not be less than 6 and more than 9.

2.4.5 Water shall be tested and approved in writing by the Incharge/Architect prior to use in the works.

2.5 Admixture

2.5.1 These are substances other than cement, aggregate and water and shall be permitted to be used to modify the properties of concrete for single, or a combination of purposes. This shall be used only on the written approval for specific purpose and at the cost of the contractor. Good concrete shall be achieved without the aid of any admixtures.

2.5.2 Admixtures shall be free from chlorides and sulphates which might affect concrete or any other material which may cause problems to the concrete in the due course of time. Also it shall have no effect on the reinforcement in case of Reinforced Cement Concrete.

2.5.3 Admixtures generally in use are classified as under:

a) **Accelerators**

b) Retarders

c) Workability agents

d) Water repelling agents

e) Air-entraining agents

f) Gas-forming agents

g) Corrosion inhibitor additive

These are manufactured and sold by various companies under brand names. The contractor proposing to use any one of them shall submit to the Incharge/Architect technical literature with its chemical composition, purpose of use and method recommended by the manufacturer and what he proposes to follow at site for strict control. The contractor's proposal shall accompany the followings with his request to use admixture.

2.5.4 a) The trade name of the admixture, its source and the manufacturer's recommended method of use.

b) Typical dosage rates and the possible detrimental effects of under and over-dosage.

c) Whether the admixture contains chloride in any free form or any other chemical present as an active ingredient which is a likely cause of corrosion of reinforcement or deterioration of concrete.

d) The average expected air content of freshly mixed concrete containing an admixture which causes air to be entrained when used at the manufacturer's recommended rate of dosage.

2.6 Miscellaneous

Integral cement water proofing compound specified for specific use shall conform to IS 2645.

2.6.1 Bituminous felts for waterproofing and damp proofing course shall conform to IS 1322.

Bituminous compounds for water proofing purposes shall conform to IS 1580. Expansion joint filler Bituminous impregnated premoulded preformed expansion joint filler board conforming to IS 1838 part (I) specification for preformed filler boards shall be of approved quality and thickness at designated locations.

2.6.2 Polysulphide sealants

1 Expansion, construction or other joints shall be sealed with approved quality polysulphide sealants.

2 One part gun grade polysulphide-based joint sealants shall conform to IS 11433 (Part I). It shall be used with the approval of the Incharge/Architect and as per the manufacturer's instructions. Correct primer shall be used at the specified location.

3 Two part polysulphide based sealant gun grade or pouring grade shall conform to IS 12118 (part I). Pouring grade shall be used in horizontal joints. Gun grade shall be used in vertical, inclined and horizontal joints. Specified primer shall be applied prior to the use of sealant. Use of sealant shall be as per instructions of the approved manufacturer.

4 Sealant shall be cured at ambient temperature and humidity when applied as per the approved manufacturer's instruction and received in suitable packs.

Each package shall indicate Manufacturer's name and trade mark Weight of the components Instructions for storage Type and grade of sealants Date of manufacture and expiry Instructions for use.

2.6.3 Water bar PVC or rubber water bar of type, quality and width shall be used as approved by the Incharge/Architect. Water bar shall be continuous and fixed at the indicated locations. Water bar should be welded or Joined with the approved method. All angles and corners shall be purpose-made and shall be joined with the approved method.

2.7 Delivery and Storage

It shall be received in bags of 50 kgs and each batch shall be accompanied with a test certificate of the factory. Reject damp or torn bags.

2.7.1 Cement shall be stored in dry and water proof shed so as to prevent deterioration due to moisture, dampness. Bags shall be stacked on rigid water-proof platforms about 15 to 20 cm clear above the floors and 25 to 35 cm clear or away from the surrounding walls. A maximum high stack of 10 bags permitted. Stacks shall be so arranged that the first batches are used first, (FIFO) and that they permit easy access for inspection and handling. Loose cement received shall be stored in silo's. Silo's shall be equipped to receive cement by pump and manually. Silo's shall be water tight and damp proof to keep cement fresh.

2.7.2 Coarse Aggregates and Fine Aggregates

Aggregate shall be stored in such a way that it does not get mixed with mud, grass, vegetables and other foreign matter. The best way is to have a hard surface platform madeout of concrete, bricks or planks. It should be to the approval of the Incharge/Architect.

2.7.3 Water

Water storage tanks shall be such as to prevent any deleterious materials getting mixed with it.

2.7.4 Covered storages

Considering the atmospheric/ weather conditions at site storages, covering shall be arranged to take care of temperature controls at site.

3.0 **CONCRETE**

Concrete is prepared by mixing graded aggregate of stone or along with cement, in a specified proportion. Mixing shall be done by a mechanical mixer. Manual hand mixing shall be permitted in specific cases with

the written permission of the Incharge/Architect on account of small quantity or location or any other reason acceptable to the Incharge/Architect.

3.1 Cement concrete

This shall be classified as plain cement concrete or reinforced cement concrete. Plain cement concrete shall be In leveling course under foundations, floors, copings. etc. and shall include form work as part of the work. Reinforced cement concrete shall be at all locations and comprises form work. reinforcement and concrete. Payment of reinforced cement concrete may be composite or item wise as specified in the BOQ. In PCC, payment for form work shall not be made. Concrete shall be classified by its compressive strength at the 28th day. The concrete grades shall be as designated in table 2 of IS 456 "Grade of concrete".

3.1 Design mix

BOQ shall specify various types of concrete aimed to be used in works. It shall be the responsibility of the contractor to carry out design mixes and approval of the same shall be obtained from the Incharge/Architect at least 35 days in advance from the actual pouring of concrete at site in the permanent works.

1. Mix design of concrete shall be done as per IS 10262 & SP 23,24.
   Following basic points shall be finalized.

- Characteristic compressive strength and targeted compressive strength required at design stage.
- Standard deviation factor based on site actual execution conditions.
- Minimum cement specified in BOQ or as per IS for strength and durability for location where concrete is to be used.
- Water cement ratio permitted by IS.
- Workability to be achieved for better workmanship and good quality concrete
- Admixtures to be used if any aggregates being used are tested to IS383.
- Include for Alkali reactivity, chloride and sulphate contents independently and combination of cement and water.
- Water being used is tested.

Further the contractor shall ensure that designed mix meet minimum cement contents as specified in BOQ/drawings and proposed revision to IS 456 along with maximum water cement ratio, to different exposure condition from durability point of view. In addition contractor shall ensure

a) Alkali – reactivity

Aggregates containing material susceptible to attack by alkali's (Na_2O and K_2O) originating from cement or other sources and producing expansive reaction shall not be used.

The aggregates source shall be initially tested for alkali reactivity prior to being used in design mix.

b) Sulphate and chlorides in concrete

Harmful salts coming from the concrete materials such as cement, aggregate, water and admixture, as well as by diffusion from environments shall be limited to following weight of cement.

- Total chlorides (as Cl) -0.15%
- Total soluble sulphate (as 803) - 4 %

3.1.2 Compressive strength

For expected strength of cubes tested on the 28th day, the design mix at preliminary test and work site shall be as per IS 456 - 2000.

3.1.3 Water cement ratio

The water-cement ratio shall be between 0.42 to 0.55. Additional water may be permitted only at the discretion of the Structural Engineer. The slump shall depend upon the location and type of work. Higher slump with use of plasticizers shall be permitted.

3.1.4 Trial mixes

3.1.4.1 The contractor shall submit, at least 5 weeks in advance, to the Incharge/Architect the mix design that he proposes to use at site. The mix design in addition to points in 3.1.2 shall also give basic details (when tested according to IS 1199 and IS 2386-Part III 1963), as per followings

a) Slump/Workability

b) Bleeding

c) Compacting factor

d) Vee-Bee time

e) Cement required for one cubic meter of concrete

f) Wet and dry density

g) Air contents if applicable

3.1.4.2 On receipt of this, the Incharge/Architect may immediately order to carry out work site test before the final approval. This shall be done with mixer and materials actually being used at site.

This shall give the contractor additional chance to check for himself actual workability and make sure that the mix proposed by him will be fully satisfactory with regards to slump, segregation, bleeding, water-cement ratio and workability.

6 cubes shall be taken from each of the 3 batches to test the mix. Cubes shall be cast, stored, cured, transported and tested to IS 516. The test may be carried out at site or laboratory as approved by the Incharge/Architect.

Trial mixes shall be approved provided that average strength of 3 consecutive cubes is not less than that specified and that one out of three may give a value. less than specified but limited to a maximum of 90% of the specified strength.

3.1.4.3 In case the trial mix falls below the above criterion, the Incharge/Architect shall order fresh trial mixes to be made as before, until the desired strength is arrived at.

3.1.4.4 This design mix and trial mix hold good so long as the materials continue to be of the same quality and from the same sources. For any change, the Incharge/Architect may order fresh design mix and trial mixes to be carried out before the same Is used at site.

Mixing of concrete

3.1.5 Machinery and equipments.

3.1.5.1 a) Batching

Batching shall be done by weigh batchers conforming to IS 2722. Aplatform scale of capacity 300kg with Fractionupto 100gms shall be at site.

For water supply to mixture through metering system shall be organized.

Design mix converted tovolumetric may be permitted by Incharge/Architect. Accordingly suitable size of boxes equivalent to 1 bag of 50kgcement shall be prepared by the contractor.

b) Mixer

Mixers used shall conform to IS. Type Capacity shall be as per size, extent and nature of work.

c) Transportation

Wheel borrows, cranes, mini dumpers, truck, agitators, belt conveyors, pumps with piping etc. as per requirement depending upon location, size, extent and nature of work shall be deployed by the contractor with prior approval of the Incharge/Architect.

d) Vibrators

Internal and external vibrators working on electricity, Pneumatic or petrol shall be approved by the Incharge/architect. Vibrators shall conform to IS.
All machineries and equipments shall be maintained regularly. Periodic calibration of all machines shall be done and records maintained in a register. As and when requested by the Incharge/Architect same shall be forwarded for his inspection.

At the start of mixing, mixer shall be rinsed/coated by loading with cement, sand, water of the same proportion of batch to be used. Loading the mixer/charging the mixer shall be done mechanically and care to be taken that all material is fully loaded. The mixer shall be run for a minimum period of 2 minutes after all materials are loaded in full quantity. The concrete produced shall be uniform in colour and consistency. Unless agreed by Incharge/Architect the first batch of concrete from mixer shall contain two-third of normal quantity of coarse aggregate.

3.1.5.2 Transportation - Concrete shall be transported to place of pour as far as possible in most efficiently, conveniently and without loss of concrete characteristic. Method of transportation shall depend upon the location, size and nature of work. Concrete should be placed within 1.5hours of production i.e. prior to initial set.

Use of admixtures such as air entraining agent, retarders etc. shall be adopted and incorporated into design mix stage.

Concrete shall be kept in agitating state when ambient temperatures are high. This shall increase placing time to 1 % hrs after water is added.

Points to be taken care are Method adopted do not permit segregation Containers used are leak proof Containers are well covered during rains, heavy winds Concrete does not get contaminated by oil, dirt etc.

3.1.5.3 Placing

The placing temperature of concrete shall not be more than 34° C. If it is more, the Incharge/Architect may order addition of ice or chilled water to the concrete. Also the contractor shall take the following precautions:

a) Mixers and weigh batchers shall be painted with white colour

b) Aggregate storing bins shall not be exposed to the Sun

c) Water shall be sprinkled on aggregates well before concreting to keep the temperature low.

d) Use chilled water for mixing or add flake ice as a proportion of the mixing water.

e) Place concrete at night.

f) Ready mix concrete (RMC)

3.1.5.4 a) Concrete - Ready mix concrete as approved only shall be used. It shall comply all requirements of concrete. Batching plant, mixture, truck mixture, pump etc shall conform to relevant Indian standard. Daily returns shall be provided showing total volume of each class of concrete received.

b) Pumping of concrete - Stationery or mobile pumps as per requirements shall be deployed. Concrete shall be continuous to avoid any blockage within pump. Concrete mix shall be with slump as desired by pump manufacturer and most desirable at site to pump operator / supervisor. Required piping, bends, clamps, chutes etc. shall be well organized and placed in position prior to start so continuous

concrete with minor changes will keep concrete flowing at predetermined location in approved manner.Mix design adopted shall be approved by Incharge /Architect and shall conform all test as detailed in specification.

Pump concrete shall flow quite fast and is placed with larger impact on formwork. Hence special precautions at design stage of formwork shall be taken and staging /scaffolds should be well restrained in all directions to withstand thrust.

Pumping shall be done with due care and safety. Recommendation of pump suppliers shall be followed strictly.

3.1.6 Shrinkage cracks

Concreting shall be avoided in very warm weather. If necessary, it shall be covered with damped hessian within 2 hours of placing of concrete.

To achieve good results the concrete shall be immediately covered with a plastic sheet and not allowed any direct wind contact. This shall eliminate shrinkage cracks. Laying of concrete

3.1.7 a) Concreting shall commence only after form work is approved, reinforcement is recorded and permission to proceed with concreting has been approved in writing from the Incharge/Architect.

b) Form work should be clean, free from sawdust, pieces of wood or any other foreign material. It should have been treated by form releasing agent prior to the laying of reinforcement and concrete. Prior to placing concrete against old concrete, masonry, rock all loose materials shall be removed and surfaces washed down. Concrete shall be worked around ties and bond and in open joints.

c) Concrete shall be as gently deposited as is practically possible, in its final position to avoid re-handling and shall be so deposited that segregation of aggregates does not occur. In case of deep trenches and footings, it may be done with the help of a chute. Columns and walls shall be so adjusted in form work so that maximum depth is 1.5 meter unless consented to by the Incharge/Architect. Concrete from wheel barrows shall not be dumped away from the face of concrete already in place. It shall be dumped into the face of concrete already in place. In excavations prevent contamination of earth and concrete without disturbing unsupported sides of excavation. Concrete shall not be placed in water except where specified.

d) Concrete onto a sloping surface shall be discharged by providing a chute with a baffle and a drop at its end so that the concrete remains on the slope.

e) Columns and walls shall be concreted in one operation to their full height to avoid any horizontal construction joint as far as possible.

f) All slabs, beams, wooden planks, and cat-walks shall be provided clear of reinforcement.

g) Concrete shall be placed in position within 30 minutes from the time it is produced. Concrete shall be laid during normal working hours. Concreting at night or on holidays shall be permitted only on the written approval of the Incharge/Architect.

h) Placing in each section shall be a continuous between construction joints. The contractor shall make provision for standby equipment. In case of delay or break down stop ends are to be provided or concrete placed to beremoved as per direction of the Incharge/Architect.

i) Placing shall not take in open during storms or rains, strong winds. Contractor to organize and provide required protection.

3.1.8 Compaction of concrete

Concrete shall be thoroughly compacted as depositing shall proceed by means of able vibrators. The vibrators shall maintain the entire concrete under treatment in an adequate state of agitation and shall continue during the whole period occupied by placing of concrete. Care shall be taken not to over- vibrate the concrete. While withdrawing needles no holes should be visible in concreting. Compaction shall be completed before the initial setting time. Concrete already set shall not be disturbed by successive vibrations.

It shall be ensured that the needle vibrators are not applied on reinforcement which may destroy the bond between concrete and reinforcement.

When electric vibrators are in use, the standby petrol vibrator must always be available at the concreting point.

3.1.9 Construction joints

In large pours, it is practically not possible to carry on concreting continuously. Hence construction joints shall be provided. Location of construction joint shall be submitted by the contractor for approval of the Incharge/Architect. Such joints shall be kept to a minimum. The joints shall be at places where shear force is nil or minimum and these shall be straight andat right angles to the direction of the main reinforcement.

Stop ends provided shall be with necessary slots for reinforcement bars to pass freely without bending or any other obstruction. Also a trapezoidal fillet nailed on stop board shall be provided to form a regular keyed joint. Joints shall be straight and truly vertical or horizontal.

Before commencement of concrete, adjacent concrete stopper and surfaces shall be chipped and roughened to expose aggregate, then wire brushed and cleaned. The concrete surface shall be sprayed with water for 24 hours before casting and kept wet until casting. True horizontal joints shall also be provided with a keyed joint by inserting planed greased timber.

Prepared joint shall be treated as above prior to the start of fresh concreting.

For vertical joints neat cement slurry shall be applied on the surface just before concreting. For horizontal joints, the surface shall be covered with a layer of mortar about 10 to 15 mm thick composed of cement and sand in the same ratio as the cement and sand in the concrete mix. This layer of cement slurry shall be freshly mixed and applied just before concreting.

3.1.10 Expansion joints

Expansion joints shall be formed and located as detailed in the drawing. Insert sealant to completely fill the joint and finish neat and smooth.

3.1.11 Curing

Curing of concrete is most important. There shall be no compromise on this activity and it is for the contractor to arrange for everything necessary to make sure that the concrete is cured to the complete satisfaction of the Incharge/Architect. As said above in clause 3.1.8, after concrete has begun to harden i.e. about 1 to 2 hours after laying,. it shall be protected from quick drying with moist or damped hessian cloth or any other material

approved by the Incharge/Architect. After 24 hours of laying of the concrete, the surface shall be cured by flooding with water or covering with damp hessian cloth for a period of 7 days to keep it moist.
For the next 7 days the surface shall be kept wet all the time by sprinkling water continuously.

For membrane curing, details as listed in 12.5 of SP 24 shall be followed.

3.1.12 Finishing

Concrete shall be finished keeping in mind the next operation to be carried out over the surface. For guidance the following points shall be noted but the Incharge/Architect shall be consulted prior to start of concreting and his decision in this regard shall be final.

a) Roof slab shall be trowel led even and smooth with a wooden float.

b) The surface that will receive plaster shall be roughened immediately.

c) Surfaces that will be in contact with any masonry work shall be roughened immediately,

The surface that will receive mosaic floor or IPS or any other type of tiled work shall be roughened while it is
green. Every care shall be taken not to disturb the freshly laid concrete.

For dust proof (or hardened) finish, clean the concrete surface of oil and contamination and apply approved dust
proof hardener as per manufacturer's instructions.

3.1.13 Inspection and corrective measures

3.1.13.1 On removal of form work, the surface shall be examined by the Incharge/Architect. Till such time, no remedial measures shall be carried out by the contractor. All patching, rectification or chipping shall be done only on the Incharge/Architect's instructions. In case of any violation of this rule, the concrete poured stands rejected. The decision of the Incharge/Architect in this regard shall be final and binding on all parties.

Sagged, bulged, patched, honeycombed work shall stand to be rejected for surfaces that are exposed, or require fair face finish or decorative textured finish. The Incharge/Architect may permit any work found structurally safe and areas of unexposed faces, for repairing. As directed by the Incharge/Architect these works shall be retained and the cost of repair shall be at the contractor's account.

3.1.13.2 Cracks observed shall be brought to the notice of the Incharge/Architect who shall examine them. It shall be kept under observation and a record shall be maintained for a period of 45 days. It shall be shown to (lie Structural Engineer and the following procedure shall be followed :-

a) Cracks not developing further and in the opinion of Structural Engineer not detrimental to the strength of the construction shall be grouted with non-shrinking cement slurry or as directed by the Incharge/Architect.

b) Cracks developing further and, in the opinion of the Structural Engineer, detrimental to the strength of construction, shall be tested as per the relevant Indian standard.

c) Based on results of the test, the Incharge/Architect in consultation with the Structural Engineer shall order remedial measures or order the contractor to dismantle construction, cart away the debris, replace the construction and carry out all the consequential works thereto.

d) Cost of the above shall be borne by the contractor if the failure was on his part. In case it is due to design faults, it shall be borne by the employer.

e) The decision of the Incharge/Architect in this matter shall be final and binding on all parties. This decision shall not be open for arbitration.

3.1.14 Testing

3.1.14.1 Quantum of cubes and testing

The minimum frequency of cube casting shall be as follows. Each sample shall consist of 6 cubes.

Concrete quantity	Number of Samples.
Up to 5 cu m in a day	: 1
5 cu m to 15 cu m	: 2
15 cu m to 30 cu m	: 3
30 cu m to 50 cu m	: 4
More than 50 cu m	: 4 + one additional per each 50 cum or part thereof

Three cubes shall be tested on the 7th day and other three cubes on the 28th day.

3.1.14.2 Field Tests

It is the responsibility of the contractor to prepare and get the cubes tested and to provide all the material, labour, moulds, equipment, casting and curing facility, charges for testing, etc. Further, the contractor shall have to provide and maintain all the equipment and staff at the site throughout to carry out the following tests in a small laboratory or get these tests from approved laboratories without extra cost to the contract.

a) Grading of coarse and fine aggregates

b) Silt content of sand

c) Moisture content of coarse and fine aggregates

d) Slump test of concrete

e) Concrete cube test

3.1.14.3 The contractor shall maintain full records of all above tests in a register. The format of records shall be prepared in consultation with the Incharge/Architect and either he or his representative shall have full access to the contractor's laboratory.

The contractor shall include charges for the above work in his rates and no extra whatsoever shall be admissible on this account of designing, testing, maintaining laboratory, etc.

3.2 Concreting under special conditions

3.2.1 Work in extreme weather conditions

During hot or cold weather the concreting should be done as per the procedure set out in IS 7861 Part I or IS 7861 Part II or as directed by the in charge/architect

3.2.2 Underwater concreting

The procedure set out under 13.2 of IS 456 shall be followed or as directed by the Incharge/Architect

3.2.3 Concreting in sea water

The procedure set out under 13.3 of IS 456 shall be followed or as directed by the Incharge/Architect.

3.2.4 Concreting in aggressive soils and water

Guidelines laid down in 13.4 of IS 456 shall be followed together with the Instructions of the Incharge/Architect.

3.3.0 Precast concrete

3.3.1 Precast concrete can be plain or reinforced. It shall meet all requirements and specifications of concrete as stated hereof. Precast concrete shall be done for cellular roof units, drainage or specially designed for specific use taking Into consideration achievements In flexibility, speed and economy in construction.

3.3.2 Precast concrete units shall be cast in a suitable mould so as to make sure that they are,

a) Easy to lift

b) Easy to transport

c) Excellently finished

d) Handy to erect and Join at site

Units shall be sound and free from cracks or any other defects that would interfere with the proper placing of units or the strength or performance of units or the structure.

3.3.3 Precast units shall be lifted and handled with proper tools from points designated to avoid any cracking or developing of any undue stresses . If required, necessary tools and tackles shall be fabricated by the contractor. Precast units shall be removed from mould within 24 hours or the time allowed by the designer or as approved by the Incharge/Architect. All units that are. in the opinion of the Incharge/Architect, cracked and unsafe, shall be removed forthwith and no arbitration on this account shall be applicable.

Units shall be stored and stacked in the precasting yard in a proper manner. The date of casting shall be noted therein and wet curing for 15 days shall be done without fail. The yard shall have a duly dressed ground and sufficient supports at the required intervals to receive precast units.

Units shall be erected only after 28 days of casting and after the cubes of those days have given the strength specified.

3.4.0 Tolerances in units shall not be more than ±3 mm as approved by the Incharge/Architect taking into consideration the purpose and location of use.

Plum Concrete

Stone plums shall be used only when specified. Size of stone plums may be from 150 to 300mm.

Plums shall be hard, double clean and free from soft or loose pieces or deleterious material and should not have sharp corners.

Generally first layer of concrete of specified mix shall be of thickness 2.5 time thickness of maximum size of plums to be used. Plums shall be laid when concrete becomes stiff but top portion is still green. No plums shall be used for concrete laid under water. The thickness of next and successive layers shall be 2 times that of largest plums.

3.5.0 Measurements

1. All works shall be measured in the decimal system.

a) Dimensions shall be measured to the nearest 0.01 metre except for thickness of slab which shall be measured to the nearest 0.005 metre.

b) Areas shall be worked out to the nearest 0.01 sq m

c) Cubic contents shall be worked out to the nearest 0.01 cum

2. All measurements of cutting shall, unless otherwise stated, be held to include the consequent waste.

3. Cement concrete work shall be classified as under:

a) Concrete cast in-situ : Plain and reinforced

b) Precast concrete : Plain and reinforced

c) Prestressed concrete : Cast in-situ or pre-cast

4. All concrete, except as hereinafter provided, shall be measured in cubic metres.

5. The price of concrete shall include ingredient material, mixing, transporting, hoisting to any height and lowering to any depth, pouring or laying, consolidating, leaving pockets, holes, and protecting them till the next operation or completion of work, hacking the surface to provide key for further work including cleaning, wetting surface, etc. and preparing construction joints as described in clause 3.1.9. of this section.

6. Concrete processed in a special manner for any specific purpose, such as cooled, heated, water-proofed, acid-proofed, heat-resistant shall be measured separately and as per provision in BOQ.

7. Admixtures shall be used if necessary at the request of the contractor for workability and the price for that shall be deemed to be included in the contractor's quoted price of concrete.

8. No deductions shall be made for:

(a) Ends of dissimilar materials (for example beams, posts, girders, purlins, corbels and steps) upto 500 sq cm in section.

(b) Opening up to 0.1 sq m,

(c) Volume occupied by reinforcement.

(d) Volume occupied by drainage, water pipes, conduits, etc. not exceeding 100 sq cm, each in cross sectional area.

(e) Small voids each not exceeding 40 sq cm in section.

Small moulds, drip moulds, chamfers, splays, rounded or covered angles, beads, grooves and rebates upto 10 cm in depth and width.

Expansion joints shall be measured in running metre or sq m as the case may be. Price shall include required shuttering, special treatment if any, filler and finishing material as detailed in drawing or the BOQ.

9. Water proofing of concrete shall be measured separately as an extra over ordinary concrete stating the quantity of water proofing material in litres or kilograms.

10. Surface treatment shall be measured in square metres stating number of coats and proportioning of water proofing liquid to water.

11. Grouting of holding-down bolts and providing temporary boxing orwedges to form holes shall be enumerated. The mix shall be specified. The price shall include requiredshuttering, grouting, etc.

12. To keep surface dry while concreting, dewatering due to rains and seepage shall be included in the price of concrete.

SECTION – II B

REINFORCEMENT WORK

1.0 GENERAL

1.1 Standard

Work shall be carried out to Indian Standards and Code of Practices. In absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be directed to the Incharge/Architect for his direction/approval. However as a general rule more stringent specification shall take precedence.

1. IS 226 Specification for steel standard quality.
2. IS 228 Methods for chemical analysis of steels.
3. IS 280 Specification for mild steel wire for general engineering purpose.
4. IS 432 Specification for mild steel and medium tensile steel burn and hard drawn steel wires for concrete requirement.

   Part 1 Mild steel and Medium tensile steel bars.

   Part 2 Hard drawn steel wire.
5. IS 456 Code of practice for construction and design of reinforced concrete.
6. IS 816 Code of practice for use of metal are welding for general construction in mild steel.
7. IS 961 Specification for structural steel: high tensile steel bars
8. IS 1566 Hard drawn steel wire fabric for concrete reinforcement.
9. IS 1599 Method of Bend test
10. IS 1642 General requirements for fire protection.
11. IS 1785 Cold drawn stress relieved wire (part I)

12. IS 1786 Specification for high strength deformed steel bars and wires for concrete reinforcement.

13. IS 2751 Code of practice for welding of MS bars.

14. IS 2502 Code of practice for bending and fixing of bars for concrete reinforcement.

15. IS 2751 Code of practice for welding of MS Bars.

16. IS 3696 Safety Code of scaffolds and ladders:

Part I Scaffolds

Part 2 Ladders

17. IS 4014 Code of practice for steel (Part 1 & 2) tubular scaffolding

18. IS 4082 Recommendation on stacking and storage of construction materials at site.

19. IS 5525 Recommendation for detailing of reinforcement in RCC work.

20. IS 9417 Recommendation for welding cold worked steel bars for reinforced concrete construction.

21. IS 10790 Method of sampling of steel for priestesses and reinforced concrete.

1.2 Quality Assurance

1.2.1 The Contractor shall procure and provide reinforcing steel bars conforming to IS specified and shall comply with all physical, chemical and mechanical test. Each type shall be from same manufacturer.

1.2.2 Steel manufacturers shall conform steel produced conforms IS requirements for reinforced cement concrete works.

Steel shall not react chemically with ingredient of reinforced cement concrete which are harmful to strength, durability of reinforced cement concrete.

1.2.3 Unit weights and diameter of rolled steel bars shall conform to IS.

1.2.4 Provide supervision and work force with minimum 5 (five) years experience to ensure workmanship of specified quality.

1.2.5 Contractor to undertake documenting of

- Test reports for steel brought at site for each lot

a) Chemical composition from factory

b) Mechanical

c) Physical

- Barbending schedule for cutting and bending
- Record of laps and anchors / development length

1.2.6 Work shall not be subjected to harmful, dangerous and damaging exposures.

1.3 Submittals

1.3.1 Submit for approval of the Incharge/Architect all details of Material / Product which conforms the specification laid down in documents.

1.3.2 Submittals shall include

- Product data sheet
- Manufacturers certificates
- Test report of laboratories
- Alternative product if any with tabulation for conformation that alternatives proposed meets / exceeds specification.

1.3.3 Samples

Samples of type materials to be used. Further during construction samples shall be taken and tested by the Contractor as per specification and as directed / instructed by the Incharge/Architect. The cost of samples and test shall be borne by the Contractor within quoted prices.

1.3.4 Shop drawings

Contractor shall prepare and submit bar bending schedule based on structural detailed drawing prior to fabrication for approval of the in charge/architect.

1.4 Examination of Conditions

Contractor shall inspect and examine sub strata and confirm prior to start that.

- Substrate is acceptable and approved by Incharge/Architect
- Conditions are satisfactory
- Setting out/Layout is verified
- Corrective measures needed if any are within reach and contractor proceeds with full responsibility for work.

2.0 MATERIAL

2.1.0 Reinforcing Bars

2.1.1 Reinforcement bars used in construction shall be mild steel or medium tensile steel round bars and high strength deformed bars. Steel shall be fresh and new. It shall be free of defects and free of rust, oil, paints, grease, loose mill scale or any other deleterious material undesirable for RCC or prevent adhesion of concrete with reinforcement.

2.1.2 M S Plain

Rolled mild steel and medium tensile steel plain round bars used in concrete shall conform to IS 432 Part I. Steel received shall conform to the following IS with regard to manufacturing and chemical composition.

1. M.S. bar Grade I Steel designation Fe 410-S of IS 226
2. M.S. bar Grade II Steel designation Fe 410-0 of IS 1977
3. Medium Tensile Steel designation Fe 540 Steel bars W-HT IS 961

2.1.3 Nominal sizes and tolerances shall be as specified in IS 432 Part I. Physical requirements shall be determined in accordance with IS 1608, read in conjunction with IS 226. For reference of minimum requirements, properties are tabulated in IS 432 Table 1 “Mechanical properties of bars mild steel & tensile steel bars”.

2.1.4 Tor / TMT (Thermo-Mechanically-Treated) Steel

High-strength deformed bars for use as reinforcement in concrete shall be of grade Fe 415, Fe 500 and Fe 550 conforming to IS 1786.

2.1.5 Chemical composition shall conform to IS 1786 when made as a relevant part of IS 228.

2.1.6 Welding of cold work steel bars in reinforcement shall be permitted as per IS 2751 and 9417. (Recommendation for welding cold worked steel bars for RCC).

2.1.7 Nominal sizes, cross sectional areas and their mass shall be as specified in IS 1786, allowing due consideration for tolerances specified therein.

2.1.8 Physical properties

a) It shall satisfy IS 1599 test for bend and rebend test in conjunction with IS 226.

b) Bond requirements shall be deemed to have been satisfied if it meets clause 4.Oof IS 1786.

c) Tensile, proof stress and percent elongation shall be as per table 3 of IS 1786.

2.1.9 Material received at site shall have ISI certification mark. Each bundle or coil containing the bars shall be suitably marked with ISI certification mark. Also bars shall be marked to identify categories. This shall be done as per IS 1387.

In case bars are without ISI certification mark, the manufacturer shall give a certificate stating process of manufacture, chemical composition and mechanical properties. Each certificate shall indicate the number or identification mark of the batch production/ cast to which it applies. Corresponding number or identification mark should be found on the material.

2.1.10 All reinforcement material shall be free from loose mill scale, excessive rust, loose rust, pitting, oil, grease, paint, mud or any foreign deleterious material present on the surface. Cleaning shall be done to the satisfaction of the Incharge/Architect.

2.1.11 Each batch brought at site shall be tested prior to use for respective specification / physical properties. Cost of all such tests shall be borne by the contractor. Material acceptable as per IS shall be allowed into the works. All rejected material shall be removed from site by the contractor within 3 days of rejection. If the same is not done, theIncharge/Architect shall impose a penalty of Rs.500/- per metric ton per day. This will be without any appeal and shall not be subjected to arbitration.

2.2.0 Cover block

Cover blocks shall be of non-corrosive material such as plastic but not wooden or broken bricks or stone. Designed purpose made PVC cover spacers shall be used in the Works. Concrete cover spacers may be permitted by the Incharge/Architect. Such concrete spacers shall be cast from concrete and not cement-mortar. Strength of these blocks shall be equal to the strength of concrete in use. These should be fully cured prior to use in works.

2.3.0 Binding Wire

Binding wire shall be 16 or 18 gauge annealed wire conforming to IS 280. It shall be free from rust, oil, paint, grease, loose mill scale or any other deleterious material undesirable for the reinforcement and concrete or which may prevent adhesion of concrete with reinforcement.

2.4.0 Mechanical Splices

Mechanical Splices fabricated out of steel pipes, sheets etc. capable of withstanding bending and compression stress equal to 1.25 times of those specified for reinforcing bars shall be used. Supplier of splices should submit

details about quality of materials, mechanical test results and method of splicing. Required hydraulic press and clipping equipments shall be arranged by the Contractor.

Samples pieces shall be prepared at site and shall be tested for torsion. Sample pieces results should give value of about 1.5 times than required for reinforcing bars.

2.5.0 Delivery and Storage

Reinforcing steel bars each batch should accompany manufacturers certificate. Reinforcement bars received at site shall be loaded and unloaded at site and stored with care such that it does not get bent or damaged. Steel received shall be as far as possible in straight length of 12 M. Steel shall be weighed in presence of representative of the contractor prior to delivery being received by him. Empty and loaded truck loads shall indicate correct quantity.

Reinforcement bars received at site shall be stored on hard concrete platform and clear of the ground with the use of timber sleeper, concrete sleeper or any other means. Reinforcement material shall be kept covered by tarpaulins or plastic to avoid excessive corrosion and other contamination. Each dia of bars shall be stacked separately. Bars without "ISI' / Tor marking shall not be brought to site.

3.0 SCOPE OF WORK

The contractor shall be responsible for

3.1 Material Procurement

a) The contractor will submit the Schedule of Procurement of steel in consultation with Incharge/Architect as specified and conforming to specifications detailed in drawings and bills of quantities.

The steel is free supply by the client to be delivered to site as per approved indent of the contractor to agreed schedule. However further all balance work to complete the reinforcement bar item shall be same as materials are supplied by the Client.

b) Receive steel and stack with covering on firm platform free of contamination.

c) Collect samples of each type for every batch received and test as per IS for

- Unit weight per running meter
- Cross section area
- Bend / Rebend Test
- Ultimate tensile strength
- Yield stress
- Elongation

d) Procure binding wire, cover blocks splices etc.

3.2 Prepare bar bending / cutting schedule detailing schedule covering as under and obtain approval of Incharge/Architect.

- Cutting lengths
- Laps
- Rings for various locations and items
- Chairs

3.3 Transport, cut, bend and shift to site reinforcing bars.

3.4 Place in position and tie as detailed in drawing reinforcement with specified cover

3.5 Provide attendance to keep reinforcement in position during concreting.

3.6 Disposal of surplus reinforcement steel as per approval of the Incharge/Architect.

3.7 Providing required tools, plants, equipments such as

- Material cutting and bending tools
- Bending platform Bar cutting machine
- Bar bending machine
- Hydraulic clipping machines

3.8 Unit weights payable per metre shall be as follows-

1. 6mm : 0.22 kg/Rmt
2. 8 mm : 0.40 kg/Rmt
3. 10 mm: 0.62 kg/Rmt
4. 12 mm: 0.89 kg/Rmt
5. 16 mm: 1.58 kg/Rmt
6. 18 mm : 2.00 kg/Rmt
7. 20 mm : 2.47 kg/Rmt
8. 22 mm : 2.98 kg/Rmt
9. 25 mm : 3.85 kg/Rmt
10. 28 mm : 4.83 kg/Rmt
11. 32 mm : 6.31 kg/Rmt
12. 36 mm : 7.99 kg/Rmt
13. 40 mm : 9.85 kg/Rmt

4.0 WORKMANSHIP

4.1 Fabrication of reinforcement

Reinforcement shall be fabricated as per the drawing and approved bar bending schedule. Bending shall be done mechanically or with hand but to the correct radius, with proper tools and platform and shall conform to IS 2502. Bending of material shall be cold bending only. Material shall be inspected for visible defects such as cracks, brittle, excessive rust, loose mill scale, etc. Cracked ends of bars shall not be used in Works. Also the bars should be free from any deleterious material and hence the best practice shall be to hose down reinforcement just prior to concreting.

It is important that bending, straightening, cutting, etc. shall be carried out in a manner not injurious to the material and the safety of the persons working should be ensured.

Anchoring - Anchoring of bars and stirrup shall be provided exactly as detailed in the structural drawing or as directed by the Incharge/Architect.

4.2 Lapping of bar

Laps shall be strictly as per the drawing or as directed by the Incharge/Architect. For general guidance, the following principles shall be followed as given in IS 456.

- Splices shall be provided as far as possible away from sections of maximum stress and be staggered.

- Not more than half of the total bars shall be spliced at a section.
- Where more than one half of the bars are spliced at a section or where splices are made at points of maximum stress, special precautions shall be taken, such as increasing the length of lap and/or using spirals or closely spaced stirrups around the length of the splice.

Lap splices shall not be used for bars larger than 36 mm diameter: For larger diameters, bars may be welded. In cases where welding is not practical, lapping of bars larger than 36 mm diameter may be permitted and additional spirals should be provided around the lapped bars. Lap length including anchorage value of hooks in flexural tension shall be Ld (as defined in 25.2,1 of IS 456) or 50 dia whichever is greater When splicing of welded wire fabric is to be carried out, lap splices of wires shall be made so that the overlap measured between the extreme cross wires shall be not less than the spacing of cross wires plus 10 cm.

4.3 Spacing of bars

Bars shall be placed in position as shown in the drawing. Following guidelines as given in IS 456 shall be followed in case of difficulties or shall be carried out as directed by the Incharge/Architect.

a) Horizontal distance between two parallel main reinforcing bars shall usually not be less than the greatest of the following:

1. The diameter of the bar, if the diameters are equal.
2. The diameter of larger bar, if the diameters are unequal, and
3. 5 mm more than the nominal maximum size of coarse aggregate (By using reduced size of aggregate in congested reinforced area, conditions given hereof should be overcome).

b) Greater horizontal distance should be provided. But when needle vibrators are used, distance between bars of a group may be reduced to two-thirds of the nominal maximum size of the coarse aggregate, provided sufficient space is left between groups of bars to enable the vibrator to be immersed.

Where there are two or more rows of bars, the bars shall be vertically in line and the minimum vertical distance between the bars shall be 15 mm, two thirds the nominal maximum size of the aggregate or the maxim size of bar, whichever is more.

4.4 Cover to reinforcement

Reinforcement shall have concrete cover and the thickness of such cover (exclusive of plaster or other decorative finish) shall be as specified in drawing or as directed by the Incharge/Architect. The following guidelines are to be observed in the absence of the above.

a) At each end of the reinforcing bar, not less than 25 mm, nor less than twice the diameter of such bar;

b) For a longitudinal bar in a column, not less than 40 mm, nor less than the diameter of such bar. In the case of columns of minimum dimension of 200mm or under, whose reinforcing bars do not exceed 12 mm, a cover of 25 mm.

c) For longitudinal reinforcing bar in beam, not less than 25 mm, nor less than the diameter of such bar.

d) For tensile, compressive, shear or other reinforcement in slab, not less than 15 mm, nor less than the diameter of such bar; and For any other reinforcement, not less than 15 mm, nor less than the diameter of such bar.

e) Increased thickness shall be provided in case the concrete members are in the surrounding of harmful chemicals, saline atmosphere, etc. and the cover shall be 50 mm or more as directed by the Incharge/Architect.

f) For concrete members totally immersed in sea water, the cover shall be 40 mm more than specified above (a) to (f).

g) This shall be 50 mm more for periodical immersion in seawater.

h) Concrete cover should not exceed 75 mm in any Case. Cover to reinforcement shall be as specified in the drawing or as directed by the Incharge/Architect. Details given in sub para (a) to (h) are for guidance and shall be followed in absence of any specific direction.

4.5 Welded joints or mechanical connections

A) Welded joints or mechanical connections in reinforcement may be used but in all cases of important connections, tests shall be made to prove that the joints are of the full strength of the connected bars. Welding of reinforcement shall be done in accordance with IS recommendation. Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that, at any one section, not more than 33 percent of the rods are welded.

B) Welding rods used shall conform to IS 814 : covered electrodes for metal arc welding of structural steel. Work shall be carried out by a competent welder. Samples from work site shall be taken at regular intervals and tested. Frequency and number of samples shall be as directed by the Incharge/Architect.

4.6 Fixing in position

4.6.1 Correctly cut and bent bars shall be accurately placed In position as detailed in the drawing. Unless otherwise specified by the Incharge/Architect, reinforcement shall be positioned within the tolerance as under:

a) for effective depth 200 mm or less, +10 mm

b) for effective depth more than 200 mm, +15 mm

But in no case shall the cover be reduced by more than 5 mm of that specified. There shall be no compromise on cover for foundation work. Reinforcing bars shall be held in position during the placing of concrete by use of PVC or concrete cover blocks (made of equal strength of well-cured concrete in use),

4.6.2 steel chair spacers, steel hangers, supporting wires, etc. and secured by tying with an annealed binding wire of 16 to 18 gauge as approved by the Incharge/Architect.

4.6.3 Layer of bars shall be separated by precast concrete spacer blocks or spacer bars. Reinforcement shall be in correct position prior to start of concreting. No reinforcing bar shall be placed on freshly laid concrete for adjusting bar spacing. Care shall be taken to maintain reinforcement in position and keep it clean, throughout the period

4.6.4 till it is embedded in the concrete. For maintaining cover, pieces of broken stone or brick or wooden blocks shall not be used at any stage.

4.6.5 Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position, care should be taken to ensure that at no time is the radius of the bend less than 4 bar diameters in case of plain mild steel or 6 bar diameters for deformed bars. Care shall be taken when bending back bars to ensure that the concrete around is not damaged/disturbed.

5.0 MEASUREMENTS

Reinforcement shall be measured as follows:

1. Lengths of different diameters of bars actually used including authorized overlaps shall be measured nearest to a centimeter and their weight calculated.

a) If steel is procured by the contractor, weight per metre given in table 3.9 shall be used.

b) If material is supplied by the client free of cost on tonnage basis to the project site, per metre weight for each diameter of the bar shall be fixed by the incharge /architect from actual stocks of steel available at site or weight per meter given in table 3.9 shall be used.

2. Chairs and spacer bars shall not be measured and paid. For reconciliation purpose it will be taken into account.

3. In case of welded coupled joints, measurement for payment shall be equivalent to the length of overlap, as per design.

4. Price build-up shall include, in addition to cost of material,

a) Cover blocks of PVC or concrete.

b) Cutting, bending, placing and fixing in position.

c) Binding wire as approved.

d) Cleaning of bars.

e) Unloading, weighing cost (to conform the weight of steel) and storing the same in proper forms and conditions on platforms.

5. In case the material is supplied by the owner free-of-cost, it shall include the following in addition to 4a) to 4d) above.

Transportation from owner's store to work site and returning surplus material back to store.

6. For purpose of reconciliation, maximum wastage permitted shall be 3% of the actual material used (returnable to owner). Balance shall be charged at 1.5 times the actual market rates as penalty.

SECTION – II C

FORM WORK

1.0 GENERAL

1.1 Standards

Work shall be carried out to Indian Standards and Code of Practices. In absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be directed to the Incharge/Architect for his direction/approval. However as a general rule more stringent specification shall take precedence.

1. IS 303 Specification for plywood for general purpose.
2. IS 456 Code of practice for construction and design of reinforced concrete.
3. IS 2751 Code of practice for welding of M.S bars used for RCC
4. IS 3696 Safety Code of scaffolds and ladders :

   Part 1 Scaffolds

   Part 2 Ladders
5. IS 4014 Code of practice for steel (part 1 & 2) tubular scaffolding
6. IS 4082 Recommendation on stacking and storage of construction materials

IS 8989 Safety code of erection of concrete formed structures

1.2 Quality assurance

Contractor shall assume and take upon himself to

a) Design, construct, erect, maintain and struck form work proprietary or custom made

b) Form work shall provide required

- Shape, size and finish
- Rigidity and durability during placing(live levels)
- Rigidity and durability for receiving fresh concrete
- Leak proof water tight joints/junctions
- Easy removal without disturbing concrete
- Provide easy access for handling and placing

c) Form work shall provide safety and shall have adequate access for concreting

d) Workers shall work with required safety measures such as safety belts,

1.3 Experience

The contractor shall provide

a) Site supervisors and foremen qualified and experienced at least 5(five) years on similar nature of form work.

b) Semi skilled/skilled labour shall be of minimum experience of 5(five) years in doing similar nature of form work

1.4 Examination of strata

The contractor shall examine, and convince himself prior to start of work that strata is firm, rigid and safe to erect scaffold. In absence, same shall be prepared by him and then work shall proceed. If it is not possible due site condition, method of erection support etc. shall be detailed and got approved from Incharge/Architect prior to start. In any case responsibility of formwork shall be that of the contractor.

2.0 MATERIAL

2.1 Timber

a) Jungle wood timber in form of planks, battens (runners), ballies, and strong durable without cracks, able to sustain warping, twisting and distortion shall be allowed in work for type of requirements.

b) Teak wood /good quality jungle wood shall be used for special decorative moulds. Moulds may be smooth planed or finished with laminate

2.2 Steel

Standard rolled steel sections shall be used with due fabrication of standard special moulds, unitised form work scaffolds, staging etc.

2.3 System

Patented proprietary designed metal (Steel, aluminum or fiber glass) form work best suited for type of work under taken and its requirements shall be used.

2.4 Wire nails confirming to IS and mating needs shall be used.

2.5 Bolts / Nuts /Clamps

MS bolts, nuts, clamps standard or purpose made shall be used. Use of these shall not be harmful to concrete and shall be easily removable or If left In concrete shall be inert to concrete in all respect. 2.6 Form release Agents

Emulsion and oil or chemical agent being used shall not react with reinforce concrete at any stage. No chemical reaction shall take place which may be harmful to reinforcement concrete for its durability strength. These shall not produce any stain and shall not stick to concrete surfaces which will reduce further bonding strength of masonry mortar, painting etc.

3.0 SCOPE OF WORK

3.1 Designing

The contractor shall draw, prepare and submit method of statement backed by designed calculations, taking into account the points noted in clause 1.2 here above at least six weeks prior to the starting of activity. Required drawing and sketches shall be enclosed along with statement for the proposed area to be taken up for working. The statement shall give

- Loadings considered
- Materials proposed
- Repetitions expected
- Staging/supporting arrangement
- Deployment of proprietary metal form work system.
- Method of handling

It shall be responsibility of the contractor to get the design approved from In charge/Architect at least four weeks prior to start of form work.

3.2 Equipments

The contractor shall provide required tools, plants, equipments including its proper maintenance during construction at site.

3.3 Proprietary metal formwork

The contractor shall arrange to provide proprietary system metal formwork applicable/adoptable to various areas of works. He shall be responsible to deploy with required mechanism for handling, shifting, transporting placing in position.

3.4 Supervision

The contractor shall be responsible to provide experienced foremen (atleast Five years) in supporting/executing similar nature and magnitude of work. He shall be able to read drawings and should be capable of guiding and getting work executed to quality.

3.5 Labour

The contractor shall provide experienced skilled carpenters to carryout work with system of formwork deployed and necessary plants and equipment shall be made available at site.

4.0 WORKMANSHIP

4.1 Form work shall be classified namely as follows :

a) Textured or decorative finish

b) Fair-faced finish

c) Rough finish

4.2 In BOQ, the contractor shall account for all material and labour etc. to achieve the above finishes to the satisfaction of the Incharge/Architect in his quoted price.

1. Erection of form work may be from pre-moulded, pre-fabricated, pre-assembled plates or forms reasonable enough to transport and erect at site to correct line and level as set out at site. Supports shall be firm and maintained in position by nails, cross bracings, tie rods, locking bolts and nuts. It shall be rigid and stiff so as to retain its shape during and after concreting.

2. Joints shall be water-tight and no cement slurry shall be allowed to slip through. In joints foamed tapes shall be used.

3. Pre-fabricated or site forms shall be assembled, so as to deshutter without any jerk to the green concrete. For this double wedges shall be used. Wedges shall be nailed, the heads reasonably left out, allowing easy removal while deshuttering.

4. Pre-fabricated or on site fabricated forms shall be of sufficient thickness and with the required supporting runners in either direction. Supporting runners shall be standardized in size for easy replacement and universal use at site.

5. Props shall be of steel only. Teak ballies may be permitted with written permission of the Incharge/Architect for specific use. Size and verticality shall be approved by the Incharge/Architect. Its spacing shall be as per design. It shall be vertical and plumbed. Base shall be a proper steel plate or timber plank, for equal distribution of load.

6. In repeated use, panels shall be clearly marked for using at defined locations.

7. Successive lift shall be tightened with previous lift by fixing foamed strips at joints to avoid grout leakage.

8. In fill pieces and panels shall be well dressed, leveled and jointed with main formwork so as to achieve smooth, even natural finish.

9. Props, Soldiers, wallings, Shores, bearers, Clamps, wall & ties etc. shall be at required spacings.

10. Props, shores shall be securely braced with firm bearing.

11. Provide and fix or fix only inserts pockets, to correct line and level and with sufficient rigidity to keep in position while concrete placing is in progress along with vibration.

12. Sloping, brackets, chajjasetc shall be well secured and firmly restrained.

13. Adequate access and working platform shall be arranged with required safety to avoid reinforcement displacement, damage to shuttering and easy movement of concrete gang.

14. Props and scaffolds are to be erected to correct plumb, line, level and with required tie. Load carrying capacity of props shall be as per table of manufacturer.

15. Props and scaffolds shall not be loaded more than allowed by manufacturer of Props /scaffolds.

16. Heavy, medium and light duty props shall not be mixed up.

17. Beams and slabs shall have camber of 4 mm per metre or as directed by the Incharge/Architect.

18. All angles and corners shall be sharp and well defined. In places where concrete edges are permanently exposed and require no further treatment, they shall be chamfered in a triangle of 25x25mm.

19. Props of steel or timber (if approved in writing) shall be provided with adequate horizontal and cross - bracing. Steel props shall use steel pipes and steel couplers. If use of timber is permitted, planks of 100 x 25 mm shall be used and shall be secured by nailing them to timber props. No other material shall be permitted.

20. At the design and erection stage, the following additional points shall be considered and incorporated into the shutters.

(a) Openings for cleaning prior to start of concreting.

(b) Pouring points shall avoid high drops and provide easy access to vibrator needles.

21. Surfaces shall be treated with mould releasing oil or emulsion as approved by the Incharge/Architect prior to reinforcement laying.

22. The following point shall be observed very carefully:

(a) Joints of moulds shall be water tight. It is easy to check from bottom and make sure that no light is visible.

(b) Props shall be on solid base, plumbed, in one straight line, and braced horizontally and cross.

(c) Tie bars in beams, walls and columns shall be at the correct place and fully tight.

(d) Wedges shall be fully secured and nailed with head left out for easy removal.

(e) All saw dust, dirt, shaving and any other unwanted materials shall be cleaned and hosed out.

(f) Provision shall be made for watching form work while concreting and any other platform needed for movement of workers without any disturbance to reinforcement.

23. Opening/inserts All required openings and pockets shall be provided as detailed in the drawing. The contractor shall provide for the required material, labour for fixing and supporting during concreting, in his quoted price. It is imperative that all openings and pockets shall be deshuttered with care and all corners of openings shall be preserved. All openings/pockets shall be in a correct line and level. After concreting, the openings shall be secured by proper covering against any accident and guard rail and warning notice, if any will be incorporated.

24. In case of multistoried building, any upper floor shall be suitably supported on atleast one floor below the same or as approved by the Incharge/Architect. The concreting of upper floor shall be done only after lower floors have attained the strength.

4.3 Checking prior to concreting.

1. All props and struts are plumbed at right spacing properly tightened up and locked.

2. Formwork is correctly aligned and leveled.

3. Stop ends are properly secured and sealed.

4. All ties are properly tightened.

5. All inserts, pockets etc are at desired level and secured.

6. Joints are sealed and no possibility of leakage of grouts.

7. Reinforcement has proper covers and required spacers.

8. All forms are cleaned, free from rubbish, tie wires etc.

9. Proper access for concreting and compaction available.

10. Required guard rails, toe boards are provided.

4.4 Tolerances

4.4.1 Tolerance is a specified permissible variation from lines, grade or dimension given in drawings. No tolerances specified for horizontal or vertical building lines or footings shall be considered to permit encroachment beyond the legal boundaries. Unless otherwise specified, the following tolerances will be permitted.

4.4.2 Tolerances for RCC buildings

1. Variation from the plumb:

(a) In the lines and surfaces of columns, piers, walls and in arises 3 mm per 2.5 m but not more than 10 mm.

(b) For exposed corner columns and other conspicuous lines,

In any bay upto 5 m maximum : 5 mm

In 10m or more : 10mm

2. Variation from the level or from the grades indicated on the drawings,

(a) In soffits of slab, ceilings, beam and in arises

In 2.5 m 5 mm

In any bay upto 5 m maximum 8 mm

In 10m or more 10 mm

(b) For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines,

In any bay upto 5 m maximum 5 mm

In 10m or more 8mm

3. Variation of the linear building lines from established position in plan and related position of columns, wall and partitions.

In any bay upto 5 m maximum 5mm

In 10 m or more 10 mm

4. Variation in the sizes and location of sleeves, openings in walls and floors 5mm (except in the case of and for anchor bolts).

5. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls - 5 mm + 10 mm

6. Footings

(a) Variation in dimension in plan • 5 mm + 50 mm

(b) Misplacement or eccentricity

2% of footing width in the direction of misplacement but not more than 50 mm

(c) Reduction in thickness

5% of specified thickness subject to a maximum of 50mm

7. Variation in steps

		Riser	Tread
(a)	In a flight of stairs	3mm	5mm
(b)	Consecutive steps	1.5 mm	3 mm

4.4.3 Tolerances in other concrete structures.

1. a) Variation of the constructed linear outline from established position in plan

In 5 m : 5 mm
In 10m or more : 10mm

b) Variations of dimensions to individual structure features from established positions

In 20m or more : 25mm
In buried construction : 50 mm

c) Variation from plumb, from specified batter or from curved surfaces of all structure

upto 2.5 m : 3 mm
2.5 m to 5 : 8 mm
5m to 10m or more : 12mm
In buried construction : Twice the above

d) Variation in cross sectional dimensions of columns, beams, buttresses, piers and similar members

(-) 5mm (+) 10mm

e) Variation in the thickness of slabs, walls, arch sections, and similar members. (-) 5 mm (+) 10 mm

2. Footings for columns, piers, walls, buttresses and similar members.

a) Variation of dimensions in plan

(-) 10 mm (+) 50 mm

b) Misplacement or eccentricity

2% of footing width in the direction of misplacement but not more than 50 mm

c) Reduction in thickness

5% of specified thickness subject to a maximum of 50mm

4.5 Removal of Form work

1. Forms shall not be struck until the concrete has reached strength at least twice the stress to which the concrete may be subjected at the time of removal of form work.

Under normal circumstances and where 53/43 grade 0.P.Cement is used, forms shall be removed after expiry of the following periods:

a)	Walls, columns and vertical faces	24 to 48 hrs
b)	Slabs (props left under)	3 days
c)	Beam soffits (props left under)	7 days
d)	Removal of props under slabs	
(i)	Spanning upto 4.5 m	7 days
(ii)	Spanning over 4.5m	14 days
e)	Removal of props under beams and arches	
(i)	Spanning upto 6 m	14 days

(ii) Spanning over 6m 21 days

For other cements, the stripping time shall be suitably modified in consultation with the Incharge/Architect.

2. Where the shape of elements is such that the form work has re- entrant angles, the form work shall be removed as soon as possible after the concrete has set, to avoid shrinkage or cracking that might occur due to the restraint imposed.

3. For precast moulds, the stripping time shall be 24 hours. The mould may be lifted and stored in the yard within 24 hours to 48 hours as approved by the Incharge/Architect.

4.6 Maintenance

It shall be responsibility of the contractor to protect, maintain and handover to next contractor / Employer in finished condition. No additional cost due to this shall be paid by the Employer Providing and fixing inserts is part of this.

a) On completion of concreting inserts shall be cleaned and required treatment such as oiling, greasing, covering with plastic/plywood boxes, painting etc. shall be carried out by the contractor to approval of the Incharge/Architect. Inserts and pockets shall be protected from weathering/or damage in course of construction.

b) Opening and pockets shall be deshuttered with due care not to damage edges, falling of debris within pockets etc. Further all opening and pockets shall be preserved, secured against accident by covering, putting up guard rails, warning notice etc. as approved by the Incharge/Architect. Guarding and protecting pockets shall be responsibility of the contractor at no extra cost to contract.

4.7 Cleaning/Stacking

All formwork deshuttered shall be cleaned with a stiff wire brush to remove dust, grout, concrete etc. and if required maintained/repaired prior to being reused. Steel plates, props, frames, proprietary formwork system shall be oiled, greased to protect against rusting, weathering etc.

Plywood and timber form shall also be applied with preservative agent if to be kept for long time without use. It shall be protected against heat, rains etc.

4.8 Measurements

Form work shall be paid for separately as per item details given in BOQ.

Wherever it is not specifically stated in description of the item that form work shall be paid for separately, the rate of R.C.C. item shall be deemed to be included in the cost of the form work.

1. Form work shall be measured as the area (in square meters) of shuttering in contact with the concrete.

2. It shall be measured to the nearest centimeter and the areas worked out corrected to second decimal places.

3. No deductions shall be made for openings upto 0.4 sq m in the plan.

4. Form work to secondary beams shall be measured upto sides of the main beams but no deduction shall be made from the form work of the main beam.

5. No deduction shall be made from the form work of column at intersection of the beam.

6. The quoted rate shall be applicable for all working conditions and at all heights,

depths or lifts specified in the BOQ. The rate shall include the cost of materials and labour for various operations involved, such as,

a) Splayed edges, notching, allowance for overlaps and plastering at angles, battens, centering, shuttering, strutting, propping, bolting, nailing, welding, casing, striking and removal.

b) Filling to form stop chamfered edges or splayed external angles not exceeding 75 mm to footing and 25 mm to beams, columns and like.

c) Temporary openings in the forms for pouring concrete and removing rubbish.

d) Dressing with oil/approved emulsion/soap solution to prevent adhesion of concrete with shuttering.

e) Racking or cutting

f) Fixing inserts and openings at the correct line and level and any required stage to support the same at the directed height and place.

g) Platforms, if any, required to keep check on form while the concreting is in progress.

h) Filling and making joints water-tight to the satisfaction of the EIC.

i) Cleaning the shuttering.

7. Any work damaged through premature or careless removal of form shall be removed and reconstructed at the contractor's cost.

8. Holes for electrical conduits, hooks for fans and for plumbing are included in the price of items.

SECTION – III

BRICK/BLOCK MASONRY WORK

1.0 INDIAN STANDARDS

Work shall be carried out to Indian Standards and Code of Practices. In absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be directed to the PM for his direction/approval. However as a general rule more stringent specification shall take precedence.

(1)	IS 226	Specification for Structural steel standard quality
(2)	IS 269	Specification for 33 grade OPC
(3)	IS 2185 (Part 3) - 1984	Specification for Aerated Autoclave Concrete Blocks
(4)	IS 1077	Specification for common burnt clay building bricks
(5)	IS 2116	Specification for sand for masonry mortars
(6)	IS 6041-1985	Code of practice for AAC Blockwork
(6)	IS 2212	Code of practice for brick work
(7)	IS 2250	Code of practice for preparation and use of masonry mortars.
(8)	IS 8112	Specification for 43 grade OPC
(9)	SP 27	Handbook of method of measurement for building works.

2.0 MATERIALS

2.1 Bricks (CLASS 150 AS PER U P, L N V/ BIS)

2.1.1 Bricks shall be sound, hard, well-burnt, uniform in size, shape and colour, homogeneous in texture, giving a metallic ringing sound, free from flaws, cracks, holes, lumps or grit and arises should be square, straight and sharply defined. They shall not break when struck against each other and dropped flat from a height of 1 m to the ground. They shall conform to IS 1077 giving classes of common burnt clay bricks. One sample brick shall be tested as per IS 3495 prior to approval by the Incharge/Architect.

2.1.2 Bricks shall be as specified and detailed in the BOQ. It shall to be approved prior to procurement. Bricks shall be obtained from an approved source and shall be of uniform colour, size, shape. Bricks shall have smooth rectangular faces with sharp straight right angle edges. Maximum absorption shall not be more than 20% of its dry weight on immersion in water for 24 hours. Minimum crushing strength shall be 75 kg/sq.cm (EQUIVALENT TO CLASS 150 BRICK WORK AS PER U P, L N V) if not specified in the BOQ.

2.1.3 Bricks of approved quality and quantity shall have to be procured by the contractor at the desired time. No delay or extra cost due to non-availability shall be accepted. The contractor is obliged to carry out the work as specified. It shall be the responsibility of the contractor to procure sufficient quantities of bricks and stack them at site or elsewhere to avoid delays.

2.2 Mortars

2.2.1Mortars for masonry shall be prepared in accordance with ARE 2250 code of practice for preparation and use of masonry mortars. 2.2.2Cement

Cement used shall be ordinary Portland cement conforming to IS and shall be of grade 43.

2.2.3 Water

Water used for masonry shall be clean and free from injurious amounts of deleterious materials.

2.2.4 Fine aggregate (sand)

2.2.4.1.1 Natural sand deposited by stream or glacial agencies as a result of disintegration of rock is the best form of fine aggregate. The fine aggregate coarse sand (coarse sand FM above 2.25 & Fine sand F M more than 1.25) shall conform to following standards.

(i) For plain and reinforced concrete IS 383 Specification for coarse and fine aggregates from natural sources for concrete.

(ii) Mortar and grout IS 2116 Specification for sand for masonry mortars.

2.2.4.2.1 Sea sand should not be used unless approved by the Incharge/Architect. If approved, the required treatment shall be done at the contractor's cost.

2.2.4.2 Sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain any appreciable amount of clay. Sand shall not contain harmful impurities such as iron, pyrites, coal particles, lignite, mica shale or similar laminated material, alkali, and organic impurities is such form or quantities as to affect the strength or durability of concrete or mortar. Also it should not contain any material liable to attack the steel reinforcement.

2.2.4.2.1 When tested as per IS 2386 Part I and Part II, fine aggregate shall not exceed permissible quantities of deleterious materials as given in IS 383 "Limits of Deleterious materials (aggregates)".

2.2.4.2.2 Fine aggregate shall be thoroughly washed at site with clean fresh water such that the percentage of all deleterious materials is within the permissible limits laid down.

2.3 Metal reinforcement

Metal reinforcement used in brick masonry shall conform to the following Indian Standard Specifications.

a) IS 226 Specification for steel standard quality

b) IS 412 Specification for Expanded metal steel sheet for general purpose.

c) IS 432 Specification for Mild steel and Medium tensile steel bars

d) IS 1566 Specification for Steel fabric or hard drawn steel wire.

3.0 MORTAR

3.1 Mortar shall be prepared by mixing fine graded aggregate with cement in the proportion specified for respective items of work as detailed in the BOQ. Mixing of mortar shall be done by mechanical mixers only. Hand mixing may be permitted in specified cases on the written permission of the Incharge/Architect.

3.2 Mortars shall be specified by proportion. Volumetric mixing shall be based on dry volumes of each ingredient. For convenience, measurement shall correspond to volume of one cement bag i.e. 0.035 cum. Boxes shall be of size 40x35x25 cm. These shall be marked as mortar mixing or mechanical mixing proportions shall be done with the use of these boxes.

3.3 Cement mortar shall be prepared by mixing cement and sand in specified proportions. Proportioning shall be carried out as detailed above. Sand shall be added suitably to allow for bulkage if required. Bulkage shall be determined as specified in IS 2386 Part III. Cement and sand added to mixer shall be thoroughly mixed and water shall be added to it gradually. After addition of water the mixer shall run for a minimum of 3 minutes. The mortar mixed shall be consumed within 30 minutes of its mixing.

4.0 WORKMANSHIP

4.1 IS 6041-1985 – Code of practice for AAC Blockwork and IS 2212 – Code of practices recommendation shall be followed.

4.2 Blocks/ bricks used for masonry in cement mortar shall be soaked by immersing in water or by hosing of water (so as to prevent bubbling.) at least one hour prior to start of actual laying.

4.3 Blockwork shall be laid in Half-Bond. There should be no less than a quarter bond ('closers') used at any point on the block wall.

Bricks shall be laid in English bond unless otherwise specified.Half or cut bricks shall be used only for the purpose of bond and at no other place.

4.4 Work shall be true to horizontal lines and perfect plumb. Vertical joints shall be truly vertical and those in alternate courses shall be in the same vertical line. The joints for Blockwork shall conform to IS 6041-1985. Brickwork joints of each course shall be within the limit of 6 mm to 10 mm depending upon the size of bricks. Total height of 9 cm brick with 5 courses and 5 mortar joints shall be 50 cm.

In no case shall joint thickness of horizontal and vertical be more than stated above. Joints should be filled to full depth and checked each time. Prior to start of work it must be noted and checked that blocks/bricks on top are full-size bricks (flat or brick on edge). To achieve this, precautions should be taken from the start of the first layer. Thickness of joints shall be so adjusted so as to have full blocks/bricks on top. Also it must be noted and checked that all horizontal joints on every floor are at the same level, so as to allow proper bonding at junctions.

Required datum levels must be established throughout the floor and only then should work start. It is equally important to take into account levels of window sills, lintels, etc. while finalizing courses and joint thickness.
In normal practice architects do take care of these while finalizing levels, but it is difficult to expect the ideal situation at all places. In such situations, the decision of the Incharge/Architect shall be taken such as providing brick on edge, concrete sills, etc.
In addition, for convenience and speed, gauge boards of exact width shall be fixed at the edges of masonry to correct line and plumb. These boards shall be marked with course levels to achieve exact height of each course and full bricks at the top.

4.5 One or half brick thick wall have minimum one face in true plumb.

4.6 It is imperative to raise the Blockwork/brick work uniformly over complete Work joined together. If this is not possible, raked Blockwork/brick work shall be done at 45 degrees to the vertical. Tooting shall not be accepted.

4.7 All iron fixtures, pipe outlets, holdfasts for doors and window shall be fixed when the brick work is in progress. It must be embedded in cement mortar or concrete as specified or as directed by the Incharge/Architect. Required treatment to fixtures shall be carried out prior to embedding.

4.8 To achieve better results and proper working, the following tools should be available with masons working at site:

1. Spirit level
2. Wooden/Aluminium straight edge 3 m long
3. 3 metre steel tape
4. Right angle ½ metre long
5. Line and pin strings
6. Plumb
7. storey rods

4.9 Joint thicknesses shall be provided as discussed above. Joints shall be filled to full depth before second course is laid. Frogs in brickwork shall be upward at all times. Joints shall be raked back to a minimum 10 to 15 mm while the mortar is green. Surface of brick work shall be cleaned with coir string, wire brushes, etc. to keep the surface free for the next operation. All dropped and spoiled mortar, broken blocks, brickbats, etc. shall be cleared from the floor before work is closed for the day.

4.10 Protection and curing

Green work shall be protected from rains by suitable covering. Masonry in cement mortar shall be kept constantly moist on all the faces for a minimum period of ten days. The top of masonry shall be left flooded with water at close of the day.

4.11 Scaffolding

Scaffolding independent of blockwork/brick work i.e. double scaffolding shall be provided. It should be tied to block work/ brick work or structure at suitable intervals in both directions. Two rows of planks shall be provided all around. Planks shall be at least 50 mm thick and well tied to scaffolding. Railing to the outside face shall be provided. While erecting scaffolding, the following points must be noted and closely followed:

1. Minimum number of holes in the horizontal direction. Holes shall be formed by omitting header brick.
2. No holes in pillars under 1 metre in width.
3. No holes near the skew backs of arches.
4. Scaffolding must be sound and strong and easy to maintain.
5. Holes lift must be closed while finishing the plaster.

5.0 AERATED AUTOCLAVE CONCRETE BLOCKS

5.1 Block units shall conform to IS2185 (Part 3) – 1984. Block units shall be made in sizes and shapes to fit different construction needs. Concrete block shall be referred to by its nominal dimensions. The maximum variation in length of units shall not be more than +-5mm and the maximum variation in the height and width of unit, not more than+-3mm. The faces shall be flat and rectangular, opposite faces shall be parallel, and all arises

shall be square and the bedding surfaces shall be at right angles to the faces of the blocks. One sample block shall be tested prior to approval by the Incharge/Architect.

5.2 The materials used for manufacturing of block work units shall conform to IS codes as:
Cement (IS 455 -1976, IS 1489 -1976, IS 6909 -1973, IS 8041 -1978, IS 8042 -1978, IS 8043 -1978)
Use of fly ash conforming to IS 3812 -1981 may be permitted to a limit of 20 percent in cement conforming to IS 269 -1976.
The lime shall conform to Class C lime specified in IS 712-1973.
Aggregates – Sand (IS 383-1970, Silica content not less than 80%), Fly Ash (IS 9812 -1981, Loss on ignition not more than 6%), Granulated Blast Furnace Slag (Notes 1 and 2 of 4.2 of IS 455-1976) Water shall meet the requirements of IS 456-1978.
Admixtures – Accelerators, water reducers & air entraining admixtures (IS 9103-1979), Waterproofing agents (IS 2645 -1975) and coloring pigments may also be added.
5.3 All units shall be sound and free of cracks or other defects which interfere with the proper placing of unit or impair the strength or performance of construction. Minor chipping resulting from the customary methods of handling during delivery, shall not be deemed grounds for rejection. Block Density shall conform to Table 1 (IS 2185 (Part 3) – 1984 when tested in accordance with IS 6441 (Part 1) – 1972. The minimum Compressive Strength of the block, being average of twelve units, shall be as prescribed in Table 1 (IS 2185 (Part 3) – 1984 and be tested in accordance with IS 6441 (Part 5) – 1972. The thermal conductivity shall not exceed values specified in Table 1 (IS 2185 (Part 3) – 1984 and be tested in accordance with IS 3346 –1980. The drying shrinkage shall not be more than 0.05% for Grade 1 blocks and 0.10% for Grade 2 blocks when determined in the manner described in IS 6441 (Part 2) – 1972.

6.0 TYPES OF BLOCKWORK/BRICK WORK
6.1 Walls 230 mm thick or more
Walls of 230 mm thickness or more shall be constructed with approved and selected Blocks/bricks. Mortar shall
be as specified in the BOQ. Points discussed above shall be followed for workmanship
Block work/Brick wall of 230 mm thickness shall be constructed from one side and one face shall be true and
plumb. Thicker wall shall be constructed with masons on both faces and both the faces shall be true and plumb.
6.1.1 Measurements shall be in cubic meters for actual executed work. All opening and concrete work for lintels,
transom/mullions shall be deducted.

6.2 Half brick work – plain or reinforced
6.2.1 115 mm thick brick work shall be called as half brick work. It shall be built by laying bricks in stretcher bond.
Mortar shall be as specified in the BOQ.
These walls may be used for forming cavities or partition walls inside buildings. Brick work shall be reinforced with either of following methods:
1) With 8 mm dia bars, 2 bars at every third layer.
2) GI metal lath/ GI hoop iron 25 mm x 1.6 mm shall be used at every third layer as detailed by layer as detailed by
the manufacturer.
3) Thin Beams of 100x150 mm high in M20 grade concrete shall be caste. Beam shall be reinforced with 2 nos. ofmm dia Tor bars and 6 mm diaM.s. links at 300 mm c/c. Thin beams shall be at every 1000 mm interval inheight.
Embedding of reinforcement shall be done very carefully. All precautions shall be taken so that edges are not exposed. Lapping of bars and lath shall be proper and staggered.
6.2.2 Measurement shall be in square meters. Reinforcement and shuttering shall not be measured separately.

7.0 RATE

7.1 The rate shall include the cost of all the materials and labour as described in their respective items of work and for all the operations as detailed in the respective specifications for the various items of work. Brick on edge courses, cut block/brick corners, splays, reveals, cavity walls, shall be included in blockwork/brick work for the purpose of payment.

7.2 The following operations shall be included in the rate for Blockwork/Brick Work:-

a) Raking out joints for plastering or for pointing done as a separate process or for finishing joints flush as work proceeds;

b) Preparing tops and sides of existing walls and the like for raising;

c) Rough cutting and waste for forming gables, cores of arches, splays at caves and the likes and all rough cutting of the body of brick work, unless otherwise stated;

d) Plumbing to angles and battered surfaces;

e) Forming reveals to jambs where fair cutting on exposed faces is not involved;

f) Leaving holes for pipes, etc;

g) Building-in holdfasts, air bricks, fixing bricks, etc;

h) Building-in ends of beams, joists, slabs, lintels, sills, trusses, etc;

i) Forming openings and flues for which no deduction is made;

j) Bedding wall plates, lintels, sills, roof tiles, corrugated sheets, etc., in or on walls, if not covered in their respective trade.

k) Leaving chases of section not exceeding 50 cm in girth.

l) Scaffolding as per clause 4.10.

SECTION – IV

PLASTERING WORK

1.0 INDIAN STANDARDS

Work shall be carried out to Indian Standards and Code of Practices. In absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be directed to the Incharge/Architect for his direction/approval. However as a general rule more stringent specification shall take precedence.

1. IS 383 Specification for coarse and fine aggregates for natural Sources for concrete.
2. IS 412 Specifications for expanded metal steel sheets for general purposes.
3. IS 1542 Specifications for sand for plaster
4. IS 1661 Code of practice for application of cement and cement Lime plaster finishes.
5. IS 2402 Code of practice for external rendered finishes 6.
6. IS 2645 Specifications for integral cement water proofing compound
7. IS 8112 Specification for 43 grade OPC.
8. SP 27 Handbook of method of measurement of building works.

2.0 MATERIALS

2.1 Cement

2.1.1 Cement shall be OPC conforming to IS and of grade 53 .If not available Bank/Architect may consider other grade on merit basis

2.2 Water

Water used for mixing and curing shall be clean, reasonably clear and free from objectionable quantities of silt, oils, alkalis, acids, salts so as not to weaken mortar.

Water tested shall be in accordance with IS 3025. Maximum permissible limits of deleterious materials in water as given in IS 456 are reproduced for ready reference in table 1 of IS 456.

Sand (coarse sand FM above 2.25 & Fine sand F M more than 1.25) shall conform to IS 1542 specification for
sand for plaster. For white or coloured renderings, only quartz or silica sand shall e used. For textured finishes
produced by treatment of freshly applied final or finishing coat with a tool coarser, particles used shall be screened through 3.35 mm IS sieve or 2.36 mm IS sieve. For torn texture a slightly larger portion of material coarser than 4.75 mm IS sieve shall be used.

2.3 Aggregate shall conform to IS 383.

2.3.1 Integral water proofing compound shall conform to IS 2645 (specification for integral water proofing compound).

2.4 GI Chicken Mesh

GI Chicken mesh of 20 gauge as approved shall be used over junctions of concrete and masonry or two dissimilar materials about 150mm wide fixed with GI wire nails etc. as directed by the Incharge/Architect.

3. MORTARS

3.0.1 Mortars shall be prepared by mixing fine graded aggregate with cement, the lime or a combination of these in the proportion specified for respective items of work as detailed in the BOQ. Mixing or mortars shall be done by mechanical mixers only. Hand mixing may be permitted in specified cases on the written permission of the Incharge/Architect.

3.0.2 Mortars shall be specified by proportion only and not by strength. Volumetric mixing shall be based on dry volumes of each ingredient. For convenience, measurement shall correspond to volume of one cement bag i.e. 0.035 cu m. Boxes shall be of size 40 x 35 x 25 cm. These shall be marked as mortar mixing boxes by red paint and shall be used throughout the contract. Hand mixing or mechanical mixing proportions shall be done with the use of these boxes.

3.1 Cement mortar

3.1.1 Cement mortar shall be prepared by mixing cement and sand in specified proportions. Proportioning shall be carried out as detailed above and shall be added suitably to allow for bulkage if required. Bulkage shall be determined as specified in IS 2386 Part III. Cement and sand added to mixer shall be thoroughly mixed and water shall be added to it gradually. After addition
of water the mixer shall run for a minimum of 3 minutes. The mortar mixed shall be consumed within 30 minutes of its mixing.

4.0 WORKMANSHIP

Work shall be carried out as per recommendations of code of practices IS 1661 and IS 2402.

4.1 Preparation of mortar mix

The material used in preparation of plastering mixes shall be measured by volume using gauge – boxes or by
weight.

4.1.1 When cement is measured by weight, 1440 kg of material shall be taken equivalent to one cubic meter.

4.2 Mixing

4.2.1 Mixing shall be done mechanically. Each mortar batch shall be used within half an hour. Hand mixing if permitted as special case shall be carried out on a clean, watertight platform. The mixing operation shall be continued with addition of necessary quantity of water until a uniform appearance and consistency of mortar is obtained.

4.2.2 Cement and sand shall be mixed dry in required proportion to obtain a uniform color and water shall then be
added to get the required consistency for the plaster.

4.3 Method of plastering:

4.3.1 Surface to be plastered must be clean and free from dust, loose material, oil, grease, mortar droppings, sticking
of foreign matter, traces of algae, etc. It is very important to ensure that there should not be any chance of the plaster getting debonded due to presence of materials harmful for bonding.

4.3.2 Raking out of joints is expected to be carried out along with masonry but it should be checked thoroughly so as
to receive good key.

4.3.3 Walls should be sufficiently damp prior to plastering. Water from plastering mortar must not be absorbed by
masonry under any condition.
4.3.4 Any unavoidable projections in masonry and concrete surfaces shall be chiseled back. Care shall be taken that
surrounding surfaces are not damaged and reinforcement is not exposed.
4.3.5 Thickness of one coat should not be more than 15 mm and less than 8 mm for single coat finished plaster.
4.3.6 In case of multi coat plaster, sufficient time shall be allowed for the undercoat t harden (cured, dried and shrunk
properly) before subsequent coats are applied.
4.3.7 Undercoats shall be scratched or roughened before they are fully hardened to form a mechanical key.
4.3.8 The method of application is also important and hence it is recommended that the mix be thrown on the surface
rather than stuck with trowel. This increases the adhesion.
4.3.9 Independent double legged scaffolding free of masonry shall be provided. Scaffolding should be rigid, allowing
free and safe movement on the platform and it should be at sufficient distance or height from the working areas.
Scaffolding with railing gives more confidence to workers and improves the quality of work.
4.3.10 Actual plastering shall be undertaken only on the approval of the Incharge/Architect. Plaster work should only
follow the steps mentioned below:
a. Surface must be thoroughly cleaned.
b. Plaster area must be provided with level dabs or sports allowing working and checking with 2-3 m straight edge.
Depth of plaster must not be less than 8 mm at any point.
c. Required concealing services must be completed and tested.
d. No further cutting of masonry must be required.
e. Repairs carried out to masonry or concealing work must be cured and dry.
f. Surface must be sufficiently damp.
g. Plaster dabs are checked for plumb and level by the Incharge/Architect or his representative.
h. Joints, concealing and repairing areas must be covered with 20 gauge GI chicken mesh as per the Incharge/Architect's instruction.
4.3.11 Corners, external or internal, shall be finished along with final coat. It is advisable to have rounded corners.
4.3.12 Plaster shall be cured for 14 days by wet curing except in neeru finish plaster. During this period plaster shall be protected from exposure to extremes of temperature and weather.
4.3.13 Plaster shall be leveled and lined by aluminium hollow section, 2-3 m long. (This will give even and leveled surface). There shall not be more than 2 mm difference in level when checked with 3 m straight edge. It is important that enough pressing and beating is done to achieve compact filling of joints and that the area is fully compacted.
4.3.14 Finishing of plaster may be carried out with wooden float (rand has) or trowel led smooth with sheet metal trowels as specified. Care shall be taken to avoid excessive trowelling and overworking of the wooden float.
4.3.15 All corners, internal or external, shall be truly vertical or horizontal. These shall be finished with a proper template to achieve best workmanship for rounding and chamfering as specified or directed.
4.3.16 Plaster shall be cut to correct horizontal or vertical line at the end of the day or if work requires to be suspended for any reason.
4.3.17 It is advisable to limit the area of plaster to 15 sq. m. to avoid cracks due to thermal movements of dissimilar material in contact, it is advisable to provide joints treated with groove or any other detail as suggested by the Architect. These joints if not specified shall be treated with 150 mm wide reinforcing chicken mesh (approved by the Incharge/Architect) fixed over joints by GI nails and the area plastered.

5.0 TYPE OF PLASTER
5.1 12 mm thick ordinary cement sand plaster

Single coat cement-sand plaster with cement-sand mix in proportion of 1:4 shall be carried out over the entire area as detailed above. This shall be finished just with wooden float to give the best smooth surface possible. This may be for internal or external areas. Thickness may be from 10 to 15 mm maximum or as specified in the item or drawing.

5.2 18 to 25 mm ordinary cement sand plaster

This is the same as for the 12 mm thick single coat plaster except that this shall be carried out in two coats. Maximum thickness of the undercoat shall be 12 mm and balance in the second finishing coat. All operations remain the same and are as detailed in Clause 3.0 of this section.

5.3 Cement finished plaster

This shall be carried out in the same manner as in Clause 5.1 and 5.2 of this section for specified thickness in single or double coat. Then it shall be finished uniformly over the entire area with a paste of neat cement when the plaster has just hardened and finished smooth with a steel trowel. It shall be worked over again to achieve a smooth leveled surface. Quantity of cement applied shall be about 1 kg/sqm.

5.4 Sand face plaster

5.4.1 This shall generally be carried out on the outside face and exposed area of masonry work and concrete work. It shall be of minimum 22 mm thickness and shall be in two coats (1st coat 16 mm and 2nd coat 6 mm). The coat shall be CM 1:4 (1cement : 4 sand). mixed with water-proofing compound 2% by weight of cement and applied as usual and surface shall be keyed.

5.4.2 The second coat shall be applied after 7 to 10 days and shall be of CM 1:4 (1 cement : 4 sand). Mortar shall be mixed with slightly coarse sand. Mix shall be worked over with 3 m gauge or wooden float to achieve an uniform surface.

5.4.3 The surface shall be allowed to harden sufficiently for sponging operation. Sponging shall be done by dipping sponge in cement water and removing fine particles and exposing large sand particles. The movement of sponge shall be such that no parches develop nor excessive material is removed from the surface. There shall not be a difference of more than 7 mm when checked with a 2 m long straight edge.

5.5 Water proof plaster

The water proofing compound shall be mixed with dry cement in the proportion by weight as specified or recommended by the approved manufacturer of water proofing compound. Mixing should be thoroughly well integrated with cement. Addition of water must not allow any slips of mixed cement.

The mix used, in general, shall be CM 1:4 (1 cement : 4 sand) and the balance application, curing, etc. remains the same as detailed above.

6.0 MEASUREMENT

6.1 Plaster work shall be measured in square meter to the second decimal place.

6.2 Thickness of plaster shall be the average depth of plaster as specified. But if extra thickness occurs due to bad quality of bricks, stones or blocks or due to bad workmanship, the repairs or extra thickness required to be carried out shall be at the cost of contractor.

6.3 a) Grooves, pattas in continuation of large areas or plaster areas shall be considered as part of the plaster and not measured separately.

b) Ceiling plaster, including ribbed beam slab shall be measured in square meters.

c) Beams and columns in continuation of masonry shall be measured in square meter.

6.4 Jambs, sills, coves, cornices, etc. shall be a part of plaster and no separate payment shall be made towards these items.

6.5 Deduction

a) Deduction for an opening in plaster shall not be for area less than 0.5 sq. m.

b) In case the opening area is 0.5 sq m. only 50% area shall be deducted from each face.

c) In case the width of door or window frames are equal to masonry, full area of opening shall be deducted.

d) In case of openings of area above 3 sqm each deduction shall be made for opening on each face and jambs, sifts, sills shall be measured.

6.6 Plaster to ceiling and walls shall be measured separately if specified in the BOQ.

7.0 RATE

7.1 Description of item in the BOQ. unless otherwise stated, includes, wherever necessary, conveyance and delivery
handling, unloading, storing, fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting and fixing in position, straight cutting and waste, return of packings and other incidental charges.

7.2 Levels and heights shall be as approved by the Incharge/Architect.

7.3 Preparation of surface shall be as approved by the Incharge/Architect.

7.4 Trimming off the projections on masonry shall be included in the price.

7.5 Scaffolding and working platform shall be included in the price.

7.6 Materials as detailed and as required to complete item as specified shall be included in the price.

7.7 Curing of plaster shall be included in the price.

7.8 Cleaning of adjacent areas, windows, door frames, etc. including masonry surface in exposed masonry work,
shall be included in the price.

7.9 Forming grooves for joints between beams/columns and masonry etc. shall be included in the price. Any special
treatment if detailed shall be measured separately as billed in BOQ.

7.10 Providing and fixing chicken mesh at junction of R.C.C., blockwork, brick work, edges, corners, chiseled and
repaired block work/brick work prior to plaster over concealed conduit, etc. shall be as directed by the Incharge/Architect. It shall be considered as part of item and no separate charge will be payable.

SECTION – V A

DOORS - WINDOWS AND HANDRAILS TIMBER SUB FRAMES

1.0 INDIAN STANDARDS

1.1 Standard

Work shall be carried out to Indian Standards and Code of Practices. In absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies / confect noticed shall be directed to the Incharge/Architect for his direction/approval. However as a general rule more stringent specification shall take precedence.

(1) IS 287 Recommendation for maximum permissible moisture content for timber used for different purposes in different zones.

(2) IS 401 Code of practice for preservation of timber.

(3) IS 733 Specification for wrought aluminum, aluminum alloys, bars, rods,sections (for general engineering purpose)

(4) IS 851 Specification for synthetic resin adhesive for construction (non- structural) in wood.

(5) IS 852 Specification for animal glue for general wood working purposes.

(6) IS 1141 Code of practice for seasoning of timber

2.0 MATERIAL

2.1 Timber

2.1.1 Timber shall be of quality as specified in BOQ and well seasoned. It shall have uniform colour, be free from defects such as cracks, dead knots, soft spongy spots and waves of injurious open shakes. Grains shall be reasonably straight. The individual hard and sound knot shall not be larger than 6 sq. cm. The aggregate area of all knots shall not exceed 0.5% area of a piece.

2.1.2 All timber shall be treated with chemical wood preservatives and be kiln seasoned to IS 1141 and conform to IS 287 for moisture content. Maximum permissible limit shall be +3% for average moisture content of all samples from a given lot and +5% for individual sample of the given lot. This is applicable when thickness of timber is more than 50 mm. Small size tolerance shall be + 2% and +3% respectively.

2.1.3 Timber used shall be treated with a 10 years guaranteed and approved anti-termite treatment. Wood work in contact with masonry of concrete shall be painted with hot bitumen coal tar before being placed in position.

2.1.4 Timber received at site shall be marked and stamped for approval prior to being used at site.

2.1.5 Sizes specified are not indicative and shall be correct finished sizes within allowable tolerances.

2.1.6 All timber shall be finished to required dimension and texture prior to being treated for chemical preservation.

2.2 All nails, screws etc. Shall be hot dip galvanized or of brass or non ferrous material.

2.3 Adhesives and glue shall be as per IS for exterior quality and water repellent.

3.0 WORKMANSHIP

3.1 Timber door windows & hand rail sub frames etc.

3.1.1 Timber brought at site shall be as approved by the Incharge/Architect.

3.1.2 No timber shall be painted, tarred, oiled etc. before its inspection by the Incharge/Architect. Any effort to hide the defects by plugging, painting, etc. shall render the piece to be rejected by the Incharge/Architect.

3.1.3 All rejected timber shall be removed at once from the site of work.

3.1.4 All sawing of timber shall be done in straight lines and planes of uniform thickness.

3.1.5 All joints shall be tongued and grooved or of the type shown in the drawings specified in the item or as directed

by the Incharge/Architect. All joints shall be glued with approved adhesive. Joints shall be strong, neat and shall
fit without wedging or filling. They shall be pinned with hard wood or bamboo pins of 10-15 mm dia after the members of the frame are glued and pressed together in a suitable vice mechanism.

3.1.6 Prior to joining, wood members of frame shall be planed smooth and accurate to the full depth. Rebates, roundings, mouldings, etc. as shown in the drawing shall be done before the members are joined.

3.1.7 All timber items shall be subjected to inspection by the Incharge/Architect prior to any treatment to be carried
out. No. item shall be installed unless it is approved by the Incharge/Architect.

4.0 MEASUREMENTS / RATE

4.1 Door sub frames shall be measured in running metres as detailed in the BOQ.

4.2 The price for an item shall include supply of specified quantity and type of timber, sawn, cut, joined, framed and
fixed in positron including supply and fixing of approved anti-corrosive treated fixtures, straps, bolts, hold-fasts, spikes, nails, screws, etc. supplying glue, coal tar, paint and anti termite treatment. The items shall also include all materials, labour, scaffolding, use of equipment, etc.

SECTION-V B

ALUMINIUM STRUCTURAL GLAZING & CLADDING WORKS

1.0 STANDARDS

The contractor must comply with all relevant Indian and British Standards Code of practice and technical literature relating to best practice pertaining to structural glazing.. Nothing in this clause shall relieve the contractor of his obligations to provide a higher standard where required and directed.

(1) I S 3548 Glazing in building

(2) C P 152 Glazing & Fixing of glass for building

(3) HE 9 WP (I S 63400 WP) Aluminum Extrusion

(4) NAAMM Standard FCI – 89, Field check for water leakage of metal external glazing

(5) NAAMM Standard SG-1-70 Specifications for dense rubber like compression gasket materials.

1.1 A standard specifications for Aluminum Structures - current edition and standard specifications for aluminum
sheet metal work in building construction.

1.2 It is the Contractor's responsibility to ensure that the codes adopted in these works are acceptance to local
building authority

1.3 Any conflict discovered between the above mentioned codes and building regulations must be reported to the

Architect, for an instruction to be issued, but as a general rule, the more stringent shall apply.

Quality assurance – Single approved source responsibility

1.4 Glass – units shall be as detailed in B.O.Q./ of standard specifications

a. Glass for each to be procured shall be from one approved standard manufacture

b Fabricated glass to comply with ASTM C 1038, ASTM C 1046 and ANSIZ 97.I.

c Submit following certificates

1. Manufacturer's letter certifying glass and glazing material's compatibility.
2. Manufacturer's letter certifying sealed insulating glass units meet or exceed specifications.
3. Manufacture's test certificate for quality of glass supplied.

1.5 Sealants

a. Sealant used shall be confirming to standard as approved by the incharge /Architect & meet or exceed specifications.
b. Sealant manufacture to confirm compatibility and give certificate for the following:

1. Manufacturer's Certification that Products:

I) Furnished materials for project meet or exceed specified requirements.
II) Assembled for each joints are compatible with each other. III) Are suitable for indicated use.

2. Manufacture's certification that sealants, primers, and cleaners comply with local regulations controlling use of volatile organic compounds.
3. Contractor's certifications that products are installed in accordance with Contract Documents, based on inspection and testing specified in the Field Quality Control.

c. Authorized Sealant applicator to be employed for work. He shall have minimum five years experience of similar work.

1.6 Guarantee

Special Warranties: Prepare and submit

1. Warranty jointly signed by manufacture, installer and Contractor agreeing to repair and / or replace assemblies which fall in material or workmanship during warranty period of 10years.
2. Warranty stating insulated glass units to be free from condensation, fogging and construction of vision due to film on internal surface for 10 years.

2.0 SCOPE OF WORK

2.1 The contractor shall be responsible for supply, fabrication, installation, test and guarantee of all items including taking all measures that may be required to complete the work as per Architectural concept drawings and specifications details.

The specialist contractor shall submit an outline of recent comparable works by the firm/ it's technical partner to illustrate the competence, experience and suitability of the firm. The Brief scope of work is :

a) Supply of all items of structural glazing system as per drawings, engineering data and prepare test reports for concept of Architectural drawings.
b) Fabrication and installation of structural glazing system.
c) All anchors, fixing, attachments, reinforcements, steel reinforcing for mullions and transoms required for a complete installation, except those specifically indicated as being provided by other trades.
d) Finishes, protection coatings and other support members.
e) Sealing with approved sealants within and around the perimeter.
f) Provisions to receive electrical outlets and outlets for conduits and other electrical work.
g) Co-ordination with the work of main contractor and other trades.
h) Guarantee for 10 years

All final exterior and interior cleaning.

3.0 MATERIAL AND FINISHES

3.1.1 Aluminum extrusions shall be designed treated alloy IS 63400 or BS 6063-T5, 6063-T6 or 6061-T6 complying with BS 1474 and aluminum sheet shall be designated alloys 1100, 3003 or 5052 complying with BS 1470. All aluminum work shall be constructed of fully heat-treated aluminum alloy.

3.1.2 The extrusion shall be clean, straight and sharply defined lines, free from distortion and defects impairing appearance, strength or durability. They shall be of suitable wall thickness and profile for rigidity and strength in respect to tensile, shear and bearing stresses, capable of providing local and lateral stability.

3.1.3 Aluminum panel profiles and sizes shall be manufactured in accordance with drawings. No alternation of profile panel sizes and location of joints shall be accepted.

The system shall be adopted to meet all structural movement and performance requirements as specified in Indian standards.

3.1.4 Finish

Finish to aluminum framing members shall be micron powder coating of adequate thickness in required shade/ colour as detailed in B.O.Q./ of standard specifications.

3.2Steel

3.2.1All steel rolled shapes, plates, bars, cold rolled sheet etc. shall comply IS2062 or with the requirements of ASTM A36 or the relevant British Standards.

3.3 Separators

Separators between steel and aluminum members and where required shall be rigid type, high impact, smooth both sides Teflon with a minimum thickness of 0.8mm as approved by the Incharge / Architect.

3.4 Sealant

3.4.1 The compatibility and sequence of installation for all sealant must be carefully considered in all proposals in order to ensure the required cure and optimum performance.

3.4.2 All sealant shall be applied in strict compliance with manufacturer's instructions and recommendations. The contractor shall note that the sealant to be used between glass surfaces, and in adjoining areas shall preferably be supplied by one manufacture.

3.4.3 Gaskets - Structural gaskets shall be EPDM or neoprene with a high resistance to aging and allow joint movements.

3.5Glazing

3.5.1Glazing shall be as specified in drawing or BOQ or as per design requirement. It shall be Indian / imported hard coated reflective bronze and heat strengthened glass. It shall be of Saint Gobain, float or equivalent approved.

4. WORKMANSHIP

4.1 General

4.1.1 No materials, equipment or practices shall be used that may adversely affect the functioning, appearance and durability of the completed structural glazing, aluminium cladding and related construction. The work shall be accomplished in compliance with the specified criteria without bucking, opening of welds, cracking of glass, leakage or other harmful effects.

4.1.2 The materials used must be capable of withstanding the effects of in situ installation and allow sufficient tolerance to prevent damage to the finished surface.

4.1.3 Materials, finishes, shapes, sizes, thickness, and joint locations shall conform strictly to those required by the drawings and specifications.

4.1.4 All work shall be of the highest quality, in accordance with best trade practices, and performed by skilled workmen.

4.1.5 All components exposed in the finished work shall be free from warping & oil-cleaning effects.

4.2 Manufacturer's Standards

Materials, components and system incorporated in the work shall be in compliance with the standards and procedures of the appropriate manufacturers and the standards and codes referred to in this specification.

4.3 Storage and Handling

4.3.1 Wherever possible all materials shall be stored in dry, well-ventliated conditions prior to fabrication.

4.4 Jointing

4.4.1 Accurately fit and firmly secure all exposed metal joints with metal to metal hair line contacts.

4.4.2 All fastenings into or through aluminum shall be stainless steel, and installed at approved spacings. Fasteners shall not penetrate gutters and drainage system.

4.5 All the joints in aluminum framing system and glazed panels as well as joints between aluminum frame with concrete and/ or Masonry meeting surrounds shall be fully sealed and made air, water and weather tight

preventing seepage of rain water under heavy wind pressures with provision of adhesive silicone sealant and superior quality approved make EPDM gaskets.

4.6 Space at each floor level between the external face of the building frame and the internal face of the building frame and the structural glazing glazed panel shall be sealed air tight by horizontal barrier to prevent of smoke / fire, air conditioned air from one floor level to other floors. There shall be continuous seal for stopping fire and smoke between the structural glazing and the building face.

4.7 Sealants

All the joints in glazing shall be air and water tight and capable of preventing leakage of rain water under heavy wind pressure and under heavy weather conditions. Directions of the manufacturer of the sealant shall be strictly followed.

5.0 INSPECTION

All shop and field materials and workmanship shall be subject to inspection by the Incharge / Architect at all the times. These inspections shall not relieve the contractor from the obligation to provide materials conforming to all requirements of the contract Document and matching approved samples.

6.0 TESTING

The contractor shall be required to perform necessary test at approved laboratory.

6.1 Field Tests

Architect/Incharge on completion or during the progress may request the Contractor to carry out such test as required to conform acceptability.

6.1.1 In the event that such testing should result in uncontrolled leakage, the Contractor shall eliminate the causes of such leakage at no additional cost to the Employer. Remedial measures must maintain standards of quality and durability and are subject to approval.

Incharge/ Architect, If dissatisfied or on account any reason attributable to the contractor shall neither be eligible for any payment nor shall have recourse to approval. He shall not be eligible for any claim on the employer.

6.2 Cost of Test

The contractor shall pay for all cost towards testing. The contractor shall arrange witness of test to Architect/ Incharge and their representatives at his cost. This shall include all transport, lodging, boarding etc. by the Contractor.

7.0 CLEANING

7.1 The contractor shall ensure that all actions are taken during installation to eliminate the effects of corrosive substances on the finishes.

7.2 The contractor shall clean both internal and external surfaces to remove corrosive substances, dust or cement/mortar dropping during the installation as may directed and instructed by the Incharge/Architect.

The internal surfaces of glass and aluminium frame are to be cleaned with compatible cleaning agents prior to installation of the internal protective sheeting.

7.3 The contractor shall also make good any physical damage to the structure including scratches, dents, abrasions, pitting, etc. to the satisfaction of the Incharge/Architect.

8.0 PERFORMANCE GUARANTEE:

The structural glazing (if required) contractor shall offer a minimum of 10 years performance warranty on stamp paper of appropriate value for the entire installation carried out. The performance guarantee shall cover for replacement of any or all members and components by the structural glazing contractor at his own cost in case of any deficiency or failure in performance of the structural glazing component as per the design requirement during the warranty period.

9.0 **MESUREMENTS**

9.1 Measurements shall be as per B.O.Q. in Sq.m of actual area covered.

10.0 RATE

Rate shall include all required labour, material, testing at approved laboratory, breakage, wastage, supervision, taxes protection till hand over and free maintenance during defect liability period etc. complete.

COMPOSITE ALUMINIUM CLADDING (if required)

1.1 GENERAL All Aluminum panel used for the cladding of building shall be 4mm thick or as specified in B.O.Q. Aluminum Composite Panel (ACP) 25 micron or as specified in B.O.Q anodized aluminum sheet as manufactured, treated and supplied by ALPOLIC or equivalent approved.

1.2 Work shall include as detail in BOQ, drawings without being limited following

- Aluminum cladding system as of APOLIC or equivalent
- All hardware
- All anchors fixing, attachments, reinforcements, sections as required in supports & backing
- Finishes, protections coatings & treatments
- All caulking, sealing, clastomeric and metal flashing, and gasket including seating at junctions with building.
- Electrical bonding and earthing of all metal claddings elements.
- Provision for electrical contents and conduits and other electrical work.
- Scheduling & monitoring of work
- Samples, mockups and test units
- Co-ordination with the work of other agencies
- Testing and verification of component and total assembly.
- Storage handling protection and cleaning
- Final cleaning interior and exterior prior to handover
- Guarantees
- Fixing to be done in conjunction with Curtain Wall system.

1.3All work in this section shall comply with the standards, codes, specified and also with local codes requirements and regulation.

1.3.1 Codes and Standards followed shall be

- Indian standards as published by the Bureau of Indian Standards
- British Standards published by British Standard Institution.

2.0 MATERIAL

2.1 Aluminum panel shall be of 4mm / 6mm thick sheet or as specified in B.O.Q.

Aluminum sheet and plate shall confirm to Bs 6063 – 76 and ASTM B 209-73. Anodizing sheet and plate shall confirm to S 1615 AA 20.

The finished surfaces shall be factory protected with self adhesive peel-off foil to withstand exposure to local weather condition without loosing the original peel of characteristic or causing stain or other damage.

2.1.1 All materials shall be free from any defect that may impair the strength, functioning, durability or appearance of the work.

2.1.2 Materials not specified shall be of the best quality and suitable for the purpose intended and as approved by the Incharge / Architect.

2.2.1 Dimensional tolerance

Width	: + 2.0 mm
Length	: + 4.0 mm
Thickness	: + 0.2 mm for 3 mm and 4mm thick panel + 0.3 mm for 6mm thick Panel
Bow	: Maximum 0.5% of the length and / or width
Squareness	: Maximum 5.0mm
Surface defect	: The surface shall not have any irregularities such as roughness, buckling and other imperfections.

2.3 Anchors and Connections

(a) Anchors and connections shall be provided to fully satisfy their required purpose of adjustability, movement and load transfer.

(b) All anchors, connections and fixing outboard of the air seal shall be stainless steel / Hot dip galvanized.

2.4 Corrosion Protection

Aluminum surfaces in contact with mortar, concrete, fireproofing, plaster, masonry, or absorptive materials ofany kind shall be coated with an anti-galvanic material, impervious to moisture.

2.5Lightning Protection

(a) All metal cladding components, as above shall be connected to building ground by earthing jumper cables and connections.

2.6 Storage and Handling

(a) Materials shall be stored in a dry, well ventilated location.

3.0 PERFORMANCE

3.1 The Contractor shall demonstrate compliance with Quality Assurance Standards and submit a comprehensive Quality Assurance Programme covering all phases of the work.

4.0 GUARANTEE

The Contractor shall give guarantee against any defects in the workmanship, quality of materials or performance of Contract Works to repair or replace defective workmanship during warranty period. The Contractor shall repair defective work at his own cost.

The contractor shall offer a minimum of 10 years performance warranty on stamp paper of appropriate value for the entire contract works carried out after the date of virtual completion.

SECTION – VI

WATER PROOFING WORK

1.0 GENERAL

1.1 Work shall be carried out to Indian Standards and Code of Practices. In absence International Standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be directed to the Incharge/Architect for his direction/approval. However as a general rule more stringent specification shall take precedence.

1. IS 269 Specification for 33 grade ordinary and low heat Portland cement.
2. IS 383 Specification for coarse and fine aggregates from natural sources.
3. IS 2645 Specification for integral cement water proofing compound.
4. IS 6494 Code of practice for water proofing of underground reservoirs and swimming pool.
5. IS 8112 Specification for 43 grade ordinary Portland cement.
6. IS 12118 Specification for two part polysulphide based cement:

   Part – I general requirements.
7. IS 13826 Method of Test.
8. IS 3495 Method of Test for Burnt clay building bricks.

1.2 Quality Assurance

1.2.1 Manufacturer's Qualification

a) Not less than five years experience in manufacturing of membrane roofing.

1. Obtain primary materials from single manufacturer. Manufacturer's name shall appear on containers and accessories.
2. Provide secondary materials as required by manufacturer of primary materials.

1.2.2 Applicators Qualification

a) Approved by manufacturer prior to execution of this Contract, with experience on at least five projects.

b) Foreman of Field Crew: Minimum five years experience with system of waterproofing being installed.

1.2.3 Certifications

Manufacturer's certification on manufacturer's letterhead:

1. Certify system design; penetration, transition; and perimeter details; and system specification areappropriate and satisfactory for this particular project.
2. Certify products proposed for use comply with standards.
3. Certify materials ordered and supplied are compatible with each other, suited for local and purpose intended and shipped in sufficient quantity to ensure proper timely installation.
4. Certify materials have express warranty of merchantability and fitness for particular purposes of this Project.
5. Certify manufacturer has reviewed Project and will issue warranty upon successful completion of installation.
6. Certify materials shopped to site meet membrane manufacturer's published performance standards and requirements of this Specification.
7. Membrane manufacturer's approval of insulation type and method of installation.
8. Manufacturer' s approval of installer.

1.3 Submittals

1.3.1 Product Data

Contractor to submit along with his proposal product data for material he proposes to use.

1.3.2 Informational Submittals

a) Certifications specified in quality assurances

b) Manufacturer's instructions

1.4 Waterproofing compounds

1.4.1 Waterproofing compounds shall be compendious (cement based) non-shrinking, self curing mixtures. These shall be

- ❖ Free from sodium and chlorides
- ❖ Free from material detrimental to concrete and reinforcement.
- ❖ Able to create a membrane in one or multiple coats as per manufacturer's instruction.
- ❖ Membrane capable to prevent infiltration when applied to interior faces and ponded.
- ❖ Permeability, shear bond strength, compressive strength, volume changes meets minimum requirements of codes.

1.4.2 Accessories

All other accessories materials such as primers, bonding agents, polymers etc. shall be as recommended by waterproofing manufacturer.

1.5 Warranty

A. Special Warranty:

1. Warranty with attachments for full replacement value of completed installation signed by manufacturer, applicator and Contractor warranting against water infiltration and defects of materials and workmanship for period of ten years.

2. Provide warranty that covers labour and workmanship, including labour for access to waterproofing, for watertight warranty.

a) Warrant penetrations, terminations, changes of direction, and membrane.

b) Warranty shall include removing and reinstalling superimposed work covering waterproofing.

2.0 MATERIALS

2.1 Cement

2.1.1 Cement shall be ordinary Portland Cement conforming to IS and shall be of grade 43 or 33. It shall be received in bags of 50 Kg and each batch shall be accompanied with a test certificate of the factory. Also it shall be tested before use to ascertain its strength, setting time, etc. In case cement has been stored for over 6 months or for any reasons the stored cement shows signs of deterioration or contamination, it shall be tested as per the direction of the Incharge/Architect prior to use in the works.

2.1.2 Cement shall be stored in such locations so as to prevent deterioration due to moisture dampness. A dry and water proof shed shall be provided. Bags shall be stacked on rigid water-proof platforms about 15 to 20 cm clear above the floors and 25 to 35 cm clear or away from the surrounding walls. A maximum high stack of 12 bags is permitted. Stacks shall be so arranged that the first batches are used first (FIFO), and that they permit easy access for inspection and handling.

2.2 Sand (coarse sand FM above 2.25 & Fine sand F M more than 1.25)

2.2.1 Natural sand deposited by stream or glacial agencies as a result of disintegration of rock is the best form of sand and shall be used.

2.2.2 Sometimes it is obtained from crushed stone screenings but often contains a high percentage of dust and clay. It tends to be flaky and angular. This type produces harsh concrete and should be avoided.

2.2.3 Sea sand shall not be used.

2.2.4 Sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain any appreciable amount of clay. Sand shall not contain harmful impurities such as iron, pyrites, coal particles, lignite, mica shale or similar laminated material, alkali, and organic impurities in such form or quantities as to affect the strength or durability of concrete or mortar.

2.2.5 When tested as per IS 2386 Part I and Part II, sand shall not exceed permissible quantities of deleterious materials as given in table 1 of IS 383.

2.2.6 Grading of sand shall conform to IS and shall fall within limits.

2.2.7 Sand shall be stored in such a way that it does not get mixed with mud, grass, vegetables and other foreign matter. The best way is to have a hard surface platform made out of concrete, bricks or planks. It should be to the approval of the Incharge/Architect.

2.3 Brick bats (CLASS 150)

2.3.1 It shall be prepared from well-burnt bricks. In no case shall under-burnt bricks be used. Flaky and elongated pieces shall be avoided. It should also be free from adherent coatings of soil or silt. Brick bats should be free from alkalis, soft fragments, organic impurities, etc. in such quantities as not to affect strength and durability of concrete.

2.3.2 Water absorption for the bricks after 24 hours immersion in cold water shall not exceed 15%.

2.4 Water

2.4.1 Water used for mixing and curing shall be clean, reasonably clear and free from objectionable quantities of silt, oils, alkalis, acids, salts so as not to weaken mortar, or concrete or cause efflorescence or attack the steel in RCC while curing. It shall be free of elements, which significantly affects the hydration reaction. Potable water is generally satisfactory but it shall be tested prior to use in the works.

2.4.2 Water tested shall be such as to prevent any deleterious materials getting mixed with it.

2.4.3 Water shall be tested and approved in writing by the Incharge/Architect prior to use in the works.

2.5 Stone tiles such as kota / shahbad shall be of best quality and free from any defects and of uniform thickness.

2.6 MEMBRANE

2.6.1 Synthetic elastomeric polymerized semisolid liquid and forming a film on curing.

2.6.2 Properties shall confirm to requirement as under:

1.	Material	:	Free from sodium and chlorines
2.	Chemicals	:	Not detrimental to concrete or reinforcing steel.
3.	Colour	:	Manufacturer's standard
4.	Testing Standards		
a)	Water	:	IS 3085
b)	High temperature stability	:	ASTM D-794
c)	Abrasion	:	ASTM D-968/57
d)	Salt spray test	:	IS 2074
e)	Acid / Alkali resistance	:	Unaffected over a period of 30 days by sulphuric acid solution pH 1 and sodium carbonate solution pH 13.5
f)	U.V. resistance	:	ASTM D-322
g)	Sword hardness after one week	:	50
h)	Elongation	:	20%
i)	Impact	:	25 Lb. test
j)	Abrasion Index	:	10-13

2.6.3 Accessories

Primers, bonding agents, water stops or plugs etc. as per recommendations of the manufacturer.

2.6.4 Mixes

a) Mix materials in accordance with manufacturer's instructions

b) Mix in clear containers

c) Do not re-temper mix after initial set.

2.7 Delivery / Storage

All materials shall be delivered and stored at site conforming to following minimum requirements.

- ❖ Material received is approved by Incharge/Architect.
- ❖ Material is in unopened container and labeled with manufacturer's name, brand name and instruction for use.
- ❖ Material received shall be along with manufacturer's certificate for quality and period of manufacture.
- ❖ Material shall be stored in dry, well ventilated and covered storage if so desired by manufacturer.
- ❖ Primers, adhesives etc. shall be as recommended by the membrane manufacturer.

3.0 SCOPE OF WORK

3.1 Work shall include supply, installation and test proprietary waterproofing systems to underground structure,
terraces, toilet sunk slabs, water tanks etc. This shall be guaranteed for 10 years on Rs. 100/- stamp paper in Performa to be approved by the Incharge/Architect.

a) Water proofing of basement including sealing of services junctions, drain points, sumps shall be as per approved
box type proprietary treatment.

b) Water proofing of terrace inclusive of grouting, sealing rainwater down takes outlets, other services outlets,
junctions of walls, slab, beam, columns, parapet wall etc., where required expansion joints all as per approved terrace proprietary treatment.

3.2 Waterproofing of toilet sunk portions and water tanks inclusive of grouting, sealing, outlet pipes of services,
junctions of slab, beams, walls and covering with protective cement sand plaster coat / screed.

3.3 Work shall include supply, installation and test proprietary box type system for basement and terrace system for
sloped/flat roofs as approved by the Incharge/Architect. This shall be guaranteed for 10 years on Rs. 100/- Stamp paper in proforma to be approved by the Incharge/Architect.
Work shall conform to minimum standards specified. Systems detailed hereunder are to clarify type of water proofing system expected. Contractor is at liberty to suggest and submit equivalent system with products meeting / exceeding standards.

3.4 Sub Contractor / specialist shall be from the approved list and shall be approved by the Incharge/Architect in
writing before being employed by the Contractor.

3.5 The Contractor shall submit

1. Statement giving detailed brief of work he proposes to carry out.

a) Name of agency with his experience certificate and quantum of work carried out. b) Technical Specifications

c) Product data sheets of material to be used

d) Shop drawing detailing

- Sections coordinated with typical installation details
- Vertical termination and sealing
- Laps needed if any
- Typical expansion, construction and control jointing details with minimum requirement.
- Horizontal fixing and laying details.
- Typical finishing arrangement.
- Flashings if required.

e) Protective measures to be taken.

f) Installation guidance

g) Samples of each product in duplicate fixed over plywood boards or similar to enable proper cross sections.

h) Manufacturer's certificate that product and material to be used is correct and shall give intended results when
applied through authorized agency.

4.0 WORKMANSHIP

4.1 **FLOOR**

Preparation of Surfaces

a) The surfaces to receive the treatment shall be thoroughly cleaned of

- Laitance, scales, loose material on surface.
- Grease, oil or other contaminants by etching with 10-15% of solution of muriatic acid using commercial grade alkaline cleaner, flushing with clean water drying and vacuuming.

b) Surfaces shall be examined and well defined cracks grouted by making 'V' groove / notches with cement slurry, shall be cured and dried well before treatment.

c) Any honeycombs shall be carefully cut and plugged, and cured well before treatment.

d) Examination of surface shall account for the fact that,

- Surfaces are cured for 14 days and no condensation has taken place.
- Horizontal and vertical surfaces have smooth finish, free from defects.
- Surfaces are dry, clean, free of grease, oil, dirt, rust, corrosion, other coatings and contaminants which could affect bond of water proofing system.

1) Preparation of surface by cleaning, leveling etc.

2) 20 mm thick cement-sand-bedding mortar 1:3 (1 cement : 3 coarse sand) mixed with water proofing powder 4% by weight of cement shall be laid on surface and 20 mm graded aggregate free from impurities shall be spread on the floor. It shall be cured for 3 days.

3) Provide insert socket and pipes to release the sub soil water pressure.

4) Then 20 mm thick rough kota or similar stones of approximate 600x600 mm in size shall be laid flat over 20mm th. 1st layer mortar and joints sealed & grouted with cement slurry mixed with WPC. This shall project 300 mm all around RCC raft.

5) Then the surface shall be screened with 25mm th. cement- coarse sand-1:3 mortar and finished smooth.

6) RCC raft, walls or masonry shall be constructed as per design and standard specification.

7) The sockets / pipes are grouted with pressure.

8) Columns or any support etc. coming out of raft shall be sealed properly with aforesaid treatment / polysulphide sealant at all levels including and at top of raft / design foundation.

4.2**WALL**

When walls are fully examined and prepared as detailed above, the treatment shall be

1) About 20 mm thick stone slabs shall be fixed with cement slurry grout. Grout mixed with water proofing compound 4% by weight of cement and joint 20mm thick (min) are well grouted and cured properly with 1:3 (cement : 3 coarse sand) mortar mixed with WPC.

2) External surface shall be plastered 20 mm thick with cement sand mortar 1:4 (1cement: 4 coarse sand) mixed with 4% by weight of water proof compound with heat cement punning mixed with WPC complete at all levels as directed by E/I Architect.

3) Vertical joint shall be well cleaned and grouted to make sure it forms a continuous treatment. If required joint may be treated with sealant.

4) Treatment shall be taken about 300 mm above finished level.

5) All pipes etc. coming out of walls shall be sealed by grouting with sealant.

4.3 **TERRACE WATERPROOFING (BRICK BAT COBA)**

4.3.1 Experienced water proofing specialists shall carry out the following or similar types of water proofing treatments. Terraces and roof slabs shall be treated with integral cement based waterproofing consisting of block koba concrete laid to slope. The treatment shall be taken over vertical surfaces as required / specified. Final finished surfaces may be laid with paving tiles, stones or finished smooth in cement and marked with false chequered marking. Points given below are just for guidelines. The actual steps and details shall be as per standard specifications and accordingly submitted by the contractor for approval of the Incharge/Architect. Work shall be carried out as per Indian standards approved method by the Incharge/Architect.

4.3.2 Surface preparation

The surface to be treated shall be cleaned and inspected thoroughly

a) All minor, medium cracks shall be marked.

b) All cracks shall be well defined and 'V' groove made. These shall be cleaned with compressed air, grouted with cement sand mortar 1:4 (1 cement: 4 sand) slurry mixed with non shrinking and waterproofing compound. Areas well cured.

c) Then again surfaces shall be well cleaned of all loose particles, laitance, moss, oil / greasy material, cement etc.

d) Roof areas shall be well marked with spot datums to create ridge, lines, slopes and drain points for easy draining of water (Nominal slopes shall be about 1:100).

e) Cement sand mortar mixed in ration 1:4 along with water proofing and non-shrinking compound as specified by manufacturer shall be mixed with clean water and layer of about 20 to 30 mm laid over the entire

area to be treated; then well soaked saturated block bats shall be arranged by proper placing to create required slope as per datum established. Minimum thickness at draining point shall be 75 mm. Rain water inlet, pipes etc. shall be well grouted; edge, corners shall be well rounded (watta) by taking up treatment about 300 mm above proposed finished level.

f) These mortar laid and bat fixed area shall be kept dipped in water for at least 3 days.

g) Slab and roof soffits shall be examined for dampness from under. Any leakage / dampness noticed shall be treated with pressure grouting and again checked by dipping the area for 3 days.

h) When no dampness noticed, area shall be drained out and cement sand mortar mixed in ratio 1:4 (1 cement: 4 sand) shall be spread over the entire area and bats well grouted.

The top surfaces shall be finished to a neat horizontal datum level to achieve well defined ridges, gutters, watta etc. Edges shall be tucked in grooves in wall / parapet about 300 mm above proposed finished level.

i) Surfaces shall be finished / prepared to receive about 40 mm thick IPS (Indian patent stone) or China mosaic etc.

j) All expansion joints shall be cleaned, primed and finished with sealant as specified by manufacturer of sealant and approved by Incharge/Architect.

4.3.3 Products and Manufacturers Acceptable Products:

1. Distilment DS+ MC-Bauchemie (India) Pvt. Ltd.

   Nafufill – VV2

2. Formak 629 Aqua Alliance Agencies
3. Tapecrete CICO
4. Hydro-tight Xypex
5. Polyakk-WP Sunanda Speciality Coatings
6. Mastercrete M-81 Choksey Chemicals Pvt. Ltd.

4.4 Basement Top terrace waterproofing

Experienced water proofing specialist shall carry out the above or similar types of waterproofing treatments. Terraces and roof slabs shall be treated with integral cement based waterproofing consisting of light weight Perlite brick bat coba concrete laid to slope. The treatment shall be taken over vertical surfaces as required / specified. Final finished surfaces may be laid with flooring / paving tiles, stones or finished smooth with cement.

4.5Points given below are just for guidelines. The actual steps and details shall be as per standard specification submitted by the contractor for approval of the Architect. Work shall be carried out as per Indian standards approved method by the Architect.

4.6. Surface preparation

4.6.1 The surface to be treated shall be cleaned and inspected thoroughly

a) All minor, medium cracks shall be marked.

b) All cracks shall be well defined and 'V' groove made. These shall be cleaned with compressed air, grouted with cement sand mortar 1:4 (1 cement: 4sand) slurry mixed withnon shrinking and waterproofing compound. Areas well cured.

c) Then again surfaces shall be well cleaned of all loose particles, laitance, moss, oil / greasy material, cement etc.

d) Roof areas shall be well marked with spot datum to create ridge, lines, slopes and drain points for easy draining of water (Nominal slopes shall be about 1:100).

e) Light weight Perlite concrete having density 450kg/Cum shall be mixed as specified by the manufacturer, with clean water and layer of about minimum 75 mm laid over the entire area to be treated; creating required slopes as per datum established. Rain water inlet, pipes etc. shall be well grouted; edge, corners shall be well rounded (watta) by taking up treatment about 300 mm above proposed finished level.

f) 4 mm thick APP Polymer modified polyester reinforced torch on membrane (Garden Moply FP 4) of STP Texsa Ltd., 16, NGN, Vaidya Marg, Bank Street, Fort, Mumbai- 400 023 (Tel: 022 22664643, Fax: 022 22661730) or equivalent approved; is laid over light weight concrete, Control and construction joint shall be reinforced with membrane strip as specified by manufacturer. All corner joints between vertical and horizontal surfaces shall be reinforced with strip as specified by the manufacturer. Expansion joints are formed as detailed and approved by structural consultant. Drains shall be sealed with proper flashings and laps as per details approved in shop drawing.

g) Slab and roof shall be examined for dampness from under. Any leakage / dampness noticed shall be treated with pressure grouting and again checked by dipping the area for 3 days.

h) When no dampness noticed, area shall be drained out and cement sand mortar mixed in ratio 1:4 (1 cement : 4 sand) shall be spread over the entire area and well grouted.

The top surfaces shall be finished to a neat horizontal datum level to achieve well defined ridges, gutters, watta etc. Edges shall be tucked in grooves in wall / parapet about 300 mm above proposed finished level.

i) Surfaces shall be finished / prepared to receive about 30 mm thick cement sand mortar screed about 30 mm thick over laid membrane and cured.

j) All expansion joints shall be cleaned, primed and finished as per specification and grouted with sealant as

specified by manufacturer of sealant and approved by Architect.

4.7 Waterproofing to water retaining structures

4.7.1Crystalline waterproofing of Xypex or equivalent approved; waterproofing compound one / two coat shall be

applied to water retaining structures.

4.7.2 Steps followed shall be as per the directions of the manufacturers and approval of the In charge /Architect. For

guideline following steps may be followed.

1. Surface preparation

Clean the surface to remove dust, loose particles and laitance.

2. Apply Crystalline waterproofing compound one / two coats at specified intervals as recommended by the manufacturer on concrete / plastered surface.

3. Protect horizontal surfaces with 30 mm thick IPS 1:2:4 (1 cement : 2 sand : 4 aggregates) laid to gradient; with adding waterproofing compound 2% by weight of cement and vertical surfaces shall be plastered with cement sand mortar in a ratio of 1:4 (1 cement : 4 sand) with using 2% waterproofing compound by weight of cement.

4. butts and rounding of corners, junctions with walls and floors and finished smooth and cured.

5. Curing shall be done for 7 days.

4.7.3 Treatment shall be tested by ponding water about 250 mm high for 72 hours. Surfaces shall be examined for leakage seepage, dampness, sweating etc.

4.7.4 Measurements shall be in square metre for finished surface area. Rates shall include all items right from cleaning of surface to completion and testing required against defects such as leakage, seepage, dampness, sweating etc. and providing guarantee of employer's.

5.0 TESTING

5.1 On completion of installation and prior to next operation or as directed by Incharge/Architect work shall be tested by the Contractor. Required water shall be arranged and disposed of by the contractor at his cost.

a) All openings, drains etc. shall be plugged.

b) Water shall be flooded about 200 mm over the Sunk portion. Water shall be kept for 72 hours.

c) Surfaces shall be observed critically and incase any leakage is observed areas shall be treated again and tests to be carried out again to the satisfaction of the Incharge/Architect.

5.2 Approval of water test does not relieve the contractor of his obligation of providing installed water proofing guaranteed for 10 years as per contract.

5.3 All arrangement of material, labour etc. required including preserving and maintaining areas flooded shall be carried out by the Contractor at his cost.

6.0 GUARANTEE

All waterproofing systems described above are to be referred as guide-lines only. The contractor may proposethe system along with his tender, giving full descriptions.

6.1 The system shall be guaranteed for 10 years against all defects and liabilities thereof from the date of completion of project. The guarantee shall be on Stamp Paper of Rs. 100/- in Performa to be approved by Employer / Incharge/Architect. (The contractor shall submit Performa to PM/ RE for approval of Employer before being written on Stamp Paper). The cost of Stamp Paper shall be to the contractor's account.

6.2 Work shall be carried through approved specialist agency as per method of working approved in writing by the Incharge/Architect.

II- PLUMBING WORKS – SANITARY, WATER SUPPLY, DRAINAGE & SEWERAGE

TECHNICAL SPECIFICATIONS FOR PLUMBING WORKS

GENERAL

a) All sanitary and plumbing work shall be carried out by skilled and licensed plumbers. It shall comply by local
Byelaws, where applicable.

b) The pipe shall be carefully cleared of all foreign matter before being laid. They shall be thoroughly brushed out internally with a well-fitted hard brush, and after laying, the open end shall be temporarily plugged to prevent ingress of water, soil etc. Precautions shall be taken to prevent flotation of the plugged pipe.

Any coating, sheathing or wrapping of the pipes shall be examined for damage and repaired, where necessary, and shall also be made continuous over the joints.

(c) All joints shall be made properly so as to be mechanically sound and leak-proof. (d) Excavation and refilling shall be carried out as per specification.

The bottoms of trench excavations shall be carefully prepared so that the barrels of the pipes when laid are well bedded for their whole length on a firm surface and are true to level and gradient

In the refilling of trenches the pipes shall be surrounded with the fine selected material, well rammed so as to resist subsequent movement of the pipes. No stones shall be in contact with the pipes and when the excavation is in rock, the excavation shall be continued to 15 cm below the level required for laying pipes and subsequently brought to the required levels by filling with a layer of the fine selected materials or (especially where there is a steep gradient) on a layer of concrete.

Refilling of trenches shall not be carried out until the laying and jointing have been approved and passed by the Engineer-in-charge.

When roads have to be crossed, half the width shall be dug at a time and proper warning notices, signs and lights shall be displayed and watchmen posted to prevent the accidents.

All types of pipes, water mains, cables etc. met within the course of excavation shall be carefully protected and supported. Care shall be taken, not to disturb the electrical and communication cable, removal of which, if necessary, shall be arranged.

WATER SUPPLY

1. GENERAL REQUIREMENTS :

(a) Any damage caused to the building, or to electric, sanitary water supply or other installations etc. therein either due to negligence on the part of the contractor, or due to actual requirements of the work, shall be made good and the building or the installations shall be restored to its original condition by the contractor.

Nothing extra shall be paid for it, except where otherwise specified.

(b) All water supply installation work shall be carried out through licensed plumbers.

(c) It is most important to ensure that wholesome water supply provided for drinking and culinary purposes, is in no way liable to contamination from any less satisfactory water. There shall, therefore, be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting for conveying or containing impure water or water liable to contamination or of uncertain quality of water which has been used for any purpose. The provision of reflux or non return valves or closed and sealed valves shall not be construed a permissible substitute for complete absence of cross-connection.

(d) No piping shall be laid or fixed so as to pass into, through or adjoining any sewer, scour outlet or drain or any manhole connected therewith nor through any ash pit or manure-pit or any material of such nature that would be likely to cause undue deterioration of the pipe.

(e) Where the laying of any pipe through fouled soil or pervious material is unavoidable, the piping shall be properly protected from contact with such soil or material by being carried through an exterior cast iron tube or

by some other suitable means. Any piping or fitting laid or fixed, which does not comply with the above requirements, shall be removed and re-laid in conformity with the above requirements.

2. MATERIALS :

The standard size of brass or gunmetal fittings shall be designated by the nominal bore of the pipe outlet to which the fittings are attached. A sample of each kind of fittings shall be got approved from the Engineer-in-charge and all supplies made according to the approved samples.

All cast fittings shall be sound and free from laps, blow holes and pitting. Both internal and external surfaces shall be clean, smooth and free from sand etc. Burning, plugging stopping or patching of the casting shall not be permissible. The bodies, bonnets, spindles and other parts shall be truly machined so that when assembled the parts shall be axial, parallel and cylindrical with surfaces smoothly finished. The area of the water way of the fittings shall not be less than area of the nominal bore, chromium plating wherever specified shall be of 0.3 micron conforming to IS : 4827. The chromium shall never be deposited on brass unless a heavy coating of nickel is interposed. In the case of iron a thick coat of copper shall first be applied, then one of nickel and finally the chromium. In finish and appearance the plated articles when inspected shall be free from plating defects such as blisters, pits roughness and unplated areas and shall not be stained or discolored. Before fitting is plated the washer plate shall be removed from the fittings, the gland packing shall be protected from the plating solution.

(a) Galvanized Iron pipes (G. I. Pipes) :

(i) The pipes (tubes) shall be galvanized mild steel hot finished seamless (HFS) or welded (ERW) screwed and socketed conforming to the requirements of IS : 1239 Part – I for medium grade. They shall be of the diameter (nominal bore) specified in the description of the item, the socket shall be designated by the respective nominal bores of the pipes for which they are intended.

(ii) **Galvanizing shall conform to IS : 4736 :** The zinc coating shall be uniform adherent, reasonably smooth and free from such imperfections as flux, ash and dross inclusions, bare batches, black spots, pimples, lumping runs, rust stains, bulky white deposits and blisters. The pipes and sockets shall be cleanly finished, well galvanized in and out and free from cracks, surface flaws laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly, and square with the axis of the tube.

(iii) **Fittings :** The fittings shall be galvanized mild steel tubular or wrought steel fittings conforming to IS : 1239 (Part – II) or as specified. The fittings shall be designated by the respective nominal bores of the pipes for which they are intended.

(b) Full Way Valve with Wheel – Gun Metal : These shall be of the gun metal fitted with wheel and shall be of gate valve type opening full way and of the size as specified. These shall generally conform to IS: 778.

LAYING AND JOINTING OF WATER SUPPLY PIPES AND FITTINGS

1. UNLOADING :

(a) The pipes shall be unloaded where they are required.

(b) Unloading (except where mechanical handling facilities are available) – pipes weighing upto 60 kg shall be handled by two persons by hand passing. Heavier pipes shall be unloaded from the lorry or wagon by holding them in loops, formed with ropes and sliding over planks set not steeper than 45 degree. The planks shall be sufficiently rigid and two ropes shall always be used to roll the pipes down the planks. The ropes should be tied on the side opposite the unloading. Only one pipe shall be unloaded at a time.

(c) Under no circumstances shall be the pipes be thrown down from the carriers or be dragged or rolled along hard surfaces.

(d) The pipes shall be checked for any visible damage (such as broken edges, cracking or sapling of pipe) while unloading and shall be sorted out for reclamation. Any pipe which shows sufficient damage to preclude it from being used shall be discarded.

2. STORING :

(a) The pipes and specials shall be handled with sufficient care to avoid damage to them. These shall be lined up on one side of the alignment of the trench socket facing upgrade when line runs uphill and upstream when lines run on level ground.

(b) Each stack shall contain pipes of same class and size, consignment or batch number and particulars of the suppliers, wherever possible, shall be marked on the stack.
(c) Storage shall be done on firm, level and clean ground. Wedges shall be provided at the bottom layer to keep the stack stable.

3. CUTTING :

(a) Cutting of pipes may be necessary when pipes are to be laid in lengths shorter than the lengths supplied, such as while replacing accessories like tees, bends, etc. at fixed position in the pipe lines.
(b) A line shall be marked around the pipe with a chalk piece at the point where it is to be cut. The line shall be so marked that the cut is truly at right angle to the longitudinal axis of the pipe.

4. TRENCHES :

(a) The trenches shall be so dug that the pipes may be laid to the required alignment and at required depth.
(b) Cover shall be measured from top of pipe to the surface of the ground.
(c) The bed of the trench, if in soft or made up earth, shall be well watered and rammed before laying the pipes and the depressions, if any, shall be properly filled with earth and consolidated in 20 cm layer.
(d) If the trench bottom is extremely hard or rocky or loose stony soil, the trench shall be excavated at least 150 mm below the trench grade. Rocks, stone or other hard substances from the bottom of the trench shall be removed and the trench brought back to the required grade by filling with selected fine earth or sand (or fine moorum if fine soil or sand is not available locally) and compacted so as to provide a smooth bedding for the pipe.
(e) After the excavation of the trench is completed, hollows shall be cut at the required position to receive the socket of the pipes and these hollows shall be of sufficient depth to ensure that the barrels of the pipes shall rest throughout their entire length on the solid ground and that sufficient spaces left for jointing the underside of the pipe joint. These socket holes shall be refilled with sand after jointing the pipe.
(f) Roots of trees within a distance of about 0.5 meter from the side of the pipe line shall be removed or killed.
(g) The excavated materials shall not be placed within 1 meter or half of the depth of the trench, whichever is greater, from the edge of the trench. The materials excavated shall be separated and stacked so that in refilling that may be re-laid and compacted in the same order to the satisfaction of the Engineer-incharge.
(h) The trench shall be kept free from water. Shoring and timbering shall be provided wherever required. Excavation below water table shall be done after dewatering the trenches.
(i) Where the pipe line or drain crosses an existing road, the road crossing shall be excavated half at a time, the 2nd half being commenced after the pipes have been laid in the first half and the trench refilled. Necessary safety measures for traffic as directed shall be adopted. All types, water main cables, etc. met within the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the electrical and communication cable met with during course of excavation, removal of which, if necessary, shall be arranged by the Engineer-in-charge.

5. LAYING :

(a) The pipes shall be lowered into the trench by means of suitably pulley blocks, sheer legs chains ropes etc. In no case the pipes shall be rolled and dropped into the trench. One end of each rope may be tied to a wooden or steel peg driven into the ground and the other end held by men which when slowly released will lower the pipe into the trench. After lowering, the pipes shall be arranged so that the spigot of one pipe is carefully centered into the socket of the next pipe, and pushed to the full distance that it can go. The pipe line shall be laid to the levels required. Specials shall also be laid in their proper position as stated above.
(b) Where so directed, the pipes and specials may be laid on masonry or concrete pillars. The pipe laid on the level ground, shall be laid with socket facing the direction of flow of water.
(c) In unstable soils, such as soft soils and dry lumpy soils it shall be checked whether the soils can support the pipe lines and if required suitable special foundation shall be provided.

6. THRUST BLOCKS :

(a) Thrust blocks are required to transfer the resulting hydraulic thrust from the fitting of pipe on to a larger load bearing soil section.
(b) Thrust blocks shall be installed wherever there is a change in the direction / size of the pipe line or the pressure line diagram, or when the pipe line ends at a dead end. If necessary, thrust blocks may be constructed at valves also.
(c) Thrust blocks shall be constructed taking into account the pipe size, water pressure, type of fitting, gravity component shell when laid on slopes and the type of soil.

7. BACK FILLING AND TAMPING :

(a) Back filling shall follow pipe installation as closely as possible to protect pipe from falling boulders, eliminating possibility of lifting of the pipe due to flooding of open trench and shifting pipe out of line by caved in soil.
(b) The initial back fill material used shall be free of large stones and dry lumps.
(c) The initial back fill shall be placed evenly in a layer of about 100 mm thick. This shall be properly consolidated and this shall be continued till there is a cushion of at least 300 mm of cover over the pipe.
(d) If it is desired to observe the joint or coupling during the testing of mains they shall be left exposed. Sufficient back fill shall be placed on the pipe to resist the movement due to pressure while testing.

8. HYDROSTATIC TESTS :

(a) After a new pipe has been laid, jointed and back filled (or any valve section thereof), it shall be subjected to the following two tests :
(j)**Pressure test :** At a pressure of at least double the maximum working pressure-pipe and joints shall be absolutely water tight under the test.
(ii)**Leakage test :** (To be conducted after the satisfactory completion of the pressure test) at a pressure to be specified by the authority for a duration of two hours.
(b) **Hydrostatic Tests:** The portions of the line shall be tested by subjecting to pressure test as the laying progresses before the entire line is completed. In this way any error of workmanship will be found immediately and can be corrected at a minimum cost. Usually the length of the section to be tested shall not exceed 500m.
(c) Where any section of a main is provided with concrete thrust blocks or anchorages, the pressure test shall not be made until at least five days have elapsed after the concrete is cast. If rapid hardening cement has been used in these blocks or anchorages, test shall not be made until atleast two days have elapsed.
(d) Prior to testing, enough back fill shall be placed over the pipe line to resist upward thrust. All thrust blocks forming part of the finished line shall have been sufficiently cured and no temporary bracing shall be used.
(e) The open end of the section shall be sealed temporarily with an end cap having an outlet which can serve as an air relief vent or for filling the line, as may be required. The blind face of the end cap shall be properly braced during testing by screw jacks and wooden planks or steel plate.
(f) The section of the line to be tested shall be filled with water manually or by a low pressure pump. Air shall be vented from all high spots in the pipe line before making the pressure strength test because entrapped air gets compressed and caused difficulty in raising the required pressure for the pressure strength test.

PROCEDURE FOR PRESSURE TEST :

1. Each valved section of the pipe shall be slowly filled with water and all air shall be expelled from the pipe through hydrants and blow offs. If these are not available at high places, necessary tapping may be made at points of highest elevation before the test is made and plugs inserted after the tests have been completed.

2. If the trench has been partially back-filled the specified pressure based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer-in-charge. The duration of the test shall not be less than 5 minutes.

3. **Examination under Pressure :** All exposed pipes, fittings, valves, hydrants and joints should be carefully examined during the open-trench test. When the joints are made with lead, all such joints showing visible leaks shall be recoiled until tight. When the joints are made with cement and show seepage or slight leakage, such joints shall be cut out and replaced as directed by the authority. Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced by sound material and the test shall be repeated until satisfactory to the Engineer-in-charge.

4. If the trench has been back-filled to the top, the section shall be first subjected to water pressure normal to the area and the exposed parts shall be carefully examined. If any defects are found, they shall be repaired and the pressure test repeated until no defects are found. The duration of the final pressure tests shall be at least one hour.

Procedure for Leakage TEST:

5. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled the water and the air expelled.

No pipe installation shall be accepted until the leakage is less than the number of cm^3/h determined by the formula: **ql = ND□P / 3.3**

Where ql = the allowable leakage in cm^3/h.
N = number of joints in the length of the pipe line.
D = diameter in mm, and
P = the average test pressure during the leakage testing Kg/cm2.

6. **Variation from Permissible Leakage:** Should any test of pipe laid in position discloses leakage greater than the specified in para 5 the defective joints shall be repaired until the leakage is within the specified allowance.

LAYING AND JOINTING OF CAST IRON PIPES AND FITTINGS (EXTERNAL WORK)

1. TRENCHES :

(a) The gradient is to be set out by means of boning rods and the required depth to be excavated at any point of the trench shall be regarded as directed by the Engineer-in-charge. The depth of the trench shall not be less than 1 meter measured from the top of the pipe to the surface of the ground under roads and not less than 0.75 meter elsewhere.

(b) The width of the trench shall be the nominal diameter of the pipe plus 40 cm but it shall not be less than 55 cm in case of all kinds of soils excluding rock and not less than 1 meter in case of rock.

2. LAYING :

Any deviation either in plan or elevation less than 11.25 degrees shall be effected by laying the straight pipes around a flat curve of such radius that minimum thickness of lead at the face of the socket shall not be reduced below 6 mm or the opening between spigot and socket increased beyond 12 mm at any joint. A deviation of about 2.25 degree can be effected at each joint in this way. At the end of each day's work the last pipe laid shall have its open ends securely closed with a wooden plug to prevent entry of water, soil, rats and any other foreign matter into the pipe.

3. LEAD CAULKED JOINTS WITH PIG LEAD :

(a) This type of lead caulking is generally done in providing joints in water lines wherever it is practicable to use cast lead caulking, but not in case of wet conditions.

(b) The approximate depth and weights (min.) of pig lead for various diameters of C. I. Pipes and specials shall be as given in table below :-

LEAD FOR DIFFERENT SIZES OF PIPES

Nominal size of pipe mm.	Lead per joint Kg.	Depth of lead joint mm.
(1)	(2)	(3)
80	1.8	15
100	2.2	45
125	2.6	45
150	3.4	50
200	5.0	50
250	6.1	50
300	7.2	55
350	8.4	55

Note :

1. The quantity of lead given in the table is on average basis and a variation of 10 percent is permissible.
2. Before pipe are jointed on large scale, three a four sample joints shall be made and the average consumption of lead per joint shall be got approved by the Engineer-in-charge.

Only required quantity of spun yarn shall be put so as to give the specified depth of lead in the joint.

4. LEAD CAULKED JOINT WITH LEAD WOOL YARN :

(a) This type of lead caulking is generally done when it is inconvenient or dangerous to use molten lead for joints, for example in cases such as inverted joints or in wet trenches or in exceptional cases. In such cases the joints shall be made with lead wool or yarn. Caulking with lead wool or yarn shall however be not carried out without the prior permission of Engineer-in-charge.

(b) **Jointing:** The spun yarn shall first be inserted and caulked into the socket as described under jointing with pig lead. Lead wool or yarn shall then be introduced in the joint in strings not less than 6 mm thick and the caulking shall be repeated with each turn or lead wool or yarn. The whole of lead wool or yarn shall be compressed into a dense mass. The joint shall then be finally finished flush with face of the socket.

5. FLANGED JOINTS :

(a) Cast iron pipes may be jointed by means of flanges cast on. The jointing material used between flanges of pipes shall be compressed fiber board or rubber of thickness between 1.5 mm to 3 mm. The fiber board shall be impregnated with chemically neutral mineral oil and shall have a smooth and hard surface. Its weight per m^2 shall be not less than 112 gm/mm thickness.

(b) Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The practice of fully tightening the bolts one after another shall not be allowed.

(c) Several proprietary flexible joints are available for jointing cast iron pipes and these may be used with the specific approval of the authority, however, they shall be used strictly in accordance with the manufacturer's instructions.

6. MEASUREMENTS :

(a) The net length of pipes as laid or fixed, shall be measured in the running meters correct to a cm specials shall be excluded and enumerated and paid for separately. The portion of the pipe within the collar at the joint shall not be included in the length of pipe work.

(b) Excavation, refilling, shoring and timbering in trenches masonry or concrete pillars and thrust blocks, wherever required, shall be measured and paid for separately, under relevant items of work.

(c) Lead caulked joints shall be measured and paid for separately.

7. RATE :

The rate shall include the cost of materials and labour involved in all the operations described above except for the items measured/enumerated separately under above para which shall be paid for separately.

LAYING AND JOINTING OF S. S. PIPES (EXTERNAL WORK)

1. TRENCHES:

The Stainless Steel pipes and fittings shall be laid in trenches. The widths and depths of the trenches for different diameters of the pipes shall be as in Table below:

TABLE

Dia of pipe (mm)	Width of trench (cm)	Depth of trench (cm)
15 to 50	30	60
65 to 100	45	75

At joints the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for earth work in trenches.
When excavation is done in rock, it shall be cut deep enough to permit the pipes to be laid on a cushion of sand minimum 7.5 cm deep.

2. CUTTING AND THREADING :

Where the pipes have to be out or rethreaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The end of the pipes shall then be carefully threaded conforming to the requirements of IS : 554 with pipe dies and tapes in such a manner as will not result in slackness of joints when the two pieces are screwed together. The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack, as the latter procedure may not result in a water tight joint. The screw threads of pipes and fitting shall be protected from damage until they are fitted.

3. JOINTING :

The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipe. The end shall then be screwed in the socket, Tee etc. with the pipe wrench. Care shall be taken that all pipes and fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Burr from the joint shall be removed after screwing. After laying, the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter.

4. THRUST BLOCKS :
In case of bigger diameter pipes where the pressure is very high, thrust blocks of cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm nominal size) of adequate size and shape shall be provided on all bends to transmit the hydraulic thrust to the ground, spreading it over a sufficient areas, depending upon the type of soil met with.

5. PAINTING :
The pipes shall be painted with two coats of anticorrosive bitu mastic paint of approved quality.

6. TESTING OF JOINTS :

The pipes and fittings after they are laid and jointed shall be tested to hydraulic pressure of 6 Kg/sq.cm (60 meter). The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off taps and stop cocks shall than be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least half an hour. The pipes and fittings shall be tested in sections as the work of laying proceeds, having the joints exposed for inspection during the testing. Pipes or fittings which are found leaking shall be replaced and joints found leaking shall be redone, without extra payment.

7. TRENCH FILLING :

The pipes shall be laid on a layer of 7.5 cm sand and filled upto 15 cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth. The surplus earth shall be disposed off as directed.

8. MEASUREMENTS :

The lengths shall be measured in running meter correct to a cm for the finished work, which shall include S.S. Pipe and S.S. Fittings such as bends, tees, elbows reducers, crosses, plugs, sockets, nipples and nuts, but exclude brass or gun metal taps (cocks), valves, lead connection pipes and shower rose. All pipes and fittings shall be classified according to their diameters, method of jointing and fixing substance, quality and finish. In case of fittings of an equal bore, the pipe shall be described as including all cuttings and wastage. In case of fittings of unequal bore, the largest bore shall be measured.

9. RATE :

The rate shall included the cost of labour and materials involved in all the operations described above including excavation in trenches & back filling. The rate shall not include painting of pipes and sand filling all round the pipes, unless otherwise specified.

LAYING AND JOINTING UNPLASTICISED P.V.C. PIPES (EXTERNAL WORK)

1. **HANDLING AND STORAGE** :

Unplasticized P.V.C. pipes are light in weight material. Reasonable care shall be taken in handling and storage of these to prevent damages. On no account the pipes shall be dragged along the ground. Pipes shall be given adequate support at all times. They shall not be stacked in large piles, especially under warm temperature conditions as the bottom pipes may distort, thus giving rise to difficulty in pipe alignment and jointing.

For temporary storage in the field, where racks are not provided care shall be taken that the ground is level and free from loose stones. Pipes stored thus shall not exceed three layers and shall be so stacked as to prevent movement; the pipes shall preferably be stored under shade.

For satisfactory service performance of plastic pipes under conditions of use, the following points must be kept in view while undertaking installation of plastic piping system :

a) The plastic materials are ‘thermoplastic’ in nature, and must not be used in contact with hot surfaces (or hot water) ;

b) They must be supported at regular intervals for above ground installation ;

c) Allowance must be made, during installation for their expansion, particularly by using loose clips / clamps ;

d) A range of specials and matching fittings must be identified and their manufactures / suppliers listed.

2. **TRENCHES :**

The trench bottom shall be carefully examined for the presence of hard objects such as flints, rock projections or tree roots etc. pipes shall be bedded in sand or soft soil free from rock and gravel. Back fill 15 cm above the pipe shall also be of fine sand or soft soil. Pipes shall not be painted. The width of trench shall be not less than outside dia meter of pipe plus 30 cm in case of gravel soils. Pipes shall be laid at least 90 cms below the ground level (measured from surface of the ground to the top of the pipe).

3. **JOINTING** :

a) Solvent welded joints : Non heat application Method :

In this method, instead of forming a socket on one pipe and an injection moulded socket fitting or coupler is used, with a provision to take in the pipes at both ends, the solvent cements are applied on the surfaces to be jointed and the joint is made at ambient temperature. Injection moulded fittings only shall be used in preference to fabricated fittings, only solvent recommended by the manufacturers of the pipes shall be used and full load on the joints applied only after 24 hours. The pipe shall be cut perpendicular to the axis of the pipe length with a metal cutting saw or an ordinary hand saw with small teeth. Pipe ends have to be beveled slightly with a beveling tool (Reamer) at an angle of about 30 degree. The total length of insertion socket (injection molded socket or couplet) shall be marked on the pipe and checked how far the pipe end could be inserted into the fitting socket. Attempt shall be made to push the pipe to the marked distance if not possible it shall at least be pushed for 2/3 of this distance.
Dust, oil, water grease etc. shall be wiped cut with a dry cloth from the surface. Further the grease should be thoroughly removed with a suitable solvent, such as methylene chloride or as an alternative the outside surface of the pipe and the inside of the fitting may be roughened with emery paper.
Generous coating of solvent cement shall be evenly applied on the inside of the fitting around the circumference for the full length of insertion and on the outside of the pipe end upto the marked line with non synthetic brush of suitable dimension. The pipe shall be pushed into the fitting socket and held for 1 or 2 minutes as otherwise the pipe may come out of the fitting due to the slippery quality of cement and the tapering inside bore of the fitting. The surplus cement on the pipe surfaces shall be wiped out. If the solvent cement has dried up too much or the tapering of the socket is too steep, jointing will not be proper and pipe will come out of the fitting.
In summer months joints shall be made preferable early in the morning or in the evening when it is cooler. This will prevent joint from pulling apart when the pipe cools off at night. Heat application method for jointing shall not be allowed.

(b) Flanged Joints :

For jointing P.V.C. pipes particularly of larger sizes to valves and vessels and larger size metal pipes where the tensile strength is required the joint is made by the compression of a gasket or ring seal set in the face of C. I. flange.
Flanges solvent welded to the P.V.C. pipes shall be supplied by the manufacturers.

4. **CROSSING ROAD OR DRAIN :**
Where the pipe line crosses a road or a drain, it shall be through C.I. or R.C.C. pipe.

5. **SUPPORTS FOR VALVE AND HYDRANT :**
Valve and hydrant tees shall be supported, so that the torque applied in operating a valve is not transmitted to the pipe line.

6. **INSPECTION AND TESTING :**
Solvent welded pipe shall not be pressure tested until at least 24 hours after the last solvent cemented joint has been done.
All control valves shall be positioned open for the duration of the test and open end closed with water tight fittings. The testing pressure on completion of the work shall not be less than one and a half time the working pressure of the pipes.
Pressure shall be applied either by hand pump or power driven pump. Pressure gauges shall be correctly positioned and closely observed to ensure that at no time are the test pressure exceeded. The systems shall be slowly and carefully filled with water to avoid surge pressure or water hammer. Air vents shall be open at all high points so that air may be expelled from the system during filling.
When the system has been fully charged with water and air displaced from the line air vent shall be closed and the line initially inspected for seepage at joints and firmness of supports under load. Pressure may then be applied until the required test pressure is reached.
Without any additional requirement of make-up-water the test pressure should not fall more than 0.2 kg/sq.cm. at the end of one hour test duration.

7. **MEASUREMENTS :**

The length shall be measured in running meter correct to a cm for the finished work which shall include P.V.C. fittings such as bends, tees, elbows, reducer, crosses, plugs, sockets, nipples and nuts, but exclude taps, valves, etc. All pipes and fittings shall be classified according to their outside diameters and pressure ratings. Fitting of unequal outside diameter shall be measured along with the larger diameter pipe.

8. **RATE :**

The rate shall include the cost of labour and material in all the operation described above except excavation in trenches, sand filling around the pipes, metal pipe used for encasing P.V.C. pipe and anchor blocks, unless otherwise specified.

SALT GLAZED STONE WARE PIPES & FITTINGS

a) MATERIAL :

(i) Stone Ware Pipes and Fittings :

All pipes with spigot and socket ends and fittings shall conform to IS : 651. These shall be sound, free from visible defects such as fire cracks or hair cracks. The glaze of the pipes shall be free from crazing. The pipes shall give a sharp clear tone when struck with a light hammer. There shall be no broken blisters. The thickness of pipes shall be as given in the Table below :

TABLE

Internal diameter mm	Thickness of the barrel and socket mm
100	12
150	16
200	17

The length of pipes shall be 60,75,90 cm exclusive of the internal depth of socket. The pipes shall be handled with sufficient care to avoid damage to them.

b) **TRENCHES :**

(i) The trenches shall be so dug that the pipes may be laid to the required alignment and at required depth.

(ii) Cover shall be measured from top of pipe to the surface of the ground.

(iii) The bed of the trench, if in soft or made up earth, shall be well watered and rammed before laying the pipes and the depressions, if any, shall be properly filled with earth and consolidated in 20 cm layer.

(iv) If the trench bottom is extremely hard or rocky or loose stony soil, the trench shall be excavated at least 150 mm below the trench grade. Rocks, stone or other hard substances from the bottom of the trench shall be removed and the trench brought back to the required grade by filling with selected fine earth or sand (or fine moorum if fine soil or sand is not available locally) and compacted so as to provide a smooth bedding for the pipe.

(v) After the excavation of the trench is completed, hollows shall be cut at the required position to receive the socket of the pipes and these hollows shall be of sufficient depth to ensure that the barrels of the pipes shall rest throughout their entire length on the solid ground and that sufficient spaces left for jointing the underside of the pipe joint. These socket holes shall be refilled with sand after jointing the pipe.

(vi) Roots of trees within a distance of about 0.5 meter from the side of the pipe line shall be removed or killed.

(vii) The excavated materials shall not be placed within 1 meter or half of the depth of the trench, whichever is greater, from the edge of the trench. The materials excavated shall be separated and stacked so that in refilling that may be re-laid and compacted in the same order to the satisfaction of the Engineer-incharge.

(viii) The trench shall be kept free from water. Shoring and timbering shall be provided wherever required. Excavation below water table shall be done after dewatering the trenches.

(ix) Where the pipe line or drain crosses an existing road, the road crossing shall be excavated half at a time, the 2nd half being commenced after the pipes have been laid in the first half and the trench refilled. Necessary safety measures for traffic as directed shall be adopted. All types, water main cables, etc. met within

the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the electrical and communication cable met with during course of excavation, removal of which, if necessary, shall be arranged by the Engineer-in-charge.

c) **CONCRETE SUPPORT** :

i) **Bedding :**

Bedding shall be rectangular in section and shall extend laterally at least 15cm beyond and on both sides of the projection of the barrel of the pipe. The thickness of the concrete below the barrel of the pipe shall be 10cm for pipes under 150mm diameter and 15cm for pipes 150mm and over in diameter. Where bedding is used alone the concrete shall be brought up at least to the invert level of the pipe to form a cradle and to avoid lime contact between the pipe and the bed.

The width of the bedding shall be external diameter of the pipe plus

(a)30cm upto trench depth of 1.2 meter.

(b) 40cm for trench depth more than 1.2 meter.

ii) **Haunching**

Concrete hunching shall consist of :

a) Concrete bed as described for bedding in (i) above.

b) The full width of the bed carried upto the level of the horizontal level of the pipe; and

c) Splays from this level carried up on both sides of the pipe; from the full width of the bed to meet the pipe barreltangentially.

iii) **Surround or Encasing**

Surround or encasing shall be similar to haunching upto the horizontal diameter of the pipe and top portion over this shall be finished in a semi circular form to give a uniform encasing for the top half of the pipe. d) LAYING : The pipe shall be laid accurately and perfectly true to line, levels and gradients. Great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in a straight line without vertical or horizontal undulation. All junction and changes in direction and diameter shall be made inside manholes by means of curves tapered channels formed in cement concrete finished smooth and benched on both sides. The body of the pipe shall, for its entire length, rest on an even level of concrete, grips being made or left in the bed to receive the sockets of the pipes. Normally the sockets ends should face the upstream. When the line runs up hill the socket ends should face the upgrade.

All pipes shall be laid on a bed of cement or lime concrete with thickness and mix as specified, projecting on each side of the pipe to the specified width of the trench. The pipes with their crown level at 1.20 m depth and less from ground shall be covered with 15 cm thick. Concrete above the crown of the pipe and sloped off to meet the outer edges of the concrete, to give a minimum thickness of 15 cm all – around the pipe. Pipes laid at a depth greater than 1.20 m at crown shall be concreted at the sides upto the level of the center of the pipe and sloped off from the edges to meet the pipe tangentially.

D) **JOINTING GLAZED STONE WARE PIPES :**

Tarred gasket or yarn soaked in neat cement slurry shall first be placed round the spigot of each pipe and spigot shall then be placed well home into the socket of pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly home so as to fill not more than one forth of the total depth of the socket.

The remainder of the socket shall be filled with a stiff mixture of cement mortar proportion of 1 part of cement and 1 part of fine sand. When the socket is filled, a fillet shall be formed round the joint with a trowel, forming an angle of 45 degree with the barrel of the pipe.

Mortar shall be mixed as necessary for immediate use and no set mortar shall be beaten up and used before it has begun to set.

After the joint is made, any extraneous material shall be removed from the inside of the joints with a suitable scrapper or The newly made joints shall be protected, until set, from the sun, dry winds, rain or frost. Sacking or other suitable materials, which shall be kept damp, may be used for the purpose.

The approximate quantity of cement required for each joint for following sizes of pipes are given below for guidance.

Nominal dia of pipe (mm)	Cement (Kg)
100	1.00
150	1.50

200	2.00
250	2.50

E) JOINTING CAST IRON PIPES WITH STONE WARE PIPES :

Where any cast iron soil pipe, waste pipe, ventilating pipe or trap is connected with a stone ware pipe or drain communicating with a sewer, the bedded spigot end of such cast iron soil pipe, waste pipe ventilating pipe or trap shall be inserted into a socket of such stone ware pipe or drain and the joint made with mortar consisting of 1 part of Portland cement and 1 part of clean sharp sand after placing a tarred gasket or hemp yarn soaked in neat cement slurry round the joint and inserted in it by means of a caulking tools.

F) CURING :

The mortar joints shall be cured at least for 7 days before testing.

G) TESTING OF JOINTS :

Hydraulic test :

The pipes shall be subjected to a pressure of at least 2.5meter head of water at the highest point of the section under test. Before commencing the hydraulic test, the pipeline shall be filled with water and maintained full for 24 hours by adding water if necessary under a head of 0.6 meter of water. The test shall be carried out by suitably plugging the low end of the drain and the ends of the connection, if any and filling the system with water. A knuckle bend shall be temporarily jointed in at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head; or the top end may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fix suitably for observation. Subsidence of the test water may be done to one or the more of the following causes

i) Absorption by pipes and joints;
ii) Sweating of pipes or joints;
iii) Leakage at joints or from defective pipes and
iv) Trapped air.

Allowance shall be made for (i) above by adding water until absorption has ceased after which the proper test should commence if any leakage is visible the defective part of the work should be made good. A slight amount of sweating which is uniform may be over looked but excessive sweating from a particular pipe or joint shall be watched for as taken as indicating a defect to be made good.

H) Rectification of faulty joints :

Any joint leaking or sweating shall be rectified or embedded into into 150mm layer of cement concrete (1:2:4) 300mm in length and the section retested.

I) REFILLING :

In cases where pipes are not bedded on concrete special care shall be taken in refilling trenches to prevent the displacement and subsequent settlement at the surface resulting in uneven street surfaces and dangers to foundations etc. The backfilling materials shall be packed by hand under and around the pipe, and rammed with a shovel and light tamper. This method of filling will be continued upto the top of pipe. The refilling shall rise evenly on both sides of the pipe continued upto 60 cm above the top of pipe so as not to disturb the pipe. No tamping should be done within 15 cm of the top of pipe.

J) MEASUREMENTS :

The lengths of pipes shall be measured in running meters nearest to a cm as laid or fixed, from inside of one manhole to the inside of the other manhole. The length shall be taken along the center line of the pipes over all fittings such as bends, junctions, etc. which shall not be measured separately.

Excavation, refilling, shoring and timbering in trenches, and cement concreting wherever required shall be measured separately under relevant items of work.

K) RATE :

The rate shall include the cost of materials and labour involved in all operations described above excluding the cost of concrete which shall be paid for separately.

REINFORCED CEMENT CONCRETE (RCC) PIPES (NP2/NP3)

a) MATERIAL :

Cement Concrete Pipes :

(a)The pipes shall be with reinforcement and shall be of the specified class. These shall conform to IS : 458. The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process while un–reinforce cement concrete pipes by spun or pressure process. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding.

Concrete used for the manufacture of unreinforced and reinforced concrete pipes and collars shall not be leaner than 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate). The maximum size of aggregate should not exceed one third of the thickness of the pipe or 200 mm whichever is smaller. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own weight.

CLASS NP2 – REINFORCED CONCRETE LIGHT DUTY, NON PRESSURE PIPES

Internal Diameter of Pipes Nominal mm	Barrel Wall Thickness Mm
80	25
100	25
150	25
200	25
225	25
250	25
300	30
350	32
400	32
450	35
500	35
600	45

CLASS NP3 – REINFORCED CONCRETE MEDIUM DUTY, NON PRESSURE PIPES

Internal Diameter of Pipes mm	Barrel Wall Thickness mm
150	25
200	30
225	30
250	30
300	40
350	75
400	75
450	75
500	75
600	85
700	85
800	95
900	100
1000	115

b) **TRENCHES :**

(i) The trenches shall be so dug that the pipes may be laid to the required alignment and at required depth.
(ii) Cover shall be measured from top of pipe to the surface of the ground.
(iii) The bed of the trench, if in soft or made up earth, shall be well watered and rammed before laying the pipes and the depressions, if any, shall be properly filled with earth and consolidated in 20 cm layer.
(iv) If the trench bottom is extremely hard or rocky or loose stony soil, the trench shall be excavated at least 150 mm below the trench grade. Rocks, stone or other hard substances from the bottom of the trench shall be removed and the trench brought back to the required grade by filling with selected fine earth or sand (or fine moorum if fine soil or sand is not available locally) and compacted so as to provide a smooth bedding for the pipe.
(v) After the excavation of the trench is completed, hollows shall be cut at the required position to receive the socket of the pipes and these hollows shall be of sufficient depth to ensure that the barrels of the pipes shall rest throughout their entire length on the solid ground and that sufficient spaces left for jointing the underside of the pipe joint. These socket holes shall be refilled with sand after jointing the pipe.
(vi) Roots of trees within a distance of about 0.5 meter from the side of the pipe line shall be removed or killed.
(vii) The excavated materials shall not be placed within 1 meter or half of the depth of the trench, whichever is greater, from the edge of the trench. The materials excavated shall be separated and stacked so that in refilling that may be re-laid and compacted in the same order to the satisfaction of the Engineer-incharge.
(viii) The trench shall be kept free from water. Shoring and timbering shall be provided wherever required. Excavation below water table shall be done after rewatering the trenches.
(ix) Where the pipe line or drain crosses an existing road, the road crossing shall be excavated half at a time, the 2nd half being commenced after the pipes have been laid in the first half and the trench refilled. Necessary safety measures for traffic as directed shall be adopted. All types, water main cables, etc. met within the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the electrical and communication cable met with during course of excavation, removal of which, if necessary, shall be arranged by the Engineer-in-charge.

c) **LAYING :**

Pipes shall be lowered into the trench carefully. Mechanical appliances may be used, where necessary, pipes shall be laid in straight lines or with easy curves and true to line and gradient as specified. Laying of pipes shall proceed up grade of a slope. In the pipes spigot end socket joints, the socket ends shall have face up stream. In the case of pipes with joints to be made with loose collars the collars shall be slipped on before the next pipe is laid.

In case where the foundation conditions are unusual such as the proximity of trees for holes, under existing or proposed tracks, manholes etc. the pipe shall be encased around in 150 mm thick cement concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size).

In case where the natural foundation is inadequate the pipes shall be laid either in concrete cradle supported on proper foundation or on any other suitably designed structure. If a concrete bedding is used, the depth of concrete below the bottom of the pipe shall be at one forth of the internal diameter of the pipe subject to the minimum of 100 mm and a maximum 300 mm. The concrete shall extend up the sides of the pipe at least to a distance of one forth of the outside diameter for pipes 300 mm and over in diameter. The pipe shall be laid in this concrete before the concrete has set. Pipes laid in trenches in earth shall be bedded evenly and as far up to the haunches of the pipe as to safety transmit the lead expected from the back sill through the pipe to the bed. This shall be done either by excavating the bottom of the trench to fit the curve of the pipe or by compacting the earth underground the curve of the pipe to from an even bed. Necessary provision shall be made for joints wherever required.

When the pipe is laid in a trench in rock hard clay, shale or other hard material the space below the pipe shall be excavated and replaced with an equalizing bed of concrete, sand or compacted earth. In no place shall pipe be laid directly on such hard material.

d) **JOINTING :**

I) Rigid Spigot and Socket Joint :

The spigot of each pipe shall be slipped home well into the socket of the pipe previously laid and adjusted in the correct position. The opening of the joint shall be filled with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) which shall be rammed with caulking tool. After a day's work any extraneous material shall be removed from the inside of the pipe and the newly made joint shall be cured.

II) Rigid Collar Joint:

The two adjoining pipes shall be butted against each other and adjusted in correct position. The collar shall then be slipped over the joint, covering equally both the pipes. The annular space shall be filled with stiff mixture of cement mortar 1:2 (1 cement : 2 fine sand) which shall be rammed with caulking fool. After a day's work any extraneous materials shall be removed from the inside of the pipe and the newly made joint shall be cured.

e) **MEASUREMENTS :**

The lengths of pipes shall be measured in running meters nearest to a cm as laid or fixed, from inside of one manhole to the inside of the other manhole. The length shall be taken along the center line of the pipes over all fittings such as bends, collars, junctions, etc. which shall not be measured separately.

Excavation, refilling, shoring and timbering in trenches, and cement concreting wherever required shall be measured separately under relevant items of work.

f) **RATE :**

The rate shall include the cost of materials and labour involved in all the operations described above.

MANHOLES

i) GENERAL :

Manholes of different types and sizes specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawing or as directed by the Engineer-in-charge. The size specified shall indicate the inside dimensions (between wall faces) of the manholes. Sewers of unequal section area shall not be jointed at the same invert in a main shall be at least two third the diameter of the main above the invert of the main. The branch sewer should deliver sewage in the manhole in direction of main flow and the junction must be made with case so that flow in the main is not impeded.

No drain from house fitting i.e. gully taps or soil pipes etc. to manholes shall normally exceed a length of 6 meter unless it is unavoidable.

At every change of alignment, gradient or diameter of a drain, there shall be a manhole or inspection chamber. Bends and junctions in the drains shall be grouped together in manhole as far as possible. The maximum distance between manholes shall be 30 m.

Where the diameter of the drain is increased, the crown of the pipe shall be fixed at the same level and necessary slope given in the invert of the manhole chamber. Manholes shall be built to the following specifications :-

a) Bed concrete :

The manhole shall be built on a bed of cement concrete 1:4:8 (1 cement : 4 coarse sand: 8 graded stone aggregate 40 mm nominal size) The thickness of Bed Concrete shall be 150 mm upto 1 meter depth, 20 cm for manholes from 1 meter to 4.25 meter depth and 30 cm for manholes of above 4.5 meter depth.

b) Walls :

The walls of the manholes shall be of brick masonry. The brick masonry shall be with bricks of class 75 in cement mortar 1:4 (1 cement : 4 coarse sand) of brick work shall be carefully built in English bond. The jointing face of each brick being well buttered with cement mortar before laying so as to ensure a full joint. The thickness of wall shall not be less than 230mm upto 1.5 meter in depth and one and a half brick for depth greater than 1.5 meter. The exact thickness of wall shall be governed by the structural design & site conditions.

c) Plaster :

The inside of wall shall be plastered 12 mm thick with cement mortar 1:3 (1 cement: 3 coarse sand) and finished with a floating coat of neat cement. All angle shall be rounded to 7.5 cm. radius and all rendered internal surfaces shall have impervious finish obtained by using a steel trowel.

Where the saturated soil is met with, also the external surface of the walls of the manhole shall be plastered with 12 mm thick cement plaster 1:3 (1 cement : 3 coarse sand) finished smooth upto 30 cm above the highest sub-soil water level with the approval of the Engineer-in-charge. The plaster shall further be water proofed with addition of approved water proofing compound in a quantity as per manufacturer's specifications.

d) Channels and benching :
Channels shall be semi circular in the bottom half and of diameter equal to the sewer. Above the horizontal diameter, the sides shall be extended vertically to the same level as the crown of the outgoing pipe and the top edge shall be suitably rounded off. The branch channels shall also be similarly constructed with respect to the benching but at their junction with the main channel on appropriate shall suitably rounded off in the direction of flow in the main channel shall be given.
The channels and benching shall be done in cement concrete 1:2:4 (1cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) rising at a slope of 1 in 6 from the edges of channel. The channels of the bottom of the chamber shall be finished with the floating coat of neat cement.

e) Foot Rests :
All manholes deeper than 0.8 m shall be provided with M. S. foot rests. These shall be embedded 20 cm deep in 20 x 20 x 10 cm blocks of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size). The concrete block with M. S. foot rest placed in its center shall be cast in situ along with the masonry and surface finished with 12 mm thick cement plaster 1:3 (1 cement : 3 coarse sand) finished smooth. Foot rests which shall be of 20 x 20 sq. M. S. bars shall be fixed 30 cm apart vertically and staggered laterally and shall project 10 cm beyond the surface of the wall. The top foot rest shall be 45 cm below the manhole cover.
Foot rests shall be painted with coal tar, the portion embedded in the cement concrete block being painted with thick cement slurry before fixing.

f) Cover slabs :
These shall be of R.C.C. 1:2:4 (1 cement :2 coarse sand : 4 graded stone aggregate 20 mm nominal size) 15 cm thick surface and edge finished fair. Full bearing equal to the width of the wall shall be given to the slab on all sides. The frame of the man hole cover shall be embedded firmly in the R.C.C. slab so that the top of the frame remains flush with the top of the R.C.C. slab.

g) Measurements:
Manholes shall be enumerated under relevant items. The depth of the manhole shall be reckoned from the top level of C. I. cover to the invert level of channel. The depth shall be measured correct to a cm. The extra depth shall be measured and paid as extra over the specified depth.

h) Rates :
The rate shall include the cost of materials and labour involved in all the operations described above including excavation but excluding the cost of (i) M.S. foot rests and (ii) 12 mm thick cement plaster with water proofing material applied at the external surface of the manhole if required. These items shall be paid for separately under relevant items of work.

Payments for extra depths of manholes shall be made separately under relevant items of work.

ii) TESTING :

Manholes shall be tested by filling with water to a depth not exceeding 1.2 meter as directed by the Engineer-incharge.
After completion o the work manhole covers shall be sealed by means of thick grease.

iii) CONNECTION TO A EXISTING SEWER :
The connection to an existing sewer shall, as far as possible, be done at the manholes. Where it is unavoidable to make connection in between two manholes, the work of breaking into the existing sewer and forming the connection shall be carried out under the supervision Administrative Authority.

Breaking of sewer shall be effected by the cautions enlargement of sewer hole and every precaution shall be taken to prevent any material from entering the sewer. No connection shall be former in such a way so as to constitute a projection into the sewer or to cause any diminutions in its effective size.

iv) DROP CONNECTIONS :
Where it is uneconomic or impracticable to arrange the connection within 600 mm height above the invert of the manhole, the connection shall be made by constructing a vertical shaft outside the manholes chamber. If the difference in the levels between the incoming drain and the sewer does not exceed 600 mm and there is sufficient room in the manhole, the connection pipe may be directly brought through the manhole wall and the fall accommodated by constructing a ramp in the benching of the manhole.

PRECAST CONCRETE MANHOLE COVERS & FRAMES

Precast reinforced cement concrete manhole covers intended for use in sewerage and water works shall generally conform to IS : 12592 (Part 1 & 2) 1991. Detailed specification are as under :

1. GRADES : TYPES & USES

Manhole covers and frames shall be of the following four grades and types :

Grades	Grade Designation	Type / shape of cover
Light Duty	LD – 2.5	Rectangular, Square, Circular
Medium Duty	MD - 10	Rectangular, Circular
Heavy Duty	HD – 20	Circular-Square, Rectangular, (Scrapper Manhole)
Extra Heavy Duty	EHD – 35	Circular, Square, Rectangular, (Scrapper Manhole)

2. The different grades and types of manhole covers may be used as follows :

a) LD – 2.5 Rectangular, Square or Circular types :
These are suitable for use within residential and institutional complexes / areas with pedestrian but occasional LMV traffic. These covers may also be used for inspection chambers.

b) MD – 10 :
These are suitable for use in service lanes / roads, car parking areas etc.

c) HD – 20 :
Suitable for use in institutional/commercial areas / carriage ways with heavy duty vehicular traffic like buses, trucks, etc.

d) EHD – 35 : Circular, square, or rectangular (scrapper manhole) types -
These are suitable for use on carriage way in commercial industrial / port areas / near warehouses / godowns where frequent loading and unloading of trucks / trailers are common, with slow to fast moving vehicular traffic of the types having wheel loads upto 11.5 tones, irrespective of the location of the manhole chambers.

3. **MATERIALS** :

(i) Cement : cement used for the manufacture of precast concrete manhole covers shall be 33 grade Portland cement conforming to IS : 269 – 1989 or 1489 (Part1&2) – 1991 or IS : 8041 – 1990 or IS : 8043 – 1990 or IS : 8112 – 1989 or IS : 155 – 1989.

(ii) Aggregates : The aggregates used shall be clean and free from deleterious matter and shall conform to the requirements of IS: 383–1970.The aggregates shall be well graded and the nominal maximum size of coarse aggregate shall not exceed 20 mm.

(iii) Concrete : The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing etc. The minimum cement content in the concrete shall be 360 kg/m^3 with a maximum water cement ratio of 0.45. Concrete weaker than grade M-30 (design mix) shall not be used. Compaction of concrete shall be done by machine vibration.

(iv) Reinforcement : The reinforcement steel shall conform to IS : 226 – 1975 or IS 432 (Part I)- 1982 or IS : 832 (Part 2) – 1982 or IS : 1556 – 1982 or IS : 1786 – 1985 as specified. Reinforcement shall be clean and free from loose mills scale, loose rust, and mud, oil, grease or any other coating which may reduce or destroy

the bond between the concrete and steel. A light film of rust may not be regarded as harmful but steel shall not be visibly pitted by rust.

a) Fibers steel : In association with in the main steel bars reinforcement steel fibers of appropriate types and forms may also be used as secondary reinforcement (upto 0.5% by volume).

(v) Plastics : Plastics fiber of polypropylene fibrillated film of suitable type and form (0.55 by weight) may also be used as reinforcement in line of steel reinforcement.

4. **SHAPES AND DIMENSIONS :**

(i) Shapes : The shapes of precast concrete manhole covers shall be square, rectangular or circular as specified. (ii) Dimensions : Dimensions of precast concrete manhole covers shall be as given in Table below, the minimum clearance at top between the frame and cover shall be 5 mm.

TABLE

Sr. No.	Description	Heavy / Extra Heavy duty HD / EHD	Medium duty M.D.	Light duty L.D.
1.	Clear opening matching the top opening of manhole	560 mm dia or 600 mm dia or square or 560 mm	450 mm dia. 480 mm dia. 500 mm dia. dia or square	600 x 450 mm (rectangular) 450 mm dia or 350 mm dia or square
2.	Precast slab with integral frame (D/T)	900 mm dia x 180 mm or square corners cut 1000 mm dia x 200 mm or square corner cut	800 mm. dia x 130 mm 800 mm dia x 150 mm	850mmx700mmx100mm 625mm dia x 100 mm or 575 mm dia x 100 mm or square
3.	Thickness of cover depth of frame (T1)	100 mm or 110 / 120 mm	70 / 80 mm	50 mm
4.	Matching Manhole Cover (B)	685 / 660 mm or 735 / 710 mm dia or square	585 mm dia or 645 mm dia or square	685 x 535 mm 515 mm dia or square 435 mm dia or square
5.	Edge protection of covers/lifting facility	Precast manhole covers are designed and provided with MS rims of 2.5 mm thickness welded around with provision of two lifting hooks welded at appropriate locations.		
6.	Chequered pattern on operative surface	The MS rims along with the edges of precast manhole covers and their operative surface are suitably coated/finished using corrosion resistant paint.		
7.	Marking on the covers	Precast manhole covers/precast slabs are suitably marked on the operative surface with the following letters, unless specified otherwise Name of the Department/Sewer or SWD/Grade/Date of MFR/Trade Name etc.		
8.	Performance requirements Test load	When tested for ULTIMATE breaking load using 300 mm dia block as per the method described in IS : 12592 (Part I) manhole covers shall be within the following range : Light duty - 2.5 tones (L.D. – 2.5) Heavy duty – 20 tones (HD – 20) Medium duty - 10 tones (MD – 10) Extra heavy duty - 35 tones (EHD – 35).		

5. **LIFTING DEVICE :**

The minimum diameter of mild steel rod used as lifting device shall be 10 mm for light and 12 mm for medium duty covers and 16 mm for heavy and extra heavy duty covers. The lifting device shall be protected from corrosion by not galvanizing or epoxy coating or any other suitable.

6. **FINISHING AND COATING** :

To prevent any possible damage from corrosion of steel the underside of the covers shall be treated with anticorrosive paint. The top surface of the covers shall be given a chequered finish.
In order to protect the edges of the covers from possible damage at the time of lifting and handling it is necessary that the manhole covers shall be cast with a protective mild steel sheet of minimum 2.5 mm thickness around the periphery of the covers. Exposed surface of mild steel sheet shall be given suitable treatment with anticorrosive paint or coating.

7. **PHYSICAL REQUIREMENTS :**

a) General :
All units shall be sound and free from cracks and other defects which interface with the proper placing of the unit or impair the strength or performance of the units. Minor chipping at the edge / surface resulting from the customary methods of handling during delivery shall not be deemed for rejecting.
b) Load test :
The breaking load of individual units when tested in accordance with the method described in IS : 12592 shall be not less than the values specified in Table below.

TABLE

Grade of cover	Type	Load in Tones	Diameter of Blocks in mm
EHD – 35	Circular, Square or Rectangular	35	300
HD – 20	Circular, Square or Rectangular	20	300
MD – 10	Circular, or Rectangular	10	300
LD – 2.5	Rectangular, Square or Circular	2.5	300

8. **FIXING :**

The frames of manhole shall be firmly embedded to correct alignment and level in RCC slab or plain concrete as the case may be on the top of masonry which shall be paid as extra unless specified otherwise.

9. **MEASUREMENTS :**

The manhole covers shall be enumerated under relevant items.

10. **RATES :**

The rate shall include the cost of materials and labour involved in all the operation described above except fixing of frames and covers which shall be paid as extra unless specified otherwise in the items.

"YIELD TEST CERTIFICATE"

S.No.	Water Pumping *Level*	Drawdown	Head	Discharge

1. 2. 3. 4.

Sand contents in water

1. Name of work ……
2. Name of Contractor .....……
3. Work order No. .....…….
4. Well No. with location .....……
5. Date of Test .....……
6. Development
   a. Development Unit .....……
   b. Size of orifice .....……
   c. Water level .....…….
   d. Development started .....……
   e. Development completed .....……...
   f. Total Development Hours .....……

Water Discharge results

S.No. Discharge Part per million parts of water by volume after run of .....5 mts 10 mts 15 mts 20 mts 25 mts 30 mts
1. 2. 3. 4.

Contractor's Representative Accepting Authority.

STRATA CHART

1. Name of work .....
2. Name of Contractor .....
3. Work order No .....
4. Well No. with location .....
5. Drilling started on .....
6. Drilling completed on .....
7. Deploy of drilled .....
8. Gravel fed .....
9. Sand stone encountered .....
10. Water level .....
11. Details of material used.

Name of material	Dia	Length	NO.
Housing pipe			
Blind pipe			
Slotted pipe			
Reducer			
Well cap			
Centering guides			
Bail plug			
Housing clamp			

12. Details of strata Formation with pipe measurements and strata sample.

Contractor's Representative Accepting Authority

PREAMBLE TO BILLS OF QUANTITIES

1.0 GENERAL

1. The contractor shall comply with all conditions as detailed in Volume – I.

2. Item description in bills of quantities is exhaustive but may not cover all items, trades, materials, labour, specifications, conditions etc. However contractor shall be responsible to read item description in conjunction with technical specifications, drawings and trade practices and is required to follow all requirements. Further description of item in BOQ, unless otherwise stated, includes, wherever necessary, conveyance and delivery handling, unloading, storing, fabrication, hoisting, scaffolding all labour for finishing to required shape and size, setting, fitting and fixing in position, straight cutting and waste, return of pickings, disposal, cleaning and other incidental charges and/all applicable taxes and duties.

3. BOQ quantities are tentative and any changes will not allow the contractor to claim extra on the rates quoted.

Quantities stated in the item are not to be used for ordering of any material. Contractor shall verify quantities himself and order with suppliers shall be placed with required wastages. Copies of orders shall be forwarded to Incharge/Architect to verify date of order, supplier and materials ordered.

4. All materials to be used at the site shall be tested as per specifications or as per the IS. Testing shall be done at site and / or at approved laboratories as specified or as directed by the Incharge/Architect at the cost of contractor. Any defective or unapproved materials will be removed from site immediately at contractors' cost.

5. The contractor shall be responsible for protection of his own work and the work of other trades during the progress and till handover to the Employer..

6. The contractor shall note that space for storage at the site is limited and shall allow for phased delivery of material to site to overcome that problem.

7. Contractor shall provide, required rigid double legged steel scaffolding accessible at all locations with safety rails.

8. Area available at site is limited and contractor to organize himself for safe storage, handling, site offices, labour accommodation if any at his cost. No extra cost payable on this account.

9. Price of each item inserted shall be considered as self supporting and do not have any bearing on other items of the project.

10. The Contractor to take required insurance for safety of structures around.

The Works shall be measured as per method of measurement detailed in Technical Specification and preamble to Bills of Quantities of this contract. In absence of these details relevant SP 27 shall be followed or shall be measured as per instruction of the Incharge/Architect.

2.0 EARTHWORK

Work and rate shall include

2.1 Following items shall be included in the rates of excavation and no additional charges shall be payable on this account.

A. Setting out works, erecting profiles, etc.

B. Site clearance such as cleaning of shrubs, brushwood, small trees not exceeding 30 cm in girth measured at one meter above ground.

C. Unauthorized battering or benching of excavations.

D. Forming (or leaving) DEAD MEN or TELL-TALES in borrow pits and their removal after measurements.

E. Forming or leaving steps in sides deep excavation and their removal after measurements.

F. Excavation for insertion of planking and strutting.

G. Removing slips or falls in excavation.

H. Dewatering (bailing or pumping out water in excavations from rains, sub-soil water, etc.)

I. Slinging or supporting pipes, electric cables, etc. met during excavation or carrying out of any item of work.

J. Dressing, trimming of sides, leveling or grading and ramming of bottoms.

K. Excavation shall be paid for PCC area and level shown in drawings or excavation drawing issued for construction or additional width approved by the Incharge/Architect when as special case. Working space shall not be considered for payment.

L. In mass excavation by machine soft rock shall not be measured separately. All types of earth / soil and soft rock shall be measured under one item.

2.2 Refilling the excavated pits, trenches for foundations, rafts, pipe laying, etc. shall be part of excavation items and shall not be measured separately nor paid for separately. also stacking usable soil within plot at area allocated by Incharge/Architect and disposal of surplus shall be part of excavation item.

2.3 Depth of excavation shall be measured below the existing ground level at the time of excavation at the respective location. Prior to filling for area development excavation for footings, pits, basement, etc. shall be completed.

2.4 Consolidation of filling shall be carried out with mechanical means. Proctor density of 95% must be achieved. Proctor density test shall be carried out by the contractor at his cost in the quoted price. Frequency of testing shall be as directed by the Incharge/Architect.

2.5 Dewatering

All items of excavation, filling, etc. shall be carried out in dry site only. The contractor to note that dewatering wherever required or ordered by the Incharge/Architect shall be part of the respective item and the contractor must make necessary allowance in his quoted rates. No additional cost on account of dewatering of any nature and for any reason shall be payable throughout the contract.

2.6 Rubble Soling

The rate shall include hand packing, filling interstices with smaller stones, chips, murrum, sand, screening and watering and using mechanical means of compacting prior to the start and after completion of works.

3.0 CONCRETE

3.1 All concrete work shall be designed mix of the grade as specified on drawing workability should be obtained by using polymer based super plasticizers and not high water cement ratio.

3.2 The rates for PCC/RCC work shall allow for

A. All test on materials and cube testing or any other testing as instructed by the Incharge/Architect as per IS.

B. All architectural effects like chases, ledges, moulds, grooves, chamfers, brackets etc. shall be created by using approved form work including making special size mould, staging arrangement, etc. No separate rate payable unless listed in Bills of Quantity and shall be considered as part of item.

C. Work at all depths, heights and leads.

D. If different grades of concrete are used at junctions, spillover of richer concrete required from practical considerations shall be included in the rate.

E. The concrete shall include ingredient material, mixing, transporting, hoisting to any height and lowering to any depth, pumping (as detailed), pouring or laying, consolidating, leaving pockets, holes and protecting them till the next operation or completion of work, closely hacking the surfaces to provide key for further work including cleaning, wetting, surface curing, etc. and preparing construction joints. The price built-up shall include the loading, unloading, weighing and storing of cement in good conditions.

F. Admixtures as required and should conform to IS 9103.

G. Water proofing compound, as required.

H. Cement grouting with non shrink grouting compound

I. Dewatering to keep area dry.

J. The contractor shall provide and maintain laboratory at site equipped as under and staffed with qualified

experienced technicians.

- A set of standard sieves
- Sieve shaker
- Measuring cylinders
- Slump cone
- Adequate number of standard cube moulds
- Weighing machines measuring to 10 grams and upto 50 Kg.
- Oven or other apparatus to dry aggregates.
- Curing tanks
- Electrically operated concrete cube testing m/c, 150T capacity.
- For reconciliation purpose, for cement, maximum wastage permitted shall be 3% of the actual consumption.

4.0 FORM WORK

4.1 Form work shall be carried out as detailed in technical specification.

4.2 Form work shall be measured and paid separately except for PCC items (not measured and paid separately).

Rate shall include

Handling, cutting, shifting, jointing, welding etc.

Rigid base of plywood / steel plaster with leak proof joints

Steel prop or system designed staging system. (Timber / Bambu props staging not allowed)

Moulds of correct size, shape with flexibility to dismantle without kicks

Erection with required camber

Erection to collect line, level, plumb and within tolerances as specified.

Shuttering oil

Maintaining in position till concrete attain desired strength.

Work at all heights, leads, lifts and depths.

4.3 Making chamfers, pattas, grooves, fixing inserts, bolts, pockets, shall not be measured separately unless special

item is provided in Bills of Quantities.

5.0 REINFORCEMENT WORK

5.1 Reinforcement work shall be carried out as detailed in technical specification.

5.2 The rate shall include

A. Providing, transporting, loading, unloading, weighing of each lot of steel to conform weight/Rmt, storing in proper forms and good conditions on suitable platforms, handling, straightening, cutting, bending, cranking, jointing, doing, welding, providing chairs, spacer pin, approved overlaps as required and as directed by the Structural Consultant / INCHARGE/ARCHITECT including binding, securing and protecting in position.

B. Testing of each batch (consignment) of steel brought to site.

C. Cleaning of bars.

D. All wastages and rolling margins.

E. Binding wire

F. Work at all height, depths and leads

G. PVC cover blocks or concrete cover blocks of grade concrete used.

H. Work at all heights, leads, lifts and depths.

6.0 STRUCTURAL STEEL WORK

6.1 The rate shall include

A. Preparing shop drawings based on architectural and structural drawings with required connections, all. conforming to standards, code of practices, instructions of Structural consultant/INCHARGE/ARCHITECT.

B. Take actual site measurement prior to fabrication and incorporate into shop drawings accordingly.

C. Coordinating, scheduling and doing works as per site programme.

D. Straightening, cutting, bolting, welding including layout and assembly.

Erecting, aligning, making plum and leveling to correct position as per shop drawings including required site repairs/adjustments.

Sand / shot blasting, priming with two coats of zinc rich primer and painting system if specified in BOQ.

Work at all heights, leads, lifts and depths.

7.0 STEEL ROOFING AND WALL CLADDING WORKS

7.1 The work shall be done as per the specifications of approved manufacturer.

7.2 The rate shall include

A. Preparing shop drawings based on architectural and structural drawings with required connections, all conforming to standards, code of practices, submitting test certificates of all materials for each lot, instructions of Structural consultant/INCHARGE/ARCHITECT.

B. Take actual site measurement prior to fabrication and incorporate into shop drawings accordingly.

Coordinating, scheduling and doing works as per site programme.

Supply and installation of Single/Double skin roofing system.

External and internal skin coverings.

Sub-grits of galvanized steel with thermal breaks as specified.

Organic coating.

Flashing, cappings and trims including making water-tight.

All essential hardware required.

Guarantee of 15 years in approved format for galvalume, non-fading coating, waterproofing, etc. of manufacturer and installer.

Cleaning, finish coating prior to handing over Work at all heights, leads, lifts and depths.

8.0 MASONRY WORK

8.1 All work as detailed in Volume-II and drawings. The rate shall include all materials, labours, wastages etc.

Testing of Bricks/Blocks

Mix of mortar shall be as specified and by using non shrink compound.
Making bonds

Patterns

Forming arches

Work at heights, depths and lead

Racking out joints

Curing

Required double legged scaffolding
Patli beam concrete

Steel binding, placing etc.

9.0 PLASTERING WORK

9.1 Plastering work shall be carried out as detailed in technical specifications.

9.2 The work and rate shall include

All materials, labours, wastages etc.

Closely Hacking R.C.C. surfaces

Racking out joints and deeply junctions of concrete and masonry. Chemical adhesive and scratch coat of plaster

Grouting junction joint with polymer grout.

Cleaning and welting of surfaces

G.I. chicken mesh, expanded metal, G.I. beads etc. as required and specified

Providing level dabs

Chamfering,

Rounding of edges

Making grooves, pattas

Making drip moulds

Finishing and making wattas

Making ready surfaces finishing and for the next operation to receive finishes as per manufacturersrequirements

Finishing with cement where specified. Curing

Required double logged scaffolding.

Work at all heights, leads, lifts and depths.

10.0 JOINERY WORK

10.1 Work shall be carried out as per specifications

10.2 The work and rate shall include

All materials with wastage

All timber shall be 2nd class good quality well seasoned, anti termite treated C.P. Teakwood.

All ferrous materials like nails, screws etc. shall be galvanized. All jointing shall be glued with exterior quality adhesive G.I. holdfast grouted in concrete mix 1:2:4.

Application of tar / bitumen on back of timber members in contact with masonry or concretework at all heights, depths and lead

11.0 WATERPROOFING WORK

11.1 BOX TYPE WATERPROOFING

Rate shall include providing and fixing Stone method Preparation of surfaces 20 mm thick cement sand mortar with waterproof compound Socket / pipes for pressure release 20 mm thick kota stone slabs for wall and 25 mm thick kota or similar stone of approximate size 600 x 600 mm.

Protective screed 20 mm thick

Grouting of joints, making chamfers, walls, etc.

Sealing with sealant

Grouting of pockets / pipes

Testing

Guarantee for 10 years on Rs. 100 stamp paper.

Cleaning prior to handing over.

Work at all heights, leads, lifts and depths.

11.2 Terrace waterproofing

Work and rate shall include

Proprietary designing and installing

Preparation of surface with required cleaning, chasing, grouting, etc. entire surface.

Grouting with cementious grout coating system (Hydro-tight of M/s. Xypex or Kosetr's alkaline cement base crystalline NB system of M/s. Chowgule Industries Ltd. or equivalent approved)as per specification including providing protective screed.

Brick bat koba of average 110 thick with cement mortar 1:4 (1 cement : 4 sand).

Admixture

Top finishing with china mosaic. (Mosaic not more than 40 x 40 mm size)

Required slope

Required treatment to wall as per instruction including wattas, tucking within parapet, etc.

Protection

Curing

Testing by ponding with 200 mm deep water for 72 hours.

Guarantee of 10 years in approved format on Rs. 100 stamp paper. Cleaning prior to handing over

11.3 Waterproofing for Basement Roof

Work and rate shall include

Proprietary designing and installing

Preparation of surface and require cleaning

Grouting with cement acetous grout as per specification for cracks

Perlite concrete of average 75 thick

4mm thick APP Polymer modified polyester reinforced torch on membrane (Garden Moply FP 4) of STP Texas Ltd. or equivalent approved.

30mm thick protective screed with adding Polypropylene Fiber mesh synthetic fibers as micro rein or cement with Micro ban for controlling microbial growth, to mortar in proportion recommended by the manufacturer.

Laying to required slope

Required treatment to wall as per instruction (minimum 300 mm above FFL)

Protection

Curing

Testing

Guarantee of 10 years in approved format on Rs. 100/- stamp paper.

Cleaning prior to handing over

11.4 Crystalline Water proofing/other type of water proofing

Work and rate shall include

Proprietary designing and installing
Preparation of surfaces
Sealing of surfaces including chasing, grouting, etc.
Preparing watts, junctions, edges, etc.
Application of Crystalline water proof system of Xypex or Chowgule or equivalent approved Testing by ponding with water for 72 hours.
10 year water Proofing Guarantee (on approved Proforma by Bank) to be submitted Cleaning prior to handing over Proforma-

VERTICALITY TEST CERTIFICATE

1. Name of work .....

2. Work order No .....

3. Well No. with location .....

4. Date of test .....

Housing Size Dia..... Suspension.....

Depth	N.	S.	E.	W.	Deviation
3 M					
6 M					
9 M					
12M					
15M					
18M					
21M					
24M					
27M					
30M					

Contractor's Representative Accepting Authority.

TECHNICAL SPECIFICATIONS

NAME OF WORK:ELEVATIONAL TREATMENT WITH GLASS AND ACP CLADDING WORK FOR BSVS AT SITAMARHI BIHAR FOR BANK OF BARODA.

PART -A

A. STRUCTURAL GLAZING SEMI UNITISED SYSTEM
B. ALUMINIUM COMPOSITE PANEL CLADDING
C. SRTUCTURAL GLAZING PUNCH WINDOW
D. CONVENTIONAL CURTAIN WALL

SCOPE OF WORK

GENERAL SPECIFICATION

LIST OF CODES FOR THE REFERENCE

SCOPE OF WORKS

• The Scope of works this contract includes design, supply, installation, protection, Guarantees, testing and maintenance up to the defects liability period of aluminum Structural Glazing semi unitized System, Conventional curtain wall, Aluminum composite Cladding, Structural Glazing Punch Windows at all levels in the building.

• The work under this includes all Labour, materials, equipment and services as required for the complete design, engineering, testing, fabrication, assembly, delivery, anchorage, installation, protection and waterproofing of the above mentioned items and all in accordance with the true intent and meaning of the specifications and drawings taken together, regardless of whether the same may or may not be particularly shown in the drawings or described in the specification provided that the same can be reasonably inferred there from. Anchorage includes all primary and secondary anchor assemblies and supportive structural framing as required to secure above-mentioned items in the building Structure.

The detailed scope of works is as outlined hereunder:

1 The aluminum Structural Glazing unitized System, Aluminum composite Cladding, and Conventional curtain wall. Structural Glazing Punch Windows at all levels in the building described hereafter shall include but will not necessarily be limited to the following:

a. Frame, vision panels, doors and windows.

b. Openable panels where indicated, inclusive of all accessories, fittings etc. door unit mentioned to have
concealed door closer and provision of panic bars as specified and (required at all levels, windows to have locking arrangement with an Allen key handle provision as per requirement.)

c. Coping, soffit trimmers and external metal cladding panels for both the wall cladding and the glazing
system.

d. All caulking, sealing and flashing including sealing at junctions with roof waterproofing and exterior wall, flashing at doorway, raised kerb and in window surrounds.

e. Sealant within and around the perimeter of all work under this section.

f. Separators, neoprene / EPD and silicon gaskets, trims etc.

g. All steel structural framing and beam supports, anchors and attachments as required for the complete installation of the whole, system, wherever specified.
h. Inserts in concrete, anchor fasteners etc. for the anchorage of all work under this section to the approval of structural consultants.
i. Isolation of all dissimilar metal surfaces as well as moving surfaces similar or dissimilar.
j. fire stops flashing, Sealing of all interfaces with building etc.
k. Protection of aluminum/glass etc with safety film during storage /installation until handing over.
l. Engineering proposals, drawings and data sheet for all the design specifications.
m. shop drawing data and structural calculations of all the system including framing, sealant, fasteners
and cladding.
n. Scheduling and monitoring of the work.
o. All samples, mock ups and test units
p. Coordination with work of main civil contractor and other agencies / contractors employed on site.
q. All final exterior and interior cleaning of the aluminum structural glazing punch window conventional
curtain wall ,Aluminum composite panel cladding
r. Hoisting, staging, scaffolding and temporary services
s. Specified tests, inclusive of necessary tests reports for silicon and glass performance and aluminum
anodizing /PVDF.
t. Maintenance manual.
u. Design and performance guarantees.
v. Periodic inspection, supervision and advice by tenderers to principals as well as back-up guarantee in
an acceptable format by the principals for the quality and performance of works.
w. Construction monitoring for regular quality and technical inspection to ensure the work conforms to
the shop drawing details (including any modification made during testing) and acceptable standards of quality.

2. REFERENCE AND STANDARD

Building Regulations

Design of the aluminum structural glazed unitized system shall comply with all government codes and regulations. for wind pressure design for Sitamarhi, all calculations shall comply with the requirements of the relevant National Building Code and Indian Standard Code IS 875 Part-3,1987,unless specified otherwise. Materials and workmanship shall comply with the latest edition of the following standards as minimum.

AS 1664-1979 The use of aluminum in structure.

ANSI	Z97.1.84	Safety glazing materials used in Buildings.
ASTM	C 1036-90	Specification for float glass.
ASTM	C 1048-90	Specification for heat treated flot glass.
ASTM	E 774-88	Specification for sealed insulating glass units
ASTM	C 864-90	Specification for compression seal gaskets
ASTM	C 1115-89	Specification for silicon rubber gaskets.
ASTM	C 920-87	Specification for sealants.
ASTM	D-523-89	Gloss retention for Cladding panels.
ASTM	D-2244-93	Color retention of cladding panels.
ASTM	C 509-90	Specification for sealing material.
CPSC	16 CFR 1201	Specification for Safety Glass.
BS	8118	Structural use of Aluminums.
EN	1396:1996	The use of aluminum in structures

- In general the Contractor may follow any International Standards subject to his satisfying the Architect / Consultant that these specifications are equivalent to latest specifications issued by ASTM, SC, AAMA, BSS & SSIR
- Copies of all codes proposed to be followed /or design; material, installation and testing shall be submitted to the Architect within 2 weeks of issue of Work Order.

TECHINICAL SPECIFICATION

GENERAL

a) All braces, supports and connections for the aluminum structural glazing unitized system and cladding shall be designed, provided and installed complete as required.

b) All design calculations for all the systems shall he designed, procured and installed only after the verification of Consultant.

c) Anchors shall be located as approved by the Consultant.

d) Member shapes and / or profiles if schematically shown on the Architect's drawings are not necessarily the shapes required or best suited for the particular condition. Final shapes and locations shall be as designed by the contractor and are subject to the Architect's review and approval.

e) No holes shall be burned, filled or drilled in any structural steel members unless expressly approved by the structural consultant in writing.

f) The contractor shall provide detailed layouts, alignments jigs etc. for the proper and exact placement of all welded anchor studs, anchorage components, and embedded anchor assemblies etc.

g) All metal structural glazing and cladding elements and their applicable anchorage assemblies shall he designed to accommodate all thermal and building movements without any harmful effect to the structural glazing arid cladding.

h) No unfinished surfaces will be permitted on exposed surfaces.

Concrete Tolerances

- The contractor shall take into account tolerance in concrete and masonry surfaces to which the structural and glazing framework is fixed.
- In general, the construction tolerances in the building will he attempted as follows.

• Surface level of floor slab, sills and lintels	±15mm
• Plumb in a storey	±15mm
• Plumb in full height of building	±15mm
• Cross-diagonal distortion between columns	±20mm
• Max. Displacement of any point on External fascia from its true location	±15mm

Lightning protection –

• The whole of the curtain wall when having insufficient clearance from the lightning protection system shall be bonded as directly as possible to the lightning protection system. At each end of each continuous length of curtain wall, cladding or louvers, provision shall be made at top and bottom for bonding by the electrical] contractor engaged by the Employer. The exact locations and details of the bonding points shall be as determined by the Architect/ Electrical Consultant.

Fire-stop and Interface with building.

• Afire-cum-smoke seal shall be provide at each window-head level, in addition the contractor shall provide aluminum flashing lo approve design at the window sill level and on 2 sides of Vision panels.

• All interfaces with building structure and other elements shall be sealed/flashed/provided with expandable gaskets to Architect's approval.

• Provisions shall be made (eg. capping of all ends of mullions) to prevent sound transmission through the system. Provision shall also be made to prevent metal-to-metal friction due to Thermal changes and wind pressure.

PERFORMANCE REQUIREMENTS

All components, assemblies and completed work included in or pertaining to the work of this section shall conform to or exceed the following performance standards and comply with all applicable and governing building codes and regulations.

• **Thermal Movement:** Provided for noiseless contraction and expansion of component materials for an ambient temperature range of 100 C to 480 C and a material temperature range of 1000 C without buckling, opening of joints, glass breakage, undue stress on fasteners, or other detrimental effects. Make allowance for vertical and horizontal expansion. For fabrication, assembly and erection, procedures shall take into account the ambient temperature range at the time of the respective operations.

• **Building Movement and Related Building tolerance**: The design and installation of the structural glazed systems shall accommodate all inherent building movements and or deflections and the fabrication and installation tolerances of all related work not involved in this section without the loss of, or any detrimental effects to, the performance requirements herein specified. The contractor shall verify and coordinate all such movements and / or tolerance with the Structural Consultants and the Architect before designing all the components of structural glazing aluminum cladding so that movement and deflections in the structure do not at any time affect the integrity and safety of curtain wall and aluminum cladding and vice versa.

• **Thermal property:** All insulation materials, fire-stops and smoke seals shall comply with the Current requirement of the Chief Fire Officer, Patna and other competent authorities.

• **Structural Properties**

a) The design of aluminum structural glazing unitized system and cladding and all related components shall comply with the requirements of National Building code. 1.8. 875 and Indian Standard Code S.S.456,

b) No aluminum structural glazing unitized system and cladding elements including sealants and sealed joints shall sustain permanent deformation of failure under loading equivalent to 1.5 times the design wind pressure herein specified.

c) Deflections: The specified deflections must be reduced if they are in any way detrimental to the aluminum
structural glazing unitized system and cladding elements and sealants.

- The maximum deflection on design wind pressure shall not exceed L1250 (double glazing) and L/175 for Single Glazing of height or 15mm whichever is lesser for mullions,
- No vertical deflection shall exceed L/300 of span
- Maximum deflection on glass under design wind pressure at centre of any panel shall not exceed 15 mm. or as recommended by the manufacturer whichever is less.

MATERIALS

- Materials and components used shall be of the best quality and suitable for the purpose to Architect approval and shall have been tried and tested in environments similar to that of Patna.
- Aluminium sheet panels shall be of a minimum thickness of 2 mm and of max 3 mm for solid sheets and 4 mm, for insulated composite units.
- All materials shall be free from any defect that may impair the strength, functioning or appearance of the glazing and cladding system or adjacent construction.
- Testing by independent testing laboratories or reviews of data by the Architect shall not relieve the contractor's responsibility to verify for himself that the work conforms to the intent of the contract documents.

METALS

- In general metals shall comply with relevant Indian and International Standards.
- Aluminum Wall/Column/Roof Cladding.

The aluminum cladding shall be fabricated with a minimum of 4 mm thick aluminum composite panel of approved make comprising of a thermoplastic resin core. The panels shall be **PVDF coated to minimum 35 micron thickness** in approved metallic colour. The resin content of the PVDF shall be 75% to 80%. The back of the panel shall be chromatised 3-4 mm thick or otherwise protected to Architect's approval. The insulation in-fill of the composite panel shall be non-toxic on burning. The panels shall be acceptable to the Chief Fire Office.

- Fasteners: The type, size. Alloy, quantity and spacing of all fasteners and / or anchorage devices shall be as required for the specified performance standards.

a)Bolts, anchors and other fastening devices shall be of approved types as required for the strength of the connections, positive results during the pullout tests, shall be self- locking, unless otherwise noted shall be suitable for the conditions encountered, and shall be torque tightened, where required to achieve the maximum torque tension relationship in the fasteners. Washers, nut and all accessory items shall be of the same material as fasteners.

b) Fastening devices between aluminum and aluminum shall be chrome/ nickel plated MS unless otherwise approved.

c) Fastening devices between aluminum and dissimilar materials shall be chrome/nickel plated MS unless otherwise approved.

d) Exposed fasteners are subject to Architect's approval and shall be stainless steel.

e) Self-locking fasteners shall be stainless steel with nylon inserts of patches.

Extrusions: 2 mm thick

Al. Section for Structural Glazing (vertical):	**104 mm X 55 mm**	IS 733 & IS 1285
Al. Section for Structural Glazing (horizontal):	**60 mm X 37 mm**	IS 733 & IS 1285
Aluminium Section for Al Cladding Works	**50.8mm X 25.4mm**	IS 733 & IS 1285

Size is subject to manufacturer's specifications but not less than the mentioned here. If it is required to provide heavier section than contractor will provide the same.

All aluminium extrusions shall conform to the system principals specification for tolerances, which shall in any case, be better than DIN standards. Any section not conforming to the tolerances shall be rejected.

In general aluminium alloy for extrusions shall be 6063 T6 as per B.S,1474. However, the grade and tempering specification shall be as recommended by the supplier for each application and shall be approved by the system principal

All aluminium sections shall be either anodized in approved colour to a minimum thickness of 20 microns or coated with PVDF as specified and approved by the consultant.

• Aluminium Flash
A Flashing concealed from view shall be made from mill-finished aluminium sheets 1.5 mm thick. Visible flashing (e.g. on periphery of vision panels) shall be 2 mm thick aluminium Sheets anodized in approved colour.
• Capping
Top capping if required shall be made from 3 mm stretch-leveled aluminum sheets coated with 35 micron PVDF in approved colour.
• Soffits and suspended ceiling System
•
Soffits and suspended ceiling system if required shall be of similar metal of the aluminium wall Cladding with a similar finish. The Architect shall select colour and shape.
Protection: materials used as permanent or temporary protection for metals shall conform to relevant Indian / international Standards.

Brackets:
• Brackets shall be made from stainless steel section 316 grades or approved Mild Steel preferably hot dipped galvanized. Slots in brackets shall be pre-drilled / punched and not flame cut. The surface shall be serrated for additional grip.

Hardware and Fittings:
• All hardware and fitting such as handles, hooks, stay-arms, floor springs etc. for doors windows and openable panels shall be to best International standards. Hinges for openable panels shall be stainless steel friction hinges / stays selected for specified wind load / dead load or specially extruded in built hinges. The Architect shall be provided with the samples of each hardware fitting be used for approval before execution.
• Each openable panel shall be provided with:
a) 1no approved locking set with die-cast handle turning 90° painted approved RAL code and stainless steel fixing plate and screws.
b) 2 nos. COTSWOLT or equivalent heavy-duty top stainless steel friction stays openable upto 15° with stainless steel screws.

SEALANTS

All sealant applications must be clearly designated on the applicable shop drawing details and reference etc. A master sealant schedule specifying materials, special instructions and application procedure. Provide documentation for the same. The compatibility and sequence of installation for all sealants must be carefully considered in all proposals in order to ensure the require cure and optimum performance. Sealants must not degrade and / or fail under all design conditions including but not limited to thermal movement, water, ultraviolet exposure and / or there adverse environmental conditions. The following sealant materials are specified for performance standards only. All proposals must be equal to or better than the materials herein specified, Thedesignation of sealant types noted on the drawings is intended for general design guidance. Final selections by the contractor for the sealant types shall be based on their conformity with the Performance Requirements herein specified and meet with the Architect's approval. Maximum precautions shall be taken to prevent failure of sealant.

- Structural sealant: Dow Corning Silicone sealant 995, GE ultra glaze 4000 or approved equivalent recommended by manufacturer. All exposed and concealed metal to metal (including tight or butt type metal to metal assembly prior to assembly), perimeter metal to concrete joint shall be silicone base sealant, preferably 2 components, in approved colour,

Conforming to the manufacturer's recommendations for the specific uses and performance criteria. The manufacturer shall conduct laboratory test for adhesion for each lot of aluminium sections and glass. Laboratory reports shall be submitted to the Architect/Structural Consultant.

- Weather sealant: the grades of the sealants for the concealed metal to metal and concrete joints such as embedments and lapping of flashings where elements are to be installed or embedded in a full bed sealant shall be the best recommended by the manufacturer for the application,(Dow Coming, GE or equivalent)
- Joint fillers and back-up materials shall be non gaseous polyethylene foam, sponge neoprene as per the written recommendation from the applicable sealant manufacturer for each specific application. Shape size hardness, compatibility and bond-breaking requirements are all factors to be considered.
- All sealants must be non staining and compatible with adjoining sealant backup materials, substrate materials and their respective finished and / or applied colour coating.
- Exposed assembly sealant will not be permitted at any wall area.
- All sealants shall be given 10 years guarantee for materials, workmanship and performance from the date of completion of contract.
- **Caulking compound**: Dow Corning 789 or approved equivalent, one pad grade. Consistency, colour to match adjacent material or approve by architect for use around frame or between frame and floor slab.

GASKETS

Gaskets and seals shall be extruded EPDM or neoprene of approved quality compatible with substrates, finished and other components they are in contact. All gaskets exposed directly on the Extruded EPDM sections shall have the following properties:

Shore Hardness	60 + 5A
Tensile Strength	Min 70 kg/cm2
Elongation	300%
Ozone resistance	No crack at 50 + 5 pphm test temp. of 40 + 20° 0.
Test	Duration of 96 hours and 20% strain.

ISOLATORS

- Isolators between steel and aluminium members and wherever required shall be of rigid type, high impact, smooth both side Teflon with a minimum thickness of 0.8 mm or other non-conducting material as approved by the Architect.

GLASS

- All glass and glazing materials shall be verified and co-ordinate with the applicable performance requirements.
- Vision glass shall have characteristics close to those specified in **PERFORMANCE CHARACTERISTICS OF GLASS**.

- The glass to meet minimum performance characteristics as follow:

The relative heat gain = 260 W/ sq.m., and U value = 5.2 W/ sq.m.

- Samples of glass shall be available in the Architects office. The contractor shall offer glass, which is the nearest to the sample in colour and tint subject to Architect's approval.

Furnish and install glass and glazing work as indicated on the drawings and as specified herein. All glass shall be cut to required sizes and ready for glazing. Any pane, which does not fit any section of the structural glazing and other above mentioned items, shall be rejected and a replacement made at the Contractor's expense.

- Glass shall conform to the quality thickness and dimensional requirements specified in US Federal specifications DD-G0451 C.

- Heat strengthened glass shall not deviate in surface flatness by more than 0.23 mm within 260 mm of leading or trailing edge, or 0.076 in centre. Direction of ripples shall be consistent and extent shall be acceptable to Architect. Distortion of glass shall be controlled as much as possible during heat strengthening. Sag distortion shall be Uni-directional as per Architect's option.

- Permanent identification marking on glass shall be accomplished by a technique selected by the manufacturer. The locators marking on glass shall be accomplished by a technique selected by the manufacturer. The location of the marking shall be proposed by the Manufacturer and approved by the Architect. All glass shall be delivered to site with the manufacturer's label of identification attached.

- Submit for Architect's approval a complete list of materials to be used, including the sealants proposed and such samples as the Architect may require. All glass and glazing methods and materials including the design and profile dimensions of glazing pockets shall be as approved and recommended in writing by the applicable glass and sealant manufacturers. A Sealant substrate test report shall be submitted for each type of sealant for adhesion and compatibility.

- All glass breakage caused by the Contractor or his sub-contractor because of negligence or caused by the installation of faulty work by him shall be replaced by the Contractor at his own expense without delay to the project completion.

- The Contractor shall be responsible to deliver to the Employer without charge replacement for any unit of glass and glazing that fails within the Guarantee period Ten (10) years form date of completion of Contract.

- The glass glazed panels / structural glazing frames for the structural glazing system shall be designed to withstand lateral imposed loads and comply with requirements of local building codes.

- Glass thickness should be selected in accordance with AS 1288 1989 "Glass in Buildings Selection and Installation" to satisfy design performance requirements.

- Glass shall be free from defects or impurities detrimental to its performance. Defects such as bubbles, waves, spots, scratches, spalls, discoloration, visibly imperfect coating, chipping, and

bubbles shall be limited in accordance with the Manufacturer's / trade guidelines. The glass is to be produced in such a way that the rollers will be parallel to what will be the horizontal position of the glass. Glass shall be consistent in colour.

• Manufacturers' glazing instructions regarding installation, clearance, dimensional tolerance, bite edge clearance etc. shall be followed.

• All solar control glass panels shall be stored with particular care and protected against abrasion, sun and moisture prior to installation.

• Precautions specified by glass manufacturers to minimize thermal stress must be followed. A thermal stress analysis shall be obtained from glass manufacturer prior to fabrication and their recommendations shall be followed. Allowance shall be made for thermal movements due to an air temperature range of 600 C and a material temperature range of 100ºC Glass panels shall be selected / rejected on the basis of product quality standards specified by the manufacturer concerning scratches, pinholes, clusters, distortion, colour variations, flaws in coating and other defects.

Each type of glass shall be obtained from only one manufacturer and in one lot.

• Setting blocks for glass shall be extruded neoprene with minimum 80-durometer hardness.

Float glass:
* Quality and finishes; as per ASTM C 1036 Type I
* Heat strengthening; ASTM 1048 HS type I Surface compression 320-450 Kg/cm
* No long marks permitted.

Glass analysis:
* A Glass analysis report showing the manufacturer's wind pressure and thermal analysis for specified maximum deflections and specified probabilities of breakage to be submitted for approval.

Glass submittals:
* A Product data: Submit product data with specific instructions and recommendations for maintenance procedures

Glass certifications

* Manufacturer to certify Glass thickness and heat strengthening
* Sealant substrate test report to be submitted;
* Certified Safety Glazing from Safety Glazing Certification Council (SGCC) or approval equivalent
* Label each unit on spacer and on one pane.

Quality assurance

* Certified Safety Glazing from Safety Glazing Certification Council (SGCC) or approval equivalent * Label each unit on spacer and one pane.

Guarantee:

• Submit written guarantee to correct failure in coating, which occur within the period of Guarantee after virtual completion, this is in addition to the Performance Guarantee to be given by the Contractor.

- Glass shall meet inspection and acceptance criteria as per ASTM-C. 1376

- All structurally glazed panes shall have their edges matt finished-and not highly polished-to avoid internal reflection of light around the edges.

- Glass edges shall he protected against damage at all stages from manufacture to handing over of works. Panes with damaged edges shall be rejected.

GLAZING COMPOUNDS

• All neoprene materials shall be extruded high. Quality ozone resistant, cured, electrometric, virgin neoprene compounds with durometer profiles and design parameters, lengths and locations all as required and recommended in writing by applicable glass manufacturers. All neoprene glazing materials shall have smooth neat exposed surfaces, all flashings and burrs removed and in profiles,
Including integral licking projections to engage into the Patent drawings. Furnish certified test reports to establish conformity with the specified standards.

• Setting blocks used to support the dead load of the glass shall be extruded in a EPDM compound or silicone material conforming to the design criteria, all as recommended by the Glass manufacture.

• Jamb shims used to centre and station the glass shall be extruded in a EPDM compound or a silicone material conforming to the design criteria, all as recommended by the glass manufacturer, Recommendations and detail drawing describing the proposed design and Installation procedure shall he submitted for Employer's review and approval.

• Fixed compression roll in glazing gaskets shall be extruded in an EPDM compound as recommended by the glass manufacturer. Gaskets shall be one piece with Injection, moulded corners free of all flashing and burrs.

METAL COATINGS

• Aluminium shall be matt anodized to minimum 20 microns / PVDF (35 microns) coated as per Architects Approval as per approved colour.

Coatings to aluminium sections and cladding where specified shall be fluoropolymer formulated and will consist of a 3-coat system comprising primer, colour coat and clear anti Abrasion topcoat. The coating system shall meet or exceed all the requirements of AAMA 605 — Voluntary specification for high performance organic coatings on architectural extrusions and panels. The total dry film thickness shall be 35 microns.

• **After selection of colour by the Architect, the Contractor shall prepare a mock up 300 mm x 300 mm, 4 panels cut and grooved indicating 4 ways joint which shall define the colour and gloss range and submit them for approval**.

• All samples shall be identified and have a full laboratory report attached.

• The coating system, including materials and application shall confirm to the requirements and recommendations of the paint manufacturer.

• Testing and Sampling Procedures In-process testing shall be performed on test Specimens of equal metal thickness pretreated and finished along with the production metal, Specimen shall, exhibit a test of at least 75 mm x 300 mm to permit instrument readings in addition to running in-process tests to assure high quality production, additional finished extrusions or panels are to be submitted to the coating manufacturer's laboratory for extended exposure Testing.

• All test samples shall be properly identified with date, batch number and shift indicated.

The following tests shall be conducted at least once per production shift and submitted to the Employer when required:

i. Dry Film Thickness — evacuated with a Perm scope, Isoscope or Dermatron instruction.
ii. Film Hardness.
iii. Dry cross batch Adhesion.
iv. Boiling Water Adhesion Test.
v. Gloss Measurement.
vi. Colour Examination against Standard.

vii. General Appearance — Smoothness, tree of blisters, sags, pinholes and other surface imperfections.

- The testing agency, Manufacturer and the Contractor shall certify testing reports.

Process

i. Dry Film Hardness -The coating shall have a hardness of H minimum when tested with "Eagle Turquoise Pencil".

ii. Film Adhesion — The coating system shall withstand the following adhesion tests:

DRY: Make ten (10) parallel cuts 1.25mm apart through film and ten (10) more cuts 90 degrees and crossing first ten cuts. Apply Scotch Transparent #710 Tape, 18 mm wide, over areas of cuts, pressing down firmly against coating. Pull tape off sharply.

WET: Make ten (10) parallel cuts as above: Immerse samples in boiling water for 5 minutes. Remove sample, dry, cool and tape-test the crosshatched area as above.

iii. Gloss Measurement — Measure gloss at various locations on painted metal with a 60 —. Gloss meter.

iv. Colour Uniformity — Check random samples of painted production metal under a uniform light source, such as natural.

- Test for cure of coating using 100 double rubs with several thicknesses of cheese cloth wet with MEK solvent. Slight dulling of the film is considered normal, but softening shall not be permitted.

Performance Requirements

Salt Spray resistance — with stand a minimum of 3000 hours exposure to 5% salt solution at 95% RH, 37.5 degrees C with no more than 1.25 mm creep age or loss of adhesion from scribed line or cut edges.

Humidity Resistance — with stand a minimum of 3000 hours exposure to 100% RH at 37.5 degrees C with no more than a few blisters, size no.8 (ASTM D714—56)

Abrasion Resistance — Withstand abrasion of sand with an abrasion coefficient value of 65 minimum when evaluated per ASTM D968-51 test method.

Mortar Resistance — Withstand wet mortar, 24 hour part test at 100% RH without gaining adhesion or any on ll painted surface of solid colours.

Detergent Resistance — Withstand immersion on in 3% synthetic detergent solution for 72 hours at 37.5 degrees C with no loss of adhesion no blistering and no visible change.

Colour Retention — Withstand immersion chalk rating of No.8 for colours and No.6 for white per test method ASTM D659-44 (1970).

Field Touch-up and Repair: The contractor and coating manufacturer shall supply materials for air-dry touch up for spray or brush application per instruction of manufacturer shall supply materials for

Air-dry touch up for spray or brush application per instruction of manufacturer. Touch up shall be held to an absolute minimum to Architect's approval.

Furnish to Owner a written guarantee / warranting for all works in connection with organic coating system be free from defects in materials and workmanship for a period of Ten (10) years from date of

Completion and to correct promptly any defect free of cost. The following units considered as defects: without being limited thereto:

- Peeling
- Checking
- Blistering
- Chalking in excess of #8Chalk rating when measured in accordance with ASTM D659-44 (1965).
- Fading or colour change in excess of 5 NBS unit when calculated from measurement on a spectrophotometer or colour meter capable of colour measurement by reflectance reading in accordance with ASTM D244-68.

STRUCTURAL GLAZING (if required):

- The method of assembly, reinforcing and anchorage of the aluminium unitized structural glazing/cladding System, where indicated, is schematic, Locations and method of providing it shall be the Contractor's responsibility, which shall design the assembly, reinforcing and anchorage to suit each specified condition in an acceptable manner complying with the requirements specified hereinafter.

- Visible joints shall be as shown on the Architect's drawings.

- All parts shall be secured by concealed means wherever possible and where exposed to view, screw positions are to be indicated on the preliminary drawings. Exposed screws shall be of the countersunk type coloured in some finish as of aluminium or non magnetic stainless steel and shall be evenly and neatly located in the approved manner.

- All component shall be assembled, secured anchored, reinforced, sealed arid made whether tight in a manner not restricting thermal or wind movements of the structural glazing where possible, sealants shall be concealed.

- All fastening into or through aluminium shall be non-magnetic stainless steel.

- Free and noiseless movement of all the components of the Curtain Walling System due to thermal effect, structural effect wind pressure, seismic forces, erection or dead loads. Shall be achieved without strain to the glass, without buckling of any components and without excessive stress to any members or assemblies.

- Aluminium surfaces in contact with mortar, concrete, plaster, masonry, wet application of fireproofing and absorptive materials shall be coated with an antigalvanic, moisture barrier material

Waterproofing

- A Complete drainage system must be incorporated into the structural glazing frame. Water leakage and condensation shall be drained or discharged to exterior face of the wall and all internal spaces vented by acceptable means to ensure pressure equalization where possible.

- Drainage system will be sealed off at every floor to prevent infiltrated water form leaking to lower floors.

- Movement of water behind and on exposed surfaces must be controlled to ensure that water is not retained and the elements will not be damaged or corroded by water and to minimize the potential to algae and fungus growth as a result of standing or trapped water.

ALLUMINUM COMPOSITE PANNELING: (if required):)

Anchorage System and Building Frame

Each glazed unit shall be fixed to the structural slab at each floor level. All fasteners shall be stainless steel of approved grade. The contractor shall also make necessary modifications to the anchor fasteners to suit existing site conditions of steel reinforcement without additional charge.

Mullions and Transoms

The sections of mullions and transoms shall be designed to restrict deflection under wind pressure as specified and shall be rigid enough to support and retain the glass under all conditions.

Reinforcing members, where used, shall he completely enclosed and if fabricated from steel shall be galvanized and protected with primer and two coats of zinc chromate.

Window units (Vision Panels)
All windows shall be glazed from inside where possible. All cladding as well as internal glazing beads, if any (unless otherwise specified) shall be in anodized aluminium.

Openable Windows and Doors

- Windows and doors shall be provided at positions as shown on the drawings. The ventilators when in closed position shall remain watertight under all weather conditions and pass the water tightness tests as specified.

- All hardware and accessories shall be supplied by the contractor and when exposed shall be of stainless steel or approved aluminium alloys in approved finish.

- Minimum aggregate openable area of the ventilator shall be as given in the Architect's drawings.

- The detailed system of the ventilators and doors must be proposed by the tenderer keeping the position as shown on the drawings.

CLADDING (if required):

- Cladding shall be non-toxic composite aluminum panels (as specified) of adequate strength with approved aluminum details. The panels shall be 4 mm thick composite units finished with PVDF coating overall 28-30 micron thick of approved metallic colour. The resin content of the PVDF coating shall be 75% to 80%. The back of the panel shall be achromatized 3-4 micron thick, compatible with adhesives for stiffeners if any or given a polymer coating.

- All cladding panels of one kind shall be obtained in one lot from the manufacturers.

- Each panel shall be guaranteed for a flatness of 1 mm from the true face after installation under no-wind conditions. Deviations from the true alignment of adjoining panels shall not be cumulative. Full load deflections shall be kept to the minimum possible. Each panel shall be capable of withstanding 300 Kg/Sq.m wind pressure without any permanent deformation.

- The cladding system shall be adequately ventilated. The air-gap between the cladding panels and the concrete/block-wall shall be at least 50 mm to allow proper ventilation of the rain screen system. The cavity shall be closed by a perforated bird/vermin-proof closer at bottom and by a flashing at top

- The fabrication processes including cutting, grooving, benching, folding, joining, root-in as well as approved aluminium support framework, fixed to wall with aluminium/galvanized steel brackets.

- The composite Aluminum panels shall satisfy the following fire codes requirements:

- BS476 part 6 class 0
- ASTM E-84 Flame Spread index 0
- Smoke developed index <15
- UBC 20-9 & NFP for 30 minute intermediate scale Multi-storey Apparatus Test to prove no flame spread beyond the area directly exposed to fire source.

FABRICATION

General: All assemblies shall be fabricated and assembled in accordance with the drawings and the Requirements of these specifications, Deviations of any nature, without approval of the Architect /Consultant shall not be permitted.

Tolerance: Furnish a schedule of fabrication tolerances for all major wall cladding components. In addition to the fabrication tolerances, provide for and schedule thermal movement including assembling and installation tolerances for all major and/or applicable wall cladding components and/or assemblies.

Workmanship

- All work shall be performed by skilled workmen, specially trained and experienced in the applicable trades and in full conformity with the applicable provisions of the listed References and Standards and/or otherwise noted on the drawings or as specified herein.
- All work shall be carefully fabricated and assembled with proper and approved provisions for the thermal expansion and contraction, fabrication and installation tolerances and design criteria.
- All forming and welding operations shall be done prior to finishing, unless otherwise noted.
- All work shall be true to detail with sharp, clean profiles, straight and free from defects, dents, marks, waves or flaws of any nature impairing strength or appearance fitted with proper joints and intersections and with specified finishes.
- All work shall be erected true to plumb, level, square to line, securely anchored, in proper alignment and relationship to work to other trades and free from waves, sags or other defects. **Joints in Metal Work**
- All exposed work shall be carefully matched to produce continuity of line, design and finish. Joints in exposed work, unless otherwise shown or required for thermal movement, shall be accurately fitted. Rigidly secured with hairline contracts and sealed watertight.
- Where two or more sections or metals are used in building up members, the surface in contact shall be brought to a smooth, true and even surface and secured together so that the joints shall be absolutely tight without the use of any pointing materials. Extrusions shall be tolerated to eliminate any edge projection or misalignment at joints.
- Furnish physical samples of all joinery elements as for comparative appraisal and approval of the production materials. Physical sample of all typical wall intersection
- Assemblies shall be colour coded on surfaces and /or areas to receive sealants.

Assembly

- As far as practicable, all fitting and assembly of the work shall be done at site.

Sleeves

- Unless otherwise noted, all aluminum sleeves shall be extruded sections designed to accurately interlock with adjacent sections and incorporate serrated surfaces for the secure bedding of sealant between the parent metal and the sleeves.

Fasteners

a) All fasteners shall be of stainless steel with self locking devices, unless otherwise noted, and of sufficient size and strength to withstand the applicable design wind load and dead load forces with safety allowance factors as required for the specific materials. The spacing and quantities of fasteners shall be as required to develop the maximum strength of the member they secure or support. Washers

and/or other accessory items shall be of the same material as the fastener. Torque tightens all assembly fasteners to achieve the maximum torque tension relationship in the fastener.

b) All fasteners shall be cancelled unless otherwise shown or approved. The head style for all exposed fasteners shall he countersunk oval head unless otherwise noted on the drawings. exposed fasteners shall be finished to match surrounding metal finish.

c) All fasteners including washers and accessory items shall be scheduled and designated on the shop drawings so that anyone can witness and assess the assembled units to ensure that all fasteners conform to the designated and approval type, size, material, spacing, etc. when certain items are not readily apparent, such as material and alloy or torque tightening requirements, special instructions for the identification and appraisal of such items shall be issued.

Protection of metals

d) Protection against galvanic action shall be provided wherever dissimilar metals are in contact.

e) Aluminum, which is to be in contact with, cured concrete, mortar or plaster shall have the contact surface protected wherever crevices between the contact surfaces may entrap moisture and corrosive elements. All metals, except stainless steel, which are to be in contact with fresh concrete, mortar or plaster shall have the contact Surfaces protected with epoxy paint.

f) Furnish a schedule of all protective coatings and related items including the Designation of area and or specific locations, materials used, special instruction, Specification data sheets, etc.
Welding

g) All welding in aluminum work shall be done by the inert gas shielded arc or flux less resistant techniques and with electrodes and/or by methods recommended by the Suppliers of the metals being welded, Type, size and spacing of welds, shall be as shown on approved shop drawings.

h) Welds in galvanized metal shall be touched up with zinc rich paint.

i) Welds behind finished aluminum surfaces shall be so done as to eliminate distortion and/or discoloration on the finished side. Weld spatter and welding oxides on
Finished surfaces shall be moved by descaling and/or grinding. Provide low heat fitted welds used chill bar on finished side to eliminate dimpling, distortion and/or discoloration on the finished or exposed surface. Plug, puddle or spot welding are not permitted. If weld beads are shown on exposed finished surfaces, the surfaces shall be ground and polished to match and blend with finish on adjacent parent metal.
Structural welds shall be made by certified welders and shall conform to the general recommendations and regulations of AWS Specification D1.0-46.

j) Vapour degreasing or suitable solvent shall remove dirt grease, lubricant, or other Organic material.

k) Joints rejected because of welding defects may be repaired only by rewelding. Chipping or machining shall remove defective welds; Flame cutting shall not be used.

• Wherever welding is done in proximity to glass or finished surfaces, such surfaces shall be protected from damage due to weld sparks, spatter to tramp metal.

- All welds shall be scheduled and designated on the shop drawing so that anyone can witness and assess the assembled units to ensure that all welds conform to the designated and approved type, size, spacing etc.

Soldering

•All soldering and/or brazing shall be done as recommended by the suppliers of the metals involved.

Shop painting of carbon Steel

•Item of carbon steel, unless galvanized or scheduled for other finish, shall be thoroughly cleaned of all loose scale, fillings. dirt and other foreign bodies and shall be painted with zinc chromate primer.

GENERAL EXECUTION

The drawings supplied by the Architect shall be considered essentially schematic, except for profiles, exposed surfaces which shall be as indicated. If, in the opinion of the contractor, a change of profiles is required in order to meet the specifications, he shall consult the Architect for a review of the conditions.

The method of assembling, reinforcing and anchorage of the aluminum structural cladding system, where indicated is schematic, location and method of providing same shall be the contractor's responsibility, who shall design, assemble, reinforce and anchor to suit each specified condition in an acceptable manner complying with main building structure. Site work shall be coordinated with the main Contractor's Programme.
Visible joints shall be as shown on the Architect's drawings.
All parts shall be secured by concealed means and screws exposed to view shall not be allowed.

All components shall be assembled, secured, anchored, reinforced, sealed and made weather tight in manner not restricting thermal or wind movement of the metal wall cladding/curtain walling system. Where possible, sealants shall be concealed.

Free and noiseless movement of all components of the aluminum structural glazing and cladding System due to thermal, structural, wind pressure, or dead loads, shall be achieved without strain to glass, without buckling of any components and without excessive stress to any members or assemblies.

The entire aluminum structural glazing and cladding system shall be assembled and installed so that all leakage and condensation shall be drained and discharged to the exterior face of the wall.

Movement of water behind exposed surfaces shall be controlled to ensure that water is not retained and that element will not be damaged or corroded by and to minimize the potential for and fungus growth as a result of standing or trapping water.

PERFORMANCE TESTING

Measurements The measurements given on Architect's drawing shall not be used by the contractor for preparing his shop drawings and for executing the work. All dimensions shall be actually measured on site and in case of any discrepancy between measurement on site and in drawings; module shall be decided in consultation with the Architect.

- The contractor shall carry out site tests as specified in at his own cost.

- The contractor shall supply copies of shop drawings and calculations to the Test Laboratory prior to installation of the test units. These drawings shall include:

- Test elevation of sections:
- Full scale typical details structurally glazed windows (intersections of number):
- Typical support details:
- Extent of sealants:
- Size and number of pressure equalization/drainage slots or holes:
- Blanking off details: and,
- Method of installation

Any deviations from the drawings shall be recorded and noted in the final report. After approval of structural calculations and shop drawings for the structural glazing test units for performance testing of the curtain wall shall be constructed by the contractor at the testing laboratory.

Test Units

- The test units shall comprise components representative both in size and shape of the facade of the building under examination. The width of the test sample shall be not less than of three typical adjoining wall panels/units. The height of the test samples to cover one floor upto the 1st column and must contain full height modules of the aluminum structural glazing system. Vertical and horizontal movement joints shall be included in the test sample.

- Where details of the building facade differ from those in the representative test sample, such as at corners, overhangs and the like, supplementary tests shall be performed on either composite of part sample of the façade.

- The materials of the test sample (glass, aluminum, reinforced concrete sealant, gaskets etc.) shall have the same details, methods of construction, flashing and anchorage as the building facade.

- If not an actual on site representative sample of the wall of the building, the test sample shall be mounted and sealed into a simulated building frame in the same manner and by the same fixings which are intended to attach the façade to the building structure. The support frame shall be of equivalent stiffness to that supporting the building to prevent unrealistic deflection of the prototype sample.

- All aluminum panels and other interconnected joints in the facade shall be sealed at the sample boundaries. This is to minimize the effects that the surrounding construction will have on the test performance of the sample. All pressure equalization and drainage slots or hole in the test sample shall be Left open.

Inspection of test units • The contractor shall allow for the Architectural /PMC to inspect the test sample regularly during erection. At his stage the adequacy and stiffness of the support structure shall be assessed. When the installation of the test sample is complete, the Architect/PMC shall inspect the test sample and if satisfied, shall approve its completeness.

- Testing shall not commence until this approval has been given.

- Full time attendance of approved representative of the contractors shall be provided for the erection of the test unit and all testing of the test units.

Test of Wind Pressure
Method The equivalent load for wind pressure or wind suction Shallbe given to the test unit as increasing and decreasing the inside pressure of the “Pressure Chamber” at which the test unit is fixed
Static [wind Pressure The static pressure shall be increased to a maximum of +/- 300 kg./sq.m. in steps.

Dynamic wind pressure the variation of dynamic pressure shall be approximately sinusoidal with each cycle having a period of 2 seconds.

Observation Deflection on each observational point of the test unit shall he observed and recorded under the static pressure as described above. Evaluation No damage or harmful permanent deformation on an’ parts shall be found at the maximum design wind pressure as defined in item14. The deflection of the main structural member in this conditionshall be less than L/250 (L=length between support) or less than 15 mm whichever is least. No damage or harmful permanent deformation of any parts except sealing materials shall be found at the maximum testing pressure. The maximum deflection /span ration of glass shall not exceed 1:90. The residual displacement of a member shall not exceed 3.0 mm. The slippage at supports and fixings shall not exceed 1.0 mm.

Test of water tightness (static pressure)
Method: Water shall be sprinkled on the unit under the same condition as under test on static wind pressure as described above. Pressure shall be maintained continuously for 10 minutes and the pressure of every ±50 kg/sq.rn shall beaded to the preceding pressure upto +100 kg/sq.m. and 150 kg/sq.m. at maximum. The volume of the sprinkling water in one minute shall be 5 liters/sq.m as per, AAMA Standards.

Observation All water leakage and drainage ventilators of the Curtain wall system observed form the inside of the chamber Conduct the test 3 times, in sequence as described below.
Conforming to the above **Mentioned conditions:**

a) Install the test unit.
b) Hold 1st water tightness test.
c) Hold test on Wind pressure as described above.
d) Hold 2nd water tightness test.
e) Cut the compound type sealant if any one purpose.
f) Hold 3rd water tightness test.

Evaluation: Water leakage at all parts of the test unit should not be observed, inside during the i water tightness test except for ventilator, where water leakage should not be observed at the pressure of 100 kg/sq.m. If water leakage and splash are observed on the ventilator they should be provided with a proper drainage system. In case water leakage is observed during the 3rd water tightness test., effective drainage system should be provided.

Test water tightness (cycle pressure)
Method: This test be performed upon completion of the test for water penetration by static pressure. Should the cyclic water penetration test not commence within thirty (30) minutes of the static water penetration test, then, immediately prior to the start of the cyclic test the exterior face of the test sample shall be completely sprayed with water at a rate not less than 0.O5LIm2Is for five (5) minutes with zero air pressure differential on the façade. Water shall be applied to completely and continuously over the exterior face of the test sample at a rate not less than 0.05/LJm2Is while a cycling positive air pressure is applied to the exterior face for a period of not less than (5) minutes. The applied positive

pressure shall be varied between the specified limits wkh a cycle time to three (3) to five (5) seconds. Each of the steps shown below:

Step	Minimum	Maximum
1.	30 kg/sq.m	60 kg/sq.m.
2.	30% positive permissible	60% positive permissible

Stress Design Pressure

The air pressure differential shall be reduced to zero for two minutes between each step with the water spray still in operation.

Observation of the internal face of the façade shall be out carried out during the water spray operation. And for five minutes alter the water spray has stopped and zero air pressure differential of the façade.

Any water appearing on the inside face of the façade shall he recorded with the extent and, if possible, the source of leakage indicated.

Evaluation There shall be no leaks at 60% of maximum positive Pressure. A leak is considered to occur when Water appears on the inside face of the façade and is visible from an occupied space uncontrolled water appears on the inside face of the façade and is likely to damage insulation or other architectural fixtures. Uncontrolled water is defined as any leakage that is notcontained and drained away within the test duration (including the five (5) minute observation period).

Air infiltration test

Method:	The face of the test sample shall be sealed airtight by covering it with an impervious film. If this is not practicable, all joints, peepholes and glazing or sealant lines of the test façade shall be sealed with impervious adhesive tape.
Proof test	Positive and negative test pressures of 7. Kg/sq.m.. shall be applied and the base air infiltration rates through the test apparatus determined by a calibrated flow mater inserted in the air pressure line. The scaling film or tape shall he removed from the Last sample and the total air infiltration through the test samples shall the difference between the base and total readings

Method:	The test sample shall be subjected to proof tests. The applied Positive and negative pressures shall be 1.5 times the positive negative permissible stress design pressure as determined form AS 1170 -1983 Part .2. Each proof test.

Pressure shall be maintained on the test sample for a period of one (1) minute.

Evaluation: Under proof test there shall be no collapse shall mean any one or any combination of the following;

a) Dislodgment of any glass.
b) Dislodgment of any frame, panel or any thereof.

c) Failure of any fixings that connect the façade to the building structure, such that the test sample is unstable
d) Failure or any stop, locking device, fastener or support, which would allow an opening light to come open.

Form Report

Details of the test sample (including an outline of the simulated building frame) and the test apparatus, instrumentation and method shall be clearly given in a report.

- The report shall include the following:

a) An identification and general; description of the façade and Certificate of Identity from the builder or his nominated contractor.
b) Drawings of the actual test sample showing modifications, if any.
c) Test sequence with pressure used in all tests.
d) Location of all transducers for the structural performance test.
e) Displacements span deflection ration and air infiltration rates.
f) Other pertinent observations.

Records Drawings • The testing laboratory shall keep a copy of approved test unit, shop drawings and calculations at testing laboratory accurately and neatly record on the above mentioned shop drawings all changes, revisions, modification, etc. made to test unit, which shall become the record drawings.
- At completion of testing and after approval of test reports, the testing laboratory shall submit the marked up record drawings to the Architect.

Site Tests

- The Contractor shall carry out site tests at his own cost to determine resistance to water leakage as per recommendations given in AAMA 501.2-94 for Field Check of Metal Storefront. Curtain walls and Sloped Glazing Systems for Water leakage."
- The test areas shall be selected by the Architect, at random in typical and non-typical Locations, one for every 600 sq.m. Approx. of installed curtain wall and glazing system. In case of any test failing, the Architect shall order more tests to be conducted at the Contractor's cost.

- Each test area shall be
a) 10 sq.m. Minimum or
b) 25 m. run of perimeter of vision and spandrel units,
c) 4 entire panels of standard types. Whichever is the least.

INSTALLATION
Qualification of workmen
All work shall be performed by skilled workmen, especially trained and experienced in the applicable provisions of the listed References and standards and/or as the otherwise noted on the Architects drawing or as specified herein. The qualification of the Contractor's installation workman shall first be filed with and approved by the PM C/Architect,
- **Setting out**

Bench marks for elevations and building lines offset marks for alignment shall be established on each floor level by the Main contractor, should any error be found in their location, the contractor shall notify

the PMC and the Main Contractor in writing and installation work shall not proceed in the affect area until the errors have been corrected.

Within 2 weeks upon the award of the contract, the contract, the contractor shall submit the structural glazing anchorage plan for endorsement by the PMC and approval by the Architect. The Contractor shall co-ordinate his system of anchorage with PMC/Civil Contractor according to site conditions.

- **Prior Inspection of the Structure**

After the setting out has been established and before beginning installation in any area the Contractor shall examine all parts of the structure on which the curtain walling system/metal wall cladding are to be placed in that area. Should any conditions be found which, in his opinion will prevent the proper execution of his work or endanger its permanency he shall report such condition in writing to the PMC and the Civil Contractor, installation work shall not proceed in that area until such conditions are corrected or adjusted to the satisfaction of the PMC.

- **Workmanship**

All parts of the aluminum structural glazing and cladding system shall be erected true plumb and in proper alignment and relation to established setting out, as shown on. Approved shop drawings.

- **Erection Tolerances**

The installed metal wall cladding/curtain walling system components shall conform to the following erection tolerances under no-wind condition:

a) Amount of total deviation and/or misalignment in any direction for vertical members:
3mm maximum in a height of 4 m (non-cumulative) and maximum 7mm in full height of cladding/curtain walling.

b) Amount of total deviation and/or misalignment in any direction for horizontal members: 3 mm max in a
length of 7m. 5 mm in full length.

c) Maximum offset from true alignment between two abutting members shall be 1 mm. No edge projection or misalignment will be permitted.

d) Maximum joints gaps or opening between removable glazing stop and adjacent member shall be 1 mm
and/or a maximum 1 mm cumulative opening at both ends of removable members (0.5 mm each end)

e) Deviation in spacing of brackets: +15 mm.

f) Allowances for the cumulative effect of all tolerances (fabrication assembly, thermal an erection) must be made to ensure a 'workmanlike installation. The documentation and distribution of this information to all applicable installation and inspection personnel is essential in order to ensure the standard of quality and workmanship required.

Installation within and/or adjacent to concrete: where work is to be installed within and/or adjacent to concrete, no aluminum structural glazing and cladding system components other than built in anchor devices shall be put in place until the concrete work is completed including the removal of al forms, Shoring etc.

- **Anchorage:**

a) Anchorage of the aluminum structural glazing and cladding system to the structure shall be by approved methods and in strict accordance with approved shop drawings. After the aluminum

structural glazing and cladding system are properly positioned, all connections so designated on approved shop drawings shall be rigidly fixed by welding or other positive means.

b) All anchorage assemblies and their related components shall be thoroughly scheduled and described on the shop drawings so that anyone can evaluate an installation and ensure its compliance with the contract documents. Designate trades responsible for furnishing and/or installing materials if other than the subcontractor. Descriptive items shall include the access removal movement and tolerances of related building and the aluminium structural glazing and cladding system direction and magnitude of thermal expansion, materials, size, quantities and any special instruction as may be required. All primary aluminium structural glazing and cladding, anchorage assemblies inclusive of skylight space frames/structural mullion shall receive a 100% inspection.

- **Welding**

All welding shall be done by skilled mechanics qualified or licensed in accordance with local building regulations. Welds and adjoining burnt areas in prime coated surfaces shall be thoroughly cleaned and painted with one coat of primer. Welds in galvanized steel shall be coated with one coat or zinc rich paint. Special care shall be taken to protect glass and other furnished surfaces form dame and to prevent causing fires.

- Use of sealing materials

a) Scaling materials shall be used in strict accordance with the manufacturer's printed instructions and shall be applied only by workmen specially trained or experienced in their use. Before applying sealant, all mortar, dirt, dust moisture and other foreign matter shall be completely removed from surfaces it will contact adjoining surfaces shall be masked when required to maintain a clean and neat appearance. Sealing compounds shall be tooled to fill the joint and provide a smooth finished surface.

b) The manufacturer (s) of the applicable materials shall, when required, render, technical assistance prior to the application of any sealant and witness the first application as well as periodic site inspections performed by the sealant Manufacture- provides close supervision of all workmen used to apply the sealant.

- Copying and soffit trimmer

The contractor shall perform installation of coping and soffit panels and field sealing between the coping and other trades.

- Tensioning of Bolts

All bolts shall correctly tension. The tension shall be specified on shop drawings. At least 10% of bolts shall be mechanically checked for correct tension.

- Sequence of Installation

If so directed by the PMC. installation of the aluminium structural glazing and cladding shall be postponed in areas as designated by the PMC for a specified period of time so as to facilities moving materials/equipment into and out of the building and installation of M & E (Mechanical & electrical) fittings during constructions. The contractor's work is to proceed along guidelines and schedule as directed by the PMC.

- Removal of Debris

All debris caused by or incidental to the installation work shall be promptly removed from the job site as the work progresses. Weep holes and drainage channels shall be unobstructed and free of dirt, rubbish and sealant.

•Protection and Cleaning

a) The contractor shall adequately protect all aluminium sections, glazing, cladding sheets, components and accessories from damage during shipment, storage erection and after completion of the work by use of protective film/foil of approved non-staining quality.

b) At such time as may be directed by the PMC, the contractor shall remove all protective coverings and/or coatings and clean surfaces free of all soil and discoloration. All cleaning agents shall be acceptable]e to the applicable aluminium, glass and co manufacturers; and where doubt exists, spot tests shall be made to satisfy the PMC.

CONTRACTOR'S RESPONSIBILITIES

•The Contractor's responsibilities include but are not necessarily limited to the following items:

a) The Contractors shall provide and install all supplementary parts necessary to complete all items generally implied in the shop drawings and in the specifications though not specifically shown or mentioned.

This shall include the design and sizing of all sections and anchor assemblies to meet the performance and design requirements, furnishing and installation of all inserts fasteners clips. Bracing and framework as required for the proper anchorage of the structural glazing window system elements to the structure, unless otherwise noted or

Specified to be furnished / installed by another contractor, Alternate anchorage proposals will be considered, if in the opinion of the Architect the general design and intent of the drawings and specifications are maintained.

The Contractors system therefore must perform satisfactorily as a whole.

b) Design Responsibility: Drawings and specifications indicate the required basic dimensions, profiles and performance criteria. The Contractor shall have the option of modification and addition of details provided the visual concept and performance requirements are fulfilled. Proposed modifications shall be clearly shown on shop Drawings as 'Design Modifications" and acceptance of the same will not relieve the Contractor form sole responsibility for performance of the aluminium structural glazing window system and cladding. The Contractor shall be solely and fully responsible for due performance of his installation based on his own design and details.

c) job site inspection: The Contractor shall afford the Employer. Architect / PMC or their authorized agent full access to plants, shops and assembly and finishing of the aluminum structural glazing system and cladding for this project.

The Architect / PMC will have the right to reject any and all aluminium structural glazing system and cladding components and assemblies during assembly and Erection if the workmanship and intent are not in strict conformity with the approved shop drawings, structural design calculations, documentation, certifications, samples and mock-up.

d) Glass, sealants and other items or materials procured by purchase shall be back to back guaranteed by the
manufacturer.

SHOP DRAWINGS

• Within 2 calendar weeks upon award of LOI, the contractor shall prepare shop drawings by necessary modifications to the preliminary drawings and two (2) copies of all shop drawings A0 size' shall be submitted to the Architect for review and approval. The Architect's review of all shop drawings will be limited to their conformity to the design concept & specifications. Architect's approval of the

shop drawings will not relieve the contractor from any of the responsibilities and requirements as stated in Contract Documents. No work shall be fabricated until the shop drawings and all other related submissions, documentation, certifications, samples and the mock-up for that work have been reviewed and approved by the Architect/PMC. On approval the Contractor shall submit 5 copies of drawings to Architect/PMC for release to site.

- Shop drawings shall incorporate scaled and dimensioned plans, elevations, sections and full size details for all work in this section.

Shop drawings shall indicate the desired dimensional profiles and modules, function, design and performance standards and, in general, delineate the scope of work. The contractor shall verify and co-ordinate these items with all applicable and / or related trades, contract drawings and specifications. Since the dimensions and modular references shown on the drawings are for specific and / or typical detail, the shop drawings shall include a full complete layout of all modular and referenced dimensions for all the Structural Glazing System, Aluminium Composite Cladding, Aluminium Doors and Windows at all levels in the building and their related elements, All dimensions I modules, etc., shall be field checked as required. The full size details shall show and specify all metal sections, types of finishes, areas to be sealed and sealant materials; gaskets, direction and magnitude of thermal expansion, direction and magnitude of all applicable construction including fasteners and welds, all anchorage assemblies and components, the fabrication and erection tolerances for the work and applicable related works adjoining, attached to or in some way related to the work covered by these specifications. The location of all static and dynamic anchor assemblies, the direction of thermal and other applicable building movements, co-ordination with concrete works and the sequence of installation shall be designated on the applicable planes, elevations and / or sections. All details shall be subject to Architect's approval.

- Shop drawings shall indicate the desired profiles; dimensions, details or metal finish and general delineate the scope of the work, Profile adjustments in the interest of economy, fabrication, erection, weather ability or ability to satisfy the performance requirements may be made with the written approval of the Architect/PMC, provided that the general design and intent of the drawings and specifications are maintained.

- Four (4) copies plus two (2) rewritable CD print each of all final approved shop drawings shall be submitted to Architect / Consultant / PMC.

STRUCTURAL CALCUALTIONS

•The Contractor shall employ a competent design engineer to design his systems and components. During the design stage. The Contractor shall interact actively with the Structural Consultants concerning all aspects of design and shall obtain all the information from them concerning the structure. Probable deflections and other building movements etc. The Contractor shall take full account of all possible building movements as well as the movements of Structural glazing system, Aluminium Composite Cladding, Aluminium Doors, and Windows in his Design. The Contractor shall submit his detailed structural Calculations for the systems and each of their components and shall guarantee that his design will ensure the structural safety and integrity of all the systems mentioned above Against all natural forces, superimposed loads, environments add consequent movements.
The Contractor shall obtain the Structural Consultants approval to his design movements. and to the provision made in his design for all the design movements, and shall directly pay fees to the Structural Consultants for their interaction in a manner such that the Contractor And the Structural Consultants shall be jointly responsible to the Employer for the correctness of the fixing and interaction of the curtain wall with the structure so as to ensure that all the movements envisaged between the structure and the curtain wall are fully taken care of however the contractor alone shall he responsible for the workmanship of fabrication and installation and shall indemnify the Employer against all claims duo to defects or non performance during the specified 10 years Guarantee period. The provision of this clause shall not in any way limit the Employer's rights under other clauses of the Contract.

- The Grade of R.C.C. in the building structure is as specified in STRUCTURAL DESIGN. The Contractor shall design anchorages for this grade of concrete with adequate safety factor.

- The Contractor shall submit 3 sets of design calculations to the Architect after they are endorsed by the Structural Consultants for compatibility with RCC and steel structure.

DOCUMENTATION AND CERTIFICATION

- **Glass and Glazing Documentation**: The applicable glass manufacture(s) shall submit written certification for Architect's review and approval stating that all glass and glazing requirements as detailed and specified on the shop drawings have been reviewed and approved or use relative to that specific application and / or design parameters, compatibility to adjacent materials and in conformity with all requirements as details and specified in the Contract Documents. Certification shall further state that the proposed glass and glazing materials are most appropriately suited for the use or uses intended and recommended for the specific use or the selection of the glass and the glazing materials including, but not limited to gaskets. Setting blocks, sealant, the design and dimensional parameters of the glass pockets and be compatibility of materials. Test Certificate from approve laboratories for U-Values and shading factor claimed by the Manufacturer shall be submitted

- **Sealant Documentation:** All sealant applications must be clearly designated on the applicable shop drawing details and referenced to a master sealant schedule specifying materials, special instructions and applications procedures. The applicable sealant manufactures(s) shall submit in writing that all sealant requirements as detailed and specified on the shop drawings have been reviewed and approved for use relative to their specific application and or design intent, compatibility to adjacent materials and in conformity with all the requirements as detailed and specified in the contract documents. The manufacturer's certification shall specify the optimum life expectance, in years, for the proposed sealant materials as detailed and specified on the shop drawings and/or master sealant schedule anti shall further state that the proposed materials are most appropriately Suited for the use or uses intended and recommended for the specific use or uses.

- **Quality Control documentation:** job site quality control procedures shall be documented in writing for Architect's/ PMC review and approval to ensure the design Integrity and performance Documentation shall include schedule, detail, isometric and / or schematic explanatory' sketches cross-referenced to shop drawings, data sheets. etc. All as required to intelligently witness and assess methods and materials, and to ensure that both the fabrication and installation are in accord with the contract documents.

The Employer / Architect / PMC shall, if required, be given free access to inspect fabrication procedures. No fabrication or assembly of job site materials shall commence until the first production until and sample of all elements specified in the contract by means of sample kit is inspected and approved by Architect / PMC.

Quality control procedures shall include but not necessarily be limited to following items:

- -Fabrication: Tolerances, Joinery Sleeves, etc
- -Finish Match: Approved finish and controls required for matching the Exposed surfaces.
- -Assembly Welds, fastener, sealants, gaskets, separators, glazing etc.
- -Protection:Handling, Protection, Shipping etc.
- -Quality Control Chart:Quality control charts for glazing and installation to be provided to PMC on a weekly basis.
- -Anchorage:Lines, grades and related building tolerances.
- -Installation:Tolerances finish match, joinery, sleeve, flashing, welds, Fasteners, sealants, etc.
- -Sealing:As recommended by the applicable sealant manufacturer (s)

- -Protection & Cleaning: As recommended by the applicable material manufacturer (s)

SAMPLES AND MANUALS

Within 3 weeks of issue of LOI, the following samples of actual job site materials together with detailed technical data / catalogues shall be submitted in duplicate, unless otherwise noted, and in the size noted, for Architect's review and approval. Omission any of an item, or Items, which require the Contractors compliance with these documents, does not relieve him from such responsibility.

a) Aluminum composite panel: Each type and thickness, 600 X 600 mm of the specified thickness.

b) Aluminum extrusions: One only of each section, 300 mm long of specified thickness and details of the temper and the alloy.

c) Glass: Each type and Kind 300 X 250 mm of specified thickness and including frame.

d) Glazing gaskets, tapes, separators, glass setting blocks, etc. Each section of unit, 300 mm long or unit.

e) Fasteners and connecting devices: Each type and size inclusive of test reports.

f) Finish samples: After approval of the final finish coating the Architect / Consultants / PMC is to be provided with six (6) approved samples.

g) Window and door ironmongery and accessories, as applicable.

h) Flashing and finish samples

i) Samples submitted should also include assembly of a various components forming a (typical fixing detail complete with flat sheets, glazing, extrusion, fastener, sealants, etc.

• Mock-up
Before the fabrication and site installation is taken up and within 4 weeks of issue of Work Order. The Contractor shall put up a mock-up of his proposed window system for 3 modules
Wide incorporating all types of hardware and fixtures as per specifications and approved samples. A mock-up of 2 curved panels of cladding one above other shall also be installed at
One of he demarcated column. The mock-ups are essential for final approval of all materials And installation details by the Architect.
The Contractor shall submit samples and catalogues of door/window for approval, as applicable,

•Maintenance Manual:

Submit three (3) copies each of detailed procedures for periodic inspection, maintenance and cleaning of all the Structural Glazing System, Aluminum Composite Cladding, Aluminium Doors and Windows etc. at all levels in the building

WORK SCHEDULE

- Immediately on receiving work order the Contractor shall submit the final programmed work schedule for the completion of the whole of the works including submittals. Approvals, fabrication. Supply at site & installation with the time schedule acceptable to the Architect /PMC.

- The time schedule shall be prepared in consultation with PMC to suit the overall project schedule and shall be updated from time to time to suit prevailing conditions and co-ordination with other Contractors employed on site.

INSPECTION OF COMPONENTS

- The contractor shall submit a schedule of material specification and procedure for inspection of the quality of components of the Structural Glazing System, Aluminium Composite Cladding, Aluminium Doors, and Windows during the fabrication in the factory.
- The contractor shall submit. Weekly reports on the results of the inspection of the components, in a format approved by the PMC.
- The contractor shall submit a description of the procedure of delivery, hoisting, storage, handling installation, scaffolding, and temporary working stage or gondola, protection and cleaning.

STORAGE, PROTECTION AND PROGRAMME

- The contractor shall submit a schedule on the procedure for inspection during installation so as to maintain quality control on the Job site.
- The contractor shall submit a daily progress report correlating to the bar chart submitted to PMC.
- The Contractor shall submit a detailed method statement for the protection of the surface of the aluminum structural glazing & cladding members during delivery and erection, with Description as to when the protection. Tape can be removed.
- The Contractor shall submit weekly reports on the inspection of erection and installation as Directed by the PMC.
- Delivery and Storage and Materials: All materials delivered to site shall be stored in allocated Spaces where the stored material will not be exposed to rainwater, moisture damage, and shall permit easy access to handling of the materials shall be stored neatly and properly **Stacked.**

a) Aluminum wall cladding/Factory made structural glazing units and or their components Shall be transported, handled and stored in a manner to preclude damage of any nature.
b) Accessory materials, required for erection at the site shall be delivered to the site in Labeled containers by the manufacturer.
c)Remove all units or components, which are cracked, bent, chipped, scratched or otherwise unsuitable for installation and replace them promptly.

GUARANTEE

The Contractor shall be fully responsible for all shall guarantee proper design and performance of his installed system for a period of 10 years from handling over of works. The design and installation shall be to the best international standards and shall specially take account of wind and seismic loads, cyclone, pollution, acoustics, Thermal stresses, building movements.
In addition specific 10 year guarantees in approved format shall be given for performance of glass, insulated glass units, anodizing, PVDF coating to cladding sheets and sealants. All the Guarantees shall be submitted before Final Payment and 50% of total security deposit shall be released after completion, and shall not in any way limit any other rights to Correction, which the Employer may have under the Contract.

Technical Specification for Electrical Works

A) ELECTRICAL

Specification for Electrical Wiring

1. All electrical works should comply with Indian Electricity Act 2003 (latest) and Indian Electricity Rules 1956/Central Electricity Authority Rules 1977/Bare act 2001 and any latest version.

2. All electrical installations works shall conform to relevant Indian Standard Code of Practice and be carried out as per relevant safety Code of Practices. Guide for Safety Procedures in Electrical Work as per IS:5216/Pt.I& II/1982 shall be observed.

3. All components used in installation shall be of appropriate ratings of voltage, current and frequency.

4. The wiring work should be done as per CPWD norms for all schedule items.

5. All cables shall be terminated using suitable size, cable gland and packing.

6. The final connection to the equipment shall be through flexible connection in case of conduit wiring and also where
equipment is likely to be moved back and forth.

7. The maximum distance of an isolator switch to any equipment which is separated from the main switch panel by a
wall or partition or other barrier or is more then 20m from the distribution panel.

8. The branch line from main panel to sub distribution board shall be separate and should not criss-cross other line.

9. The entire installation shall be tested as per electricity rule prior to the commissioning of the complete installation and suitable test report furnishes by a competent and authorized person should be submitted. No extra payment shall be made to obtain the test report

Laying & Installation of Cable

This specification covers the requirements for the selection and installation of power cables for low, medium and high voltage applications.

1.Type of Cables:-
- The cables for applications for low and medium voltage supply shall be PVC sheathed conforming to IS 1554 Part I- 1964.
- The cables for applications above 1.1KV but up to and including 11 KV supply shall be either PVC insulated and PVC sheathed conforming to IS 1554 part-II-1970 or paper insulated lead sheathed conforming to IS 6921965.
- The cables for applications above 11 KV but up to and inclusive of 33 KV supply shall be paper insulated lead sheathed conforming to IS 692-1965.
- The cables shall have stranded aluminum conductors.
- Where paper insulated cables are used, in predominantly vertically situation, these shall be of non-draining type.

2.Selection of Cables:-
- Cable sizes shall be selected considering the current carrying capacity, voltage drop, maximum short circuit duty and the period of short circuit to meet the present and future anticipated loads.
- Medium voltage distributions shall be designed such that the voltage available at final outlets are generally within the limits recommended by IS 732-1963.
- Guidance for the selection of cables shall be derived from the relevant Indian Standards such as IS 3961(Part-I) _1967.IS 3961(Part II)- 1967, IS 5819-1970, IS 1255-1967 etc.

- While deciding cable sizes, the derating factors for type and depth of laying, grouping, ambient temperature, ground temperature, and soil resistivity shall be taken into account.

3.Handling and Storage:-

- The cable drums should be stored on a well drained, hard surface, preferably a concrete platform, so that the drums do not sink into the ground causing flange rot land damage to the cable.
- During storage the drum should be rolled periodically at least once in three months through ninety (90) degrees in the direction of arrow marked on the drum.
- During storage it should be ensured that both the ends of the cable are properly sealed with plastic caps to prevent ingress of moisture into the insulation.
- Adequate protection should be provided from rain & sun. ventilation should be sufficient between the power cable drums. Adequate drainage between the cable drums should be ensured to avoid water logging.
- The drum shall be rested on the flanges and not on the flat side.
- In case the batons of drums get damaged, the same should be replaced.
- Whenever the drums are required to be moved to short distance these should be rolled in the direction of arrow marked on the drums.
- While transporting the drums over longer distance the drums should be mounted on cable drum wheel strong enough to carry the weight of drum and cable should be rolled with ropes. Alternatively, the drum should be mounted on a trailer for movement, otherwise suitable mechanical means of transporting should be utilized.
- In order to unload the drum from the transport vehicle use of cranes should be made, otherwise the drum should be rolled down carefully on suitable ramps or rails wherever necessary.
- For removing the cable from drum, the drum should be properly mounted on jacks or on a cable wheel ensuring adequate strength of jack and spindles for carrying the weight of drum.
- If the cable is to be transferred from one drum to another, it should be ensured that new drum should not have diameter less that of the original drum.
- While unloading, transporting or removing the cables, it should be ensured that cable should not be bent to small radius. The minimum safe bending radius for all types of PVC/paper insulated cable should be at least 15 times of the diameter of the cable, up to 11 KV grade and 20 times diameter for cables, above 11 KV grade.
- For XLPE cables, minimum bending radius of 15 times the diameter for cables up to 11 KV and beyond is permissible 1.12. At the termination and under onerous site conditions, the binging radius for cables may be reduced from the value mentioned above, without causing any damages to the cables and taking adequate precautions.
- At the joints and terminations bending radius for the individual cables should be above 12 times the diameter over the insulation.
- The maximum permissible tensile strength for cables i.e. PVC and XLPE insulated armored power cables shall be 9 D2 where D is the outer diameter of cables in mm. The force thus calculated shall be in Newton (N).
- It should be given due consideration when cables are pulled with stocking.
- For the cables pulled with pulling eye the maximum permissible tensile stress shall be 50 N/mm2 for alum. conductored cables.

4. Installation of Cables

- It should be ensured that no cable with kinks or similar apparent defects like defective armoring shall be installed.
- Prov. of BIS 1255-1983 should be followed in general for laying of and installation of cables.

5.Route of Cable

The route of the cable should be decided before the work of cable laying is under taken. It should be got approved from the Engineer-in-Charge. A proper drawing showing the route of the cable should be prepared and got approved before hand and should be preserved as proper record for posterity.

- Always the shortest possible route should be preferred to economies in the use of cables. Cable runs should generally follow the fixed developments such of roads. Pathway etc. with proper off sets so that the future maintenance work, identification etc. can be easily done. Cross country runs for shorter routes should be avoided as it would create problem in identification and maintenance later on.
- Care should be taken to avoid the corrosive soil, around surrounding, sewage effluent etc. In case it is not possible to avoid such like corrosive soils etc. proper protection of the cable should be ensured for avoiding deterioration at a later stage.
- As far as possible the alignment of cable should be decided taking into consideration the present and future requirement of other services like water supply, sewage, telecommunication cable.
- The cable route should be kept adequately away from the drains to avoid any seepage of water.
- Wherever the power and telecom cables are to cross each other the same should be laid at right angles to avoid interference. Wherever it is unavoidable to lay them in proximity, horizontal and vertical clearance between the two should not normally be less than 600mm.

Cable Jointing

1.0 Identification of cores :

1.1 Cores shall be provided with following co-lour scheme for PVC insulation.

1	Core	-	Red/Black/Yellow/Blue.
2	Core	-	Red & black.
3	Core	-	Red, Yellow and Blue.
4	Core	-	Red, yellow, Blue, Black (Black is for neutral).

2.0 Cable jointings :-

2.1 The manufacturer's instructions mentioned in the jointing kit should be followed.

2.2 The manufacturer's instructions mentioned in the jointing kit should be followed.

2.3 Insulation resistance of cables to be jointed should be measured with 500V megger up to 1.1 KV grade and with 2500V megger for cables of higher voltage. Unless insulation resistance value of cables are satisfactory the jointing should not be done.

2.4 Before jointing work is taken up safety precautions like insulation, earthing etc. should be observed to ensure that the cable would not be inadvertently charged. Metallic Armour and external bonding should be connected to earth.

2.5 Wherever the system of permit to work is prevalent, the same should be followed for cable jointing work.

2.6 Identification of cables should be very properly done before jointing is taken up. Proper identification of individual core is also very important to avoid any cross connection and damage to installation.

2.7 Complete record of joint etc. shall be maintained as per Annexure-B in addition to site plan.

Cable Testing

1.0 Testing.

1.1 All cables before laying should be tested with 500V megger up to and including 1,1 KV grade or with 2500/5000V

megger for cables of higher voltage. The cable cores should be tested for continuity, insulation resistance etc. All cables should be tested during laying and before covering. After laying and jointing the cable should be subjected to a 15 minutes pressure test.

1.2 After laying of cable and jointing, the cables should be subjected in a high voltage last guidelines of BIS; 1255-

1983 and the results are recorded as per Annexure 'C'.

1.3 In case high voltage test is not possible at site, the cables should be tested for one minute with 1000V meggar up to 1.1 KV grade and with 2500/5000V megger for cables of higher grade.

Distribution Boards

Distribution Board shall be of standard type. Distribution boards shall contain miniature circuit breakers of rating specified in BOQ/DB Schedule.

Miniature circuit breakers shall be quick make and quick break type with trip free mechanism. MCB shall have thermal and magnetic short circuit protection

MCB's shall be provided on the phase of each circuit. The individual banks of MCB's shall be detachable. There shall be ample space behind the banks of MCB's to accommodate all the wiring. All the distribution boards shall be completely factory wired, ready for connections. All the terminals shall have adequate current rating and size to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

Before procurement of Distribution Boards the contractor has to make the DB Schedule of Each DB on the basis of the working drawings and take approval of the DB Schedule/Drawings of each DB from the Engineer-In-Charge. The whole unit i.e. Distribution Board shall come from the manufactures premises/ workshop. After inspection and clearance from the Engineer-In-Charge the same may be dispatched to site for installation. However if a single component is required for any reason such as replacement, increase in no. of circuits in the DB, change in the load of existing circuit, change in the total load on a particular DB etc., the same may be ordered separately but after the approval of Engineer-In-Charge.

1. GENERAL

These conditions of contract are mean to amplify the specifications. Schedule of quantities and drawings in additions to those conditions specified from time to time as additions or omissions to these said general conditions of contract. incase of non-conditions of contract.

2. SCOPE OF WORK

2.1 The items/activities covered are following :

i) Rising mains

Floor LT panels cum meter boards. LT panel common services. SWBD plant room SWBD basement. SWBD for lift,

AHU. Common area. ADB common area SDB lift & SWBD axial/propeller fans.

LT cables

From main LT panel to rise.

From riser mains to floorwise LT panels

From Main LT panel to LT panel common services

From Main LT panel to SWBD lifts.

From LT panel common services to SWBD lift. SWBD basement. SWBD common area

From SWBD AHU's to AHU's & SWBD plant room to blowers. SWBD Axial/Propeller fans and axial/propeller
fans to axial flow fans and SDB lift to Façade cleaning M/C on terrace.

iv) Distribution boards MCB type for final distribution lighting and power circuit for common area & lift machine room.
v) Submain wiring /cables form floor wise LT panel in Electrical room to final Distribution boards.
vi) Point wiring of full lights points. Ceiling fan points. Exhausted fan points light plug points general power points in common areas lift machine room and substation building including conduiting supply and fixing of light and power accessories complete in all respects.
vii) Supply and erection of ceiling fans and exhaust fans.
viii) Supply and erection of light fixtures.
ix)Telephone system
a) Conduiting and wiring form telephone outlet points (in common area upto telephone distribution board (tag block)
including tab block)
b) Floor tab block including cabling from main telephone tab block located at upper basement.
c) Main telephone tag block including cabling from main telephone feeder pillar.
d) EPABX and handset not in scope of this contract.
x) Lighting protection system consisting of lightning arrestors horizontal and vertical conductors, test joints, earthing etc. complete in all respects.
xi) Earthing conductor along with rising mains cables and submains wiring.
xii) Scope of work shall include supply installation, testing and commissioning of complete electrical installation as described above.
xiii) Obtaining approvals form Chief Electrical Inspector, Local Supply Authority and all other statutory authorities for the complete scope of work.

2.2 The items / activities covered under "Basement" including the following.

i) Distribution boards MCB type for final distribution of lighting and power circuit.
ii) Submain wiring/cables from SWBD basement of final Distribution boards & DB sump to sump pumps.
iii) Point wiring of all lights points, ceiling fan points, exhaust fan point, general power point sin existing conduit in 1st
and 2nd basement area, including conduiting, supply and fixing of light and power accessories etc. in existing boxescomplete in all respect.
iv) Erection of ceiling fans and exhaust fans
v) Erection of light fixture
vi) Scope of work shall include supply installation, testing and commissioning of complete electrical installation as
described above. vii)Obtaining approvals form Chief electrical Inspector, Local Electrical Supply Authority and all
other statutory authorities for the complete scope of work.

2.3 It is not the intent to specify completely herein all aspects of design and constructional features of equipments and
details of the work to be carried out. Nevertheless the equipment and work shall conform in all respects to high standards of Engineering design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the Architect/ Consultant/Engineer-in-charge who will interpret the meaning of the specifications and drawings and shall have right to reject or accept any work or material which in his assessment is not complete to meet the requirement of this specifications and or applicable code and standards mentioned else where in these specifications.

3. REGULATIONS AND STANDARDS

The installation shall conform in all respects to Indian Standard code of practice for Internal and external electrical works, electrical wiring installations IS 732-1989 and as per CPWD general specifications for electrical works (I&II). It shall also be in conformity with the current Indian Electricity. Rules and regulation and

requirements in so far as these become applicable to the installation. Wherever this specifications shall take precedence over the said regulation and standards.

4. SPECIFICATIONS & DRAWINGS

The work shall be executed in accordance with the specifications enclosed the working drawings the bill of quantities and instructions issued from time to time . Wherever these specifications are found wanting in any way the IS codes and CPWD specifications shall apply.
The specifications and schedule of items shall be considers as part of this contract and any work or material shown on schedule and not called for in the specification or vice versa shall be executed as if specially called for in both.
The drawing indicates the extent and general layout. The drawings are diagrammatic.
The work shall be installed as indicated in the drawing , however any minor changes found essential to coordinate the installation of this work with the other trades shall be made without any additional cost to the owner. The date given hare in and on the drawings is as exact as could be secured , but its complete accuracy is not guaranteed. The drawings are for are for guidance of the Contractor and exact locations, distance and levels will be governed by the building. Contractor shall not be entitled to any extras for omission or defects in electrical drawings or when they conflict with the work. The Contractor shall be prepared working drawings and get it approved form the Architect/Consultant/Engineer-in-charge before commencing the work.
In case there is any conflict in the description of items in the bill of quantities and the technical specifications and the drawings. Then the interpretation of the scope of work of the particular item shall be made in the following order of preference

i Description of the item in the Bill of Quantities
ii Drawings issued for the work
iii The specifications of the item

TENDER FOR INTERNAL ELECTRICAL WORKS

TECHNICAL SPECIFICATIONS

WIRING

1. **GENERAL**

Technical specifications in this section cover the Internal wiring installations comprising of :

- Wiring for lights and convenience socket outlets etc. in concealed/surface conduit/raceways
- Wiring for telephone outlets.
- Wiring for fire detection system
- Submain wiring.

2. **STANDARDS AND CODES**

The following Indian standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/ or IEC Standards shall be applicable.
BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.
It is to be noted that updated and current Standards shall be applicable irrespective of those listed below

660/1100 V grade PVC insulated wires	IS 694:1990
Rigid steel conduit for electrical wiring	IS 9537:Part I 1980 IS 9537:Part II 1981
Accessories for rigid steel conduits	IS 3837 : 1990
Flexible steel conduits for electrical wiring	IS 3480 : 1990
Switch socket outlets	IS 4615 : 1990
Switches for domestic and similar purposes	IS 3854 : 1997
Boxes for the enclosure of electrical accessories	artsI&II 1969

Code of practice for personal hazard fire safety of buildings	IS 1644:1998
Code of practice for electrical installation fire safety of buildings	IS 1646:1997
Code of practice for electrical wiring installations	IS 732:1989

3. CONDUITS/ RACEWAYS

3.1 Steel Conduits

These shall be of mild steel 16 gauge upto 32mm and 14 gauge for sizes above 32mm, electric resistance welded (ERW), electric threaded type having perfectly circular tubing. Conduits shall be press ion welded ERW And shall be fabricated form tested steel strips of thickness as per ISS by high frequency induction weld process. Weld shall be smooth and of consistent of high equality to ensure crack proof bending. The conduits shall be black enamel painted inside and outside in its manufactured form. Wherever so specified, the conduit shall be galvanized. All conduits used in this work shall be ISI embossed .

3.2 PVC Raceways

Wiring for power convenience socket outlets over work tables in laboratories shall be carried out in 100 mm x 50mm PVC raceways in surface on wall just above the laboratory table top as directed by Engineer in charge. The raceway shall be fabricated from superior quality engineering plastics and shall be complete with all standard accessories like couplers, end caps, bents, tees and mounting frames suitable for fixing modular wiring accessories. The raceway and accessories shall be as described in the Schedule of Quantities. Wiring upto the raceway shall be brought in MS conduit and approved adapter box to connect the conduit to the raceway shall be provided. Combined 6/16 amp

modular switch socket outlets shall be provided on the raceway at modular intervals or as indicated in layout drawings. Each 6/16 amp outlet shall be wired to a separate circuits in the raceway shall be bunched separately. Installation of the raceway wiring system shall be carried out as per manufacturers recommendations.

3.3 Steel Conduit Connections

Connections between steel conduits shall be with screwed couplers of approved quality and finish, ensuring screwed metal to metal contact. Length of threads shall be as per ISS and sufficient to accommodate pipes to full threaded portion of couplers or accessories. Threads and sockets shall be free from grease and oil. Conduits shall be connected to outlet boxes by means of MS hexagon check-nuts fixed both inside and outside the box. Conduit edges shall be free of burrs and provided with screwed PVC bushes to avoid damage to insulation of conductors while pulling them to the conduits. Connections between MS and PVC conduits, if required, shall be through a junction box and never directly.

3.4 Bends

Large right angle bends (more than 75 mm radius) or non right angle bends in conduit runs shall be made by means of conduits bending machines carefully so as not to cause any crack in the conduit. Small right angle bends in conduits runs can be made by standard conduit accessories (solid/inspection bends/elbows) no run of conduits shall have more than four right angle bends from outlet to outlet. Bends in multi runs of conduits shall be parallel to each other and neat to appearance, maintaining the same distance as between straight runs of conduits.

3.5 Conduit Accessories

3.5.1 Standard accessories

Heavy duty black enamel painted standard conduit fittings and accessories like standard / extra-deep circular boxes, looping in boxes, junction boxes, normal/ inspection bends, solid / inspection elbows, solid / inspection tees, couplers, nipples, check nuts, earth clip, ball socket joints etc. shall be of superior quality and of approved makes. Heavy duty covers screwed with approved quality screws shall be used. Superior quality screwed PVC buses shall be used Samples of all conduits fittings and accessories shall be got approved by Owners / Architects before use.

3.5.2 Fabricated accessories

Where ever required, outlet / junction boxes of required sizes shall be fabricated from 1.6 mm thick MS sheets excepting ceiling fan outlet boxes which shall be fabricated from minimum 2 mm thick sheets. The outlet boxes shall be of approved quality, finish and manufacture. Suitable means of fixing connectors etc., if required, shall be provided in the boxes. The boxes shall be protected from rust by zinc phosphate primer process. Boxes shall be finished with minimum 2 coats of enamel paints of approved colour. A screwed brass stud shall be provided in all boxes as earthing terminal.

3.5.2.1 Outlet Boxes For Light Fittings.

These shall be minimum 75mm x 75mm x 50mm deep and provided with required number of threaded collars of conduit entry. For ceiling mounted florescent fittings, the boxes shall be provided 300 mm off center for a

1200 mm fitting and 150 mm off center for a 600 mm fitting so that the wiring is taken directly to the down rod, 3 mm thick perspex/hylam sheet cover of matching colour shall be provided. 3.5.2.2 Outlet Boxes For Ceiling Outlet boxes for ceiling fans shall be fabricated from minimum 2mm thick MS steel. The boxes shall be hexagonal in shape of minimum 100mm depth and 60mm sides. Each box shall be provided with a recessed fan hook in the form of one 'U' shaped 15mm dia rod welded to the box and securely tied to the top reinforcement of the concrete slab for a length of minimum 150 mm on either side, 3 mm thick perspex/hylam sheet cover of matching colour shall be provided.

3.5.3 Boxes For Modular Wiring Accessories

3.5.3.1 Switch Boxes-Modular Type

Switch boxes suitable to house modular type switches of required ratings, and fan regulators as required shall be provided. In case the number of switches in one box is not tallying with that available in standard manufacturer, the box accommodating the next higher of switches shall be provided without any extra cost. In case fan regulator/regulators is/are to be provided at a later dated, suitable provision for accommodating such regulators shall be made in the switch boxes and blank of covers shall be provided without any extra cost.
Switch boxes shall be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on the side for accommodating conductors, check-nuts and screwed bushes at conduit entries etc.. The grid plates and MS boxes shall be fitted with a brass earth terminal. Boxes shall be attached to conduits by means of check-nuts on either sides of their walls. Moulded front covers made from high impact resistant and ultra violet stabilised engineering plastics shall be fixed by means of counter sunk chromium plated brass machine screw. No timber shall be used for any supports. Switch boxes shall be located with bottom at 1200mm above floor level unless otherwise indicated.

3.5.3.2 Modular Type Boxes For Socket / Telephone / Call Bell Outlets

Outlet boxes shall be suitable for housing modular type switches socket outlets / telephone outlets / buzzers and any other outlet as required. These shall be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on the sides for accommodating conductors, check nuts and screwed bushes at conduit entries etc.. The grid plates and MS boxes shall be fitted with a brass earth terminal. These shall be attached to conduits by means of check nuts on either sides of their walls. Moulded front covers made from high impact resistant, flame retardant and ultra violet stabilized engineering plastics shall be used to mount the outlets and shall be fixed to the outlet MS boxes by means of counter sunk chromium plated brass machine screws. No timber supports shall be used. Boxes shall be located at skirting level or bottom at 1200mm from floor or inside raceways on laboratory work table., as indicated in drawings and / or as directed.

3.6 Cross Section

The conduits shall be of ample sectional area to facilitate simultaneous drawing of wires and permit future provision also. Total cross section of wires measured overall shall not normally be more than half the area of the conduit. Maximum number of PVC insulated 660/1100 Voltage grade copper conductor cable conforming to IS - 694 - 1990 as per table give below.
Maximum no. of PVC insulated 660/1100 V grade aluminium / copper Conductor cable conforming to IS : 694 - 1990 Note :

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables
2. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw boxes and which do not deflect form the straight by an angle of more than 15 degrees. The columns headed 'B' apply to runs of conduit which deflect form the straight by an angle of more than 15 degrees.
3. Conduits sizes are the nominal external diameters.

4. WIRES

Wiring shall be carried out with PVC insulated 660/1100 volt grade unsheathed single core wires with electrolytic annealed stranded copper (unless otherwise stated) conductors and conforming to IS 694/1990. All wire rolls shall be ISI marked. All wires shall bear manufacturers label and shall be brought to site in new and original packages. Manufacturers certificate certifying that wires brought of site are of their manufacture shall be furnished as required.

5. COAXIAL CABLES

The coaxial cables shall be of videband type with operation upto 300 MHz capability. Aging resistance shall comply with DIM 472.52 part 2 e.i. maximum 5% increase in attenuation at 200 MHz measured by artificial aging (14 days at 80ºC) cables shall meet all exceed following specifications.

Center core Dia	0.8 mm
Diaelectric Dia	4.8 mm
Dielectric	PE
Outer Conductor Dia	5.4 mm
Outer Dia	7.0 mm
Bending radius	more than 30mm
Impedance	75ohms
D.C. Resistance	50 ohms/Km
Screening factor	more than 50
Attenuation	
50MHz	6.5
100 MHz	9
200 MHz	13
300 MHz	16

6. LAYING OF CONDUITS

- Conduits shall be laid either recessed in walls and ceilings or on surface on walls and ceilings or partly recessedpartly on surface, as required.
- Same rate shall apply for recessed and surface conduiting in this contract.
- Stranded copper conductor insulated wire of size as per schedule of quantities shall be provided in entire conduiting for loop earthing.
- GI wire of suitable size to serve as a fish wire shall be left in all conduit runs to facilitate drawing of wires after completion of conduiting.

6.1 Recessed Conduiting

Conduits recessed in concrete members shall be laid before casting in the upper portion of slabs or otherwise as may be instructed, so as to embed the entire run of conduits and ceiling outlet boxes with a cover of minimum 12mm concrete. Conduits shall be adequately tied to the reinforcement to prevent displacement during casting at intervals of maximum 1 meter. No reinforcement bars shall be cut fix the conduits. Suitable flexible joints shall be provided at all locations where conduits cross expansion joints in the building.
Conduits recessed in brick work shall be laid in chases to be cut by electrical contractor in brick work before plastering. The chases shall be cut by a chase cutting electric machine. The chases shall be of sufficient width to accommodate the required number of conduits and of sufficient depth to permit full thickness of plaster over conduits. The conduits shall be secured in the chase by means of heavy duty pressed steel clamps screwed to MS flat strip saddles at intervals of maximum 1 meter. The chases shall then be filled with cement and coarse sand mortar (1:3) and properly cured by watering.Entire recessed conduit work in concrete members and in brick work shall be carried out in close coordination with progress of civil works. Conduits in concrete members shall be laid before casting and conduits in brick work shall be laid before plastering. Should it become necessary to embedded conduits in already cast concrete members, suitable chase shall be cut in concrete for the purpose. For minimizing this cutting. Conduits of lesser diameter than 25 mm and outlet boxes of lesser depth than 50mm could be used by the contractor for such extensions only after obtaining specific approval from Architects/Owners. For embedding conduits in finished and plastered brick work. The chase would have to be made in the finished brick work. After fixing conduit in chases, chases shall be made good in most workmanlike manner to match with the original finish.
Cutting chases in finished concrete or finished plastered brick work for recessing conduits and outlet boxes etc.
shall be done by the contractors without any extra cost.

6.2 Surface Conducting

Wherever so desired conduit shall be laid in surface over finished concrete and /or plastered brick work suitable spacer saddles of approved make and finish shall be fixed to the finished structural surface along the conduit

route at intervals not exceeding 600mm . Holes in concrete or brick work for fixing the saddles shall be made neatly by electric drills using masonry drill bits. Conduits shall be fixed on the saddles by means of good quality heavy duty MS clamps screwed to the saddles by counter sunk screws. Neat appearance and good workmanship of surface conduiting work is of particular importance. The entire conduit work shall be in absolute line and plumb.

6.3 Fixing of conduit fittings and accessories

For concealed conducting work, the fittings and accessories shall be completely embedded in walls/ceilings leaving top surface flush with finished wall/ceiling surface in a workman like manner.
Loop earthling wire shall be connected to a screwed earth stead inside outlet boxes to make an effective contact with the metal body.

6.4 Painting and Colour coding of conduits

Before laying, conduits shall be painted specially at such places where paint has been damaged due to vice or wrench grip or any other reason. If so specified, surface conduits shall be provided with 20mm wide and 100mm long colour coding strips as below

Use	Code colour
Low voltage	Grey
Fire alarm	Red
Telephone	Black
PA system	Brown
Earthing system	Green
Control system lighting	Purple

6.5 Protection Conduits

To safeguard against filling up with mortar/plaster etc. all the outlet and switch boxes shall be provided with temporary covers and plugs which shall be replaced by sheet/plate covers as required. All screwed and socket joints shall be made fully water tight with white lead paste.

6.6 Cleaning of Conduit Runs

The entire conduit system including outlets and boxes shall be thoroughly cleaned after completion of erection and before drawing in of cables.

6.7 Protection Against Dampness

6.8 Expansion Joints

When crossing through expansion joints in buildings. The conduit sections across the joint shall be though approved quality heavy duty metal flexible conduits of the same size as the rigid conduit.

6.9 Loop Earthing

Loop earthing shall be provided by means of insulated stranded copper conductor wires of sizes as per Schedule of Quantity laid along with wiring inside conduits for all wiring outlets and sub-mains Earthing terminals shall be provided inside all switch boxes etc.

7.LAYING AND DRAWING OF WIRES

Bunching of Wires

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

Drawing of Wires

The drawing of wires shall be done with due regard to the following precautions:-

- No wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire is complete.

  Burrs in cut conduits shall be smoothen before erection of conduits. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Approved type bushes shall be provided at conduit terminations.

- Before the wires are drawn into the conduits, conduits shall be thoroughly cleaned of moisture, dust dirt or any other

  obstruction by forcing compressed air through the conduits if necessary.

- While drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinds which cause breakage of conductors.
- There shall be no sharp bends.
- The contractor shall , after wiring is complete , provide a blank metal sheet/sunmica plate on all switch/ outlet/ junction boxes for security and to ensure that wires are not stolen till switches/ outlets etc. are fixed at no extra cost the contractor shall be responsible to ensure that wires and loop earthing conductors are not broken and stolen. In the event of the wire been partly/ fully stolen, the contractor shall replace the entire wiring along with loop earthing at no extra cost to the Owners. No joint of any nature whatsoever shall be permitted in wiring and loop earthing.

Termination/Jointing of Wires

- Sub-circuit wiring shall be carried out in looping system. Joints shall be made only at distribution board terminals, switches/buzzers and at ceiling roses/connectors/lamp holders terminals for lights/fans/socket outlets. No joints shall be made inside conduits or junction/draw/ inspection boxes.
- Switches controlling lights, fans or socket outlets shall be connected in the phase wire of the final sub circuit only. Switches shall never be connected in the neutral wire.
- Wiring conductors shall be continuous from outlet to outlet. Joints where unavoidable, due to any special reasonshall be made by approved connectors. Specific prior permission from Architect/Owners in writing shall be obtained before making such joint.
- Insulation shall be shaved off for a length of 15mm at the end of wire like sharpening of a pencil and if shall not be removed by cutting it square or wringing.
- Strands of wires shall not be cut for connecting terminals. All strands of wires shall be twisted round at the end before connection.
- Conductors having nominal cross sectional area exceeding 4 sq mm shall always be provided with crimping sockets.
- At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used.
- Brass nuts and bolts shall be used for all connections.
- The pressure applied to tighten terminal screws shall be just adequate, neither too much no too less.
- Switches controlling lights, fans socket outlets etc. shall be connected to the phase wire of circuits only.
- Only certified valid license holder wiremen shall be employed to do wiring /jointing work.

Load Balancing

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

Colour Code of Conductors

Colour code shall be maintained for the entire wiring installation – red, yellow, blue for three phases, black for neutral and green for earth.

8.MEASUREMENT AND PAYMENT OF WIRING

Wiring for lights, fans convenience socket outlets and telephone outlets etc. shall be measured and paid for on POINT BASIS as itemized schedule of quantities and as elaborated as below unless otherwise stated.

Primary and Secondary light point wiring

In respect of group control of lights (more than one light controlled by one switch or MCB), wiring upto the first light in the group shall be measured and paid for as a primary light point. Wiring for other lights looped in one group for switch controlled as also MCB controlled lights shall be measured and paid for as secondary light points. Primary light points for switch controlled lights shall include the cost of control switch whereas primary light points controlled by MCBs shall not include the switch cost. The cost of

MCB controlling such lights shall not be included in the primary light point rate since the MCB shall be paid for in the item of DB.

The point wiring basis shall assume average wiring basis shall assume average wiring length and average conduiting length per point based on parameters stipulated in para 8.2 below. The average wiring length and average conducting length forming the basis of point wiring payment, shall take at the electrical layouts of the entire project into consideration. Tenderers are advised to seek clarifications, if they so desire, on this aspect before submitting their tenders. No claim for extra payment on account of electrical layouts in part or whole of the project requiring larger average wiring and conduiting length per point, whether specifically shown in tender drawings or not, shall be entertained after the award of contract.

Parameters : Wiring shall be carried out as per following parameters in recessed / surface conduit system.

- Only looping system of wiring shall be adopted throughout. No joints excepting at wiring terminals shall be permitted.
- All accessories shall be flush type unless otherwise stated
- For estimation of load, following loads per point shall be assumed.

Light points	100 Watts
6 amps socket outlet points	100 Watts
Fan points	60 Watts
Exhaust fan points	300 Watts or as specified
16 amp socket outlet points	1000 Watts

- Lights, fans and 6 amp socket outlets may be wired on a common final such circuit. Such circuit shall not normally have more than a total of ten lights, fans or socket outlets or a load of 800 watts whichever is lesser.
- Power circuits shall normally have maximum one 16amps socket outlet unless otherwise stated. Separate circuit shall be run for each geyser, kitchen equipment, window air conditioners and similar appliances.
- Wiring rates shall include painting of conduits and other accessories as required.
- Wiring rates shall include cleaning of dust, splashes of colour wash or paint from all fixtures, fans fittings etc. at the time of taking over of the installation.
- Wiring rates shall include blanking of outlet boxes to prevent damage/pilferage of wires as elaborated in para 7.2

Definitions

Wiring for Lights

Primary Light Points : Wiring for primary light points, as defined in para 8.1 above shall commence at the Distribution Board terminals and shall terminate at the ceiling rose/connector in ceiling box/lamp holder via the control switch (for switch controlled lights). Rates for primary light point wiring shall be deemed to be inclusive of the cost of entire material and labour require for completion of primary light point thus defined including:

- Recessed/ surface conduting system with all accessories, junction/draw/inspection boxes, bushes, check nuts etc. complete as required,
- Wiring with stranded copper conductor PVC insulated 660/1000 volt grade wires including terminations etc. complete as required.
- Control switch with switch box and cover plate of specified type including fixing screws, earth terminal etc. complete as required. Cost of this switch is applicable only for switch controlled points. This cost shall not beapplicable for DB controlled points.
- Loop earthing with insulated copper wires.

Secondary Light points :

- Secondary light points, as defined in para 8.1 above, shall cover the cost of interconnection wiring between group controlled light fittings and shall be deemed to be inclusive of the cost of entire materials and labour required for completion of the secondary light point thus defined including.
- Recessed/surface conduting system with all accessories, junction/draw/inspection boxes, bushes, check nuts etc. complete as required,
- Wiring with stranded copper conductor PVC insulated 600/1000 volt grade wires including terminations etc. complete as required.
- Loop earthing with insulated copper wires.

Wiring for Ceiling Fans

Wiring for ceiling fan points shall be same as for primary light points and shall, in addition, include ceiling outlet box with recessed fan hooks and provision in the switch box for mounting the fan regulator.

Wiring for Exhaust Fans

Wiring for exhaust fan points shall be same as for primary light points and shall in addition include cost of providing a 3/5 pin 6 amp socket outlet near the fan and a 6 amp. Control switch at convenient location near the room entry.

Wiring for Call Bell Points

Wiring for call bell points shall be the same as for primary light points and shall in addition include the cost of a call bell/buzzer of approved type and make in the required location and a call bell in lieu of the control switch at a convenient location as required.

Wiring for Telephone Outlets

Wiring for telephone outlets points shall include the entire wiring and conduiting from the telephone tag block to the telephone outlet including the telephone outlet complete as required and as itemized in the Schedule of Quantities

Wiring for convenience Socket Outlets

3/5 pin 6 amps and 3/6 pin 16 amps single phase switched convenience socket outlets shall be provided in the building as indicated in the layout drawings. In addition, combined 3 pin 6/ 16 amps socket outlets at modular intervals in special PVC raceway over the work tables in laboratories shall be provided. Wherever required, 20/32/50 amps single phase and 32/50 amps 3 phase outlets shall also be provided.

Wiring for 3/5 pin 6 amps convenience socket outlets

Point wiring for 3/5 pin 6 amps socket outlets (in locations other than over the laboratory work tables) on point wiring basis shall be the same as primary light point defined in para 8.3.1 and shall in addition include 3/5 pin 6 amp socket outlet with 6 amp control switch in MS box with cover including loop earthing of the third pin complete as required as itemized in scheduled of quantities.

Wiring for 3/6 pin 16 amps convenience socket outlets

Point wiring for 3/6 pin 16 amps convenience Socket outlets (in locations other than over the laboratory work tables) on point wiring basis shall be the same as primary light point defined in para 8.3.1 and shall in addition include 3/6 pin 16 amp socket outlet with 16 amp control switch in MS box with cover including loop earthing of the third pin complete as required as itemized in scheduled of quantities.

Wiring for combined 3 pin 6/16 amps socket outlets in laboratories

Wiring for 3 pin 6/16 amp combined socket outlets in existing PVC raceways (provided over laboratory work tables) on point wiring basis shall include the cost of wiring from DB terminals to the outlets along with loop earthing of the earth pin and the switched combination 6/16 amp outlet with 16 amp control switch housed in the existing raceway, as indicated in layout drawings and as itemized in schedule of quantities. PVC raceway/conduit required for this wiring shall be paid extra as itemized in the schedule of quantities.

Wiring for special socket outlets

In addition to the above, special convenience outlets of 20/32/50 amps single phase and 32/50 amps three phase, required in few locations as indicated in the layout drawings, shall be paid for on linear basis as itemized in schedule of quantities. Outlets only shall be paid separately in numbers as per actuals. Wiring alongwith loop earthing shall be paid separately on running meter basis and conduiting / PVC raceway shall be paid separately on running meter basis.

9. ROUTINE AND COMPLETION TESTS

9.1 Installation Completion Tests

At the completion of the work, the entire installation shall be subject to the following tests :

1. Wiring continuity test
2. Insulation resistance test
3. Earth continuity test
4. Earth resistivity test

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

9.2 Wiring Continuity Test

All wiring systems shall be tested for continuity of circuits short circuits and earthing after wiring is completed and before installation is energized.

9.3 Insulation Resistance Test

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance lower than one mega ohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between the two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant standard specification or where there is no such specification, shall not be less than half a mega ohm or when PVC insulated cables are used for wiring 12.5 mega ohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Mega ohms is acceptable.

9.4 Testing of Earth Continuity Path

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

9.5 Testing of Polarity of Non-Linked Single Pole Switches

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to 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. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Architect as well as the local authorities.

9.6 **Earth Resistivity Test**
Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

9.7 **Performance**
Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests are to be carried out by the contractor without any extra charge.

9.**7.1** **Tests And Test Reports**
The contractor shall furnish test reports and preliminary drawings for the equipment to the Architect/owners for approval before commencing supply of the equipment. The contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc. , required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge.

TECHNICAL SPECIFICATIONS

11 KV AND MEDIUM VOLTAGE CABLES

1. **GENERAL**

Technical specifications in this section covers supplying and laying of :
- 11 KV cables
- Medium voltage cables

2. **STANDARDS AND CODES**

All equipments components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and / or IEC Standards shall be applicable.
Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in supports of this certification shall be submitted as required.
It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with
ISS's in the tender documents.

PVC insulated heavy duty cables	IS 1554-1988
Cross link polyethylene insulated PVC (sheathed XLPE cables)	IS 7098-1985
Code of practice for installation and maintenance of power cables	IS 1255-1983
Conductors for insulated electrical cables	IS 8130-1984
Drums for electrical cable	IS10418-1982
Methods of test for cables	**IS10810-1988**
Recommended current rating	IS 3961-1987
Recommended short circuit rating of high voltage PVC cables	IS 5891-1970

3. **CABLES**

3.1 11 kV Cables

11kV cable shall be aluminium conductor with cross linked polyethylene (XLPE) insulation, galvanized steel armouring and PVC sheathing conforming to IS 7098. Conductors shall be sector shaped, made from electrical purely aluminium of 3x4 H or H temper conforming to IS 8130 XLPE insulation of high purity shall be extruded

on the conductors with screen a layer of semi-conducting materials shall be applied over the XLPE insulation to prevent partial discharge at insulation surface. This shall be followed up by metallic aluminium tape screen the cross shall be discharged tested. Built up cores shall then be laid up and filler codes added. Combined core shall be provided with extruded PVC sheathing.
Galvanized steel wire cores strip armoring shall then be provided protected by an overall extruded black PVC sheet.
The outer sheath shall bear the manufacturer's name and trade mark at every meter length.

3.2 Medium Voltage Cables

Medium Voltage Cables shall be aluminium conductor PVC insulated, PVC sheathed armoured conforming to IS 1554. Cables shall be rated for a 1100 volts. The conductor of cables from 16 sq. mm to 50 sq. mm shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq. mm and above. Conductors shall be made of electrical purity aluminium ¾ H or H temper. Conductors shall be insulated with high quality 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 outer sheath of PVC sheathing. The outer sheath shall bear the manufacturer's name and trade mark at every meter length. Cores shall be provided with following colour scheme of PVC insulation.

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

Current ratings shall be based on the following conditions

a)	Maximum conductor temperature	700º C
b)	Ambient air temperature	450ºC
c)	Ground temperature	300 ºC
d)	Depth of laying	1000mm

Short circuit rating of cables shall be as specified in IS 1554 Part – I

Cables have been selected considering conditions of maximum connected loads, ambient temperature, grouping of cables and allowable voltage drop. However, the contractor shall recheck the sizes before cables are fixed and connected to service.

4. DELIVERY, STORAGE AND HANDLING

Cable drum shall be stored on a well-drained, hard surface, preferably of concrete, so that the drums do not sink in ground causing rot and damage to the cable drum. The cable drum shall conform to IS 10418. During storage, periodical rolling of drums, in the direction of arrow marked on the drum, shall be done once in 3 month through 90º C Both ends of cables shall be properly sealed to prevent moisture ingress Drums shall be stored in well ventilated area protected from sun and rain. Drums shall always be rested on the flanges and not on flat sides. Damaged battens of drums etc. shall be replaced. Movement of drums shall always be in direction of the arrow marked on the drum wheels and pulled by ropes or they shall be mounted on trailers etc. drums shall be unloaded preferably by crane otherwise they shall be rolled down carefully on suitable ramps. While transferring cable form 1 drum to another, the barrel of the new drum shall have diameter not less than the original drum. Cables with links or similar visible defects like defective armoring etc. shall rejected. Cables shall be supplied at site in out pieces as per actual requirements.

5. LAYING OF CABLES

Cables shall be so laid that the maximum bending radius is 12 times the overall diameter of the cable for medium voltage cables and 15 times the overall diameter for 11 KV cables. Cables shall be laid in masonry trenches, directly on walls/ cable trays,. Directly buried in ground or in pipes/ducts as elaborated below.
Cables of different voltages and also power and control cables shall be laid in different trenches with adequate separation. Wherever available space is restricted such that this requirement cannot be met, medium voltage cables shall be laid above HT cables.

5.1 In Masonry Trenches

Wherever so specified, cables shall be laid in indoor/outdoor masonry/RCC trenches to be provided by Owners. Cables shall be laid on MS supports fabricated from minimum 38mm x 38mm x 6mm painted / galvanized angle iron supports grouted in trench walls at intervals not exceeding 600mm. If required, cables shall be arranged in tier formation inside the trench. Suitable clamps, hooks and saddles shall be used for securing the cables in position and dressing properly so that the clear spacing between the cables shall not be less then the diameter of the cable. Trenches shall be provided with chequered plate/RCC covers. Wherever so specified, trenches shall be filled with fine sand.

5.2 On Trays/Walls

Wherever so specified, cables shall be laid along walls/ceiling or on cable trays. Cable shall be secured in position and dressed properly by means of suitable clamps, hooks, saddles etc. such that the minimum clear spacing between cables is diameter of the cable. Clamping of cables shall be at minimum intervals as below.

Type of cables	Size	Clamping by	Fixing intervals
MV	Upto and including 25 sqmm	Saddles 1 mm thick	45cm
MV & HV	35 sqmm to 120 sqmm	Clamps 3 mm thick 25 mm wide	60 cm
MV & HV	150 sqmm and above	Clamps 3mm thick 40mm wide	60 cm

Note : The fixing intervals specified apply to straight runs. In the case of bends, additional clamping shall be provided at 30cm from the center of the bend on both sides.

Cable trays, of sizes as per schedule of quantities and drawings shall be of perforated doubled bend channel/ladder design unless otherwise stated. Cables trays shall be fabricated from minimum 2 mm thick sheet steel and shall be complete with tees, elbows, risers and all necessary hardware. Cable trays shall comply with the following :

Trays shall have suitable strength and rigidity to provide proper support for all contained cables. Trays shall not have sharp edges, burrs or projections injurious to cable insulation. Trays shall include fittings for changes in direction and elevation. Cable trays and accessories shall be painted with one shop coated of red oxide zinc chromate primer and two side coats of aluminium alkyd paint or approved equivalent. Cable trays shall not have sharp edges, burrs or projection that may damage the insulation jackets of the wiring. Cable trays shall have side rails or equivalent structural members.

Unless otherwise specifically noted on the relevant layout drawing, all cable tray mounting works to be carried out ensuring the following :

Cable tray mounting arrangement type to be as marked on layout drawing. Assembly of tray mounting structure shall be supplied fabricated, erected & painted by the electrical contractor. Tray mounting structures shall be welded to plate inserts or to structural beams as approved by the Owners/Architects. Wherever embedded plates & structural beams are not available for welding the tray mounting structure electrical contractor to supply the MS plates & fix them to floor slab by four anchor fasteners of minimum 16mm dia having minimum holding power of 5000 Kg at no extra cost. Maximum loading on a horizontal support arm to be 120 Kg. Metre of cable run. Width of the horizontal arms of the tray supporting structures to be same as the tray widths specified in tray layout drawings, plus length required, for welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiers shown in tray layout drawings. Spacing between horizontal supports arms of vertical tray runs of be 300mm. Cable trays will be welded to their mounting supports. Minimum clearance between the top most tray tier and structural member to be 300mm. Cables in vertical race ways to be clamped by saddle type clamps to the horizontal slotted angles. Clamps to be fabricated from 3mm thick aluminium strip at site by the electrical contractor to suit cable groups. The structural steel (standard quality) shall be according to latest revision of IS:226&808. Welding shall be as per latest revisions of IS : 816 . All structural steel to be painted with one shop coat of red oxide and oil primer followed by a finishing coat of aluminium alkyd paint where any cuts or holes are made on finished steel work these shall be sealed against oxidation by red oxide followed by the same finishing paint. Steel sheet covers wherever indicated to be similarly painted. Trays shall be erected properly to present a neat and clean appearance. Trays shall be installed as a complete system. Trays shall be supported adequately by means of painted MS structural members secured to the structure by dash fasteners or by grouting. The entire cable tray system shall be rigid.

Each run of cable tray shall be completed before laying of cables. Cable trays shall be erected so as to be exposed and accessible.

5.3 Buried Directly in Ground

5.3.1General

Cables shall be so laid that they will not interfere with under ground structures. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded as directed by Architects/ Owners. Surface of the ground shall be made good so as to confirm in all respects to the surrounding ground to the satisfaction of a Architects/ Owners.

5.3.2Routing cables

Before cable laying work is undertaken, the route of the cables shall be decided with the Architects/Owners. while shortest practicable route shall be preferred, cable runs shall follow fixed development such as roads, footpaths etc with proper off-sets so that future maintenance and identification are rendered easy. Whenever cables are laid along well demarcated or established roads., the LV/MV cables shall be laid further from the kerb line than HV cables, cables of different voltages and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted. LV/MV cables shall be laid above HV cable. Where cables cross one another, the cables of higher voltage shall be laid at a lower level than the cables of lower voltage. Power and communication cables shall as far as possible cross at right angles. Where power cables are laid in proximity to communications cables the horizontal and vertical clearances shall not normally be less than 60cm.

5.3.3Width Of Trench

The width of trench shall be determined on the following basis. The minimum width of trench for laying single cables shall be 350mm. Where more than one cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables except where otherwise specified shall be at least 200mm. There shall be a clearance of at least 150mm between axis of the end cables and the sides of the trench.

5.3.4Depth Of Trench

The depth of trench shall be determined on the following basis :

- Where cables are laid in single tier formation, the total depth of the trench shall not be less than 750mm for cable s upto 1.1 kV and 1250mm for cables above 1.1 kV.
- When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of trench shall be increased by 300mm for each additional tier to be formed.

5.3.5Excavation of Trenches

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature of 12 times the overall diameter of the largest cable shall be provided. Where gradients and changes in depths are unavoidable these shall be gradual. Excavation should be done by any suitable manual or mechanical means. Excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. Adequate precautions shall be taken not to damage any exiting cables, pipes or other such installations during excavation. Wherever bricks, tiles or protected covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Architects/Owners. Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Architects/ Owners. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled as required. If there is any danger of a trench collapsing or endangering adjacent structures the sides shall be well shored up with timbering and/or sheathing as the excavation proceeds. Where necessary these may even be left in place when back filling the trench. Excavation through lawns shall be done in consultation with the Architects/Owners. Bottom of the trench shall be level and free from stone, brick. Etc. The trench shall then be provided with a layer of clean dry sand cushion of not less than 800 mm in depth.

5.3.6Laying of Cable in Trench

The cable drum shall be properly mounted on jacks or on a cable wheel at a suitable location. It should be ensured that the spindle, jack etc are strong enough to carry the weight of the drum without failure and that the

spindle is horizontal in the bearings so as to prevent the drum creeping to one side while rotating. The cable shall be pulled over rollers in the trench steadily and uniformly without jerks or strains. The entire cable length shall, as far as possible, be laid in one stretch. However when this is not possible the remainder of the cable shall be removed by flaking i.e. making one long loop in the reverse direction. After the cable is uncoiled and laid over the rollers, the cable shall be lifted slightly over the rollers beginning from one end by helpers standing about 10 metres apart and drawn straight. The cable should then be taken off the rollers by additional helpers lifting the cables and then laid in the trench in a reasonably straight line. For short runs and cable sizes upto 50sq mm 1.1 KV grade the alternative method of direct handling can be adopted with the prior approval of the Architects/ Owners. If tow or more cables are laid in the same trench care should be taken to preserve relative position. All the cables following the same routes shall be laid in the same trench. Cables shall not cross each other as far as possible. When the cable has been properly straightened the cores shall be tested for continuity and insulation resistance. The cable shall be measured thereafter . Suitable moisture sealing compound/tape shall be used for sealing of the ends. Cable laid in trenches in a single tier formation shall have a covering of clean dry sand of not less than 170 mm above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation after the first cable has been laid a sand cushion of 300mm shall be provided over the initial bed before the second tier is laid. If additional tiers are formed each of the subsequent tiers also shall have a sand cushion of 300mm The top most cable shall have a final sand covering not less than 170mm before the protective cover is laid. A final protection to cables shall be laid to provide warning to future excavators of the presence of the cable and also to protect the cables against accidental mechanical damage. Such protection shall be with second class bricks of not less than 200mm x 100mm (normal size) laid breadth wise for the full length of the cable to the satisfaction of the Owners /Architects. Where more than one cable is to be laid in the same trench this protective covering shall cover all the cables and project at least 50 mm over the sides of the end cables. In addition bricks on edge shall be placed along the entire run on either side of the cable run. The trenches shall then be back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered in successive layers not exceeding 300 mm Unless otherwise specified a crown of earth not less than 50mm in the center and tapering towards the side of the trench shall be left to allow for subsidence. The crown of earth should however not exceed 100mm so as not to be a hazard to vehicular traffic. Where road berms or lawns have been cut or kerb stones displaced the same shall be repaired and made good to the satisfaction of the Clients and all surplus earth and rocks removed to places as specified.

5.3.7Laying In Pipes/Closed Ducts

In locations such as road crossings, entry to buildings/poles in paved areas etc., cables shall be laid in pipes or closed ducts. Spun reinforced concrete pipes shall be used for such purposes and the pipe shall not be less than 100mm in diameter for a single cable and not less than 150mm for more than one cable. These pipes shall be laid directly in ground without any special bed. Sand cushioning and/or brick tiles need not be used in such installations. Unless otherwise specified the top surface of pipes shall be at a minimum depth of 1000mm from the ground level when laid under roads, pavements etc. The pipes for road crossings shall preferably be on the skew to reduce the angle of bend as the cable enters and leavers the crossing. Pipes shall be continuous and clear of debris or concrete before cable is drawn. Sharp edges at ends shall be smoothened to prevent injury to cable insulation or sheathing . No deduction shall be made for sand and bricks not used for cables passing through RCC Hume pipes or for parts of vertical cables at the lighting poles. Wherever so required, cables shall be laid at the bed of the lake through existing PVC pipe as itemized in bill of quantities.

5.3.8Laying of Cables in Floors

Laying of cables directly in floors shall be avoided and GI pipes of adequate size shall be used wherever necessary. However if the cables have to be laid direct in the floor specific written approval of architect/ owners shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

5.3.9Cable Entry Into Buildings

Cable entry into buildings shall be made through RCC pipes recessed in the floor RCC Hume pipes shall be provided well in advance for service cable entries. The pipe shall be filled with sand and sealed at both ends with bitumen mastic to avoid entry of water. Suitable size manholes shall be provided wherever required to facilitate drawing of cables as per requirements.

6. TERMINATION/JOINTING OF CABLES

Soldered Jointing/termination shall be totally avoided. Solderless terminations by using. Dowel crimping tools and suitable legs shall be adopted for all cable terminations. Maybe any terminations without use of proper

crimping tool is ought to be liable to be rejected. In the case of aluminium conductors, it is to be ensured that the conductor oxidation is cleaned by means of emery paper and then a thin coat of tin is applied before pinching into any equipment. Heat shrinkable Raychem type or approved equivalent terminations shall be provided for High Voltage cables and Siemens make or approved equivalent make brass double compression glands shall be provided for Medium Voltage cable terminations. Straight through jointing of Medium Voltage or High Voltage cable shall normally be totally avoided. If absolutely unavoidable, such jointing shall be carried out as per procedure to be got specifically approved from Architect/Owners.

7. MEASUREMENT OF CABLE RUNS

The cable runs shall be measured upto the outer end of the boxes without any allowances for over lap in joints. The actual run of the cables shall be measured and the rate shall include all the above mentioned material, labour etc. for laying as required.

8. CABLE LOOPS

At the time of the installation approximately 3 meters of surplus cable shall be left

- at each end of the cable
- on each side of underground straight through/tee termination joints.
- At entries to buildings
- And such other places as may be decided by the architects/owners.

This cable shall be left in the form of loop. Wherever long runs of cable length are installed cable loops shall be left at suitable intervals as specified by the architect/owners.

9. BONDING OF CABLES

Where a cable enters any piece of apparatus it shall be connected to the casting by means of an approved type of armoured clamps or gland . The clamps must grip the armouring firmly to the gland or casting, so that in the event of ground movement no undue stress is placed on to the cable conductors.

10. TESTING

10.1 Tests At Manufacturer's Work

The cables shall be subjected to shop test in accordance with relevant standards to prove the design and general qualities to the cables as below (as per IS 10810) :

- Routine test on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot
- Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

10.2 Site Testing

- All cables before laying shall be tested with a 500 V megger for 11 KV grade or with a 2,500/5,000 V megger forcables of higher voltages. The cables cores shall be tested for continuity, absence of cross phasing, insulation resistance to earth/sheath/armour and insulation resistance between conductors.
- All cables shall be subject to above mentioned test during laying, before covering the cables by the cables by protective covers and back filling and also before the jointing operations.
- After laying and jointing, the cable shall be subjected to a 1.5 minutes AC/DC pressure test.
- In the absence of facilities for pressure testing in accordance with clause above it is sufficient to test for one minute with 1000 V megger for cables of 11 KV grade and with 2,500/5,000 V megger for cables of higher voltages.

10.3 Test Witness

Tests shall be performed in presence of representative of Owners/Architect. The contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

MEDIUM VOLTAGE DISTRIBUTION BOARDS

1 GENERAL -This section covers specification of DBs.

2 STANDARDS AND CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.
BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.
It is to be noted that updated and current standards shall be applicable irrespective of those listed below.

Miniature Air Circuit Breakers for AC circuits	IS 8828 : 1978
Degrees of Protection provided by enclosures for low voltage Switchgear	IS 2147 : 1962
Code of Practice for installation and maintenance of switchgear not exceeding 1000 volts	IS 10118 : 1982
General requirements for switchgear and control gear for voltages not exceeding 1000 volts	IS 4237 : 1982

3. MINATURE CIRCUIT BREAKERS

- The MCB's shall be of the completely moulded design suitable for operation at 240/415 volts 50 Hz system.
- The MCB's shall have a rupturing capacity of 10 KA at 0.5 p.f.
- The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with HRC fuse/PVC cable characteristic.
- Type test certificates from independent authorities shall be submitted with the tender.

4. FINAL DISTRIBUTION BOARDS

- Final distribution boards shall be flush mounting totally enclosed, dust and vermin proof and shall comprise of miniature circuit breakers, earth leakage circuit breakers, neutral link etc as detailed in the schedule of quantities.
- The distribution equipment forming a part of the Distribution Boards shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and as per detailed specifications included in this tender document.
- The board shall be fabricated from 14 gauge CRCA sheet steel and shall have a hinged lockable spring loaded cover.

  All cutouts and covers shall be provided with synthetic rubber gaskets . The entire construction shall give a IP 42 degree of protection.
- The bus-bar shall be of electrical grade copper having a maximum current density of 1.6 ampere per square mm and PVC insulated throughout the length.
- All the internal connections shall be with either solid copper PVC insulated or copper conductor PVC insulated wires of adequate rating.
- All the internal connections shall be concealed by providing a hinged protective panel to avoid accidental contact with live points.
- All outgoing equipment shall be connected direct to the bus bar on the live side. The equipment shall be mounted ona frame work for easy removal and maintenance.
- The sheet steel work shall undergo a rigorous rust proofing process. Two coats of filler oxide primer and final powder coated paint finish.
- All the circuits shall have an independent neutral insulated wire, one per circuit, and shall be numbered and marked as required by the Owners.
- A sample of the completed board is to be got approved by the architects/owners before commencement of supply and erection.

5 SHEET STEEL TREATMENT AND PAINTING

- Sheet steel materials used in the construction of these unit should have undergone a rigorous rust proofing process comprising of alkaline degresing, descaling in dilute sulphuric acid and a recognized phosphating process. The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.
- All sheet steel shall after metal treatment be given powder coated finish painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stored and the paint thickness shall not be less than 50 microns.

6. NAME PLATES AND LABELS

Suitable engraved white on black name plates and identification labels of metal for all switch boards and circuits shall be provided. These shall indicate the feeder number and feeder designation.

TECHNICAL SPECIFICATIONS

MEDIUM VOLTAGES SWITCHGEAR

1. GENERAL

This section covers specification of Medium Voltage Switchboards incorporating items of switchgear like Circuit Breakers, SFUs, metering and protection.

2. STANDARDS AND CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.
BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.
It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Low Voltage switchgear & control gear		IS 13947 : 1993
Part I	:	General rules
Part II	:	Circuit Breakers
Part III	:	switches, disconnectors, switch disconnectors and fuse combination units
Part IV	:	Contactors and Motors starters
Part V	:	Control circuit devices and switching elements

Marking of Switch gear bus bars	IS 11353 : 1985
Degree of Protection of Enclosures for low voltage switch gear	IS 2147 : 1962
Electrical relays for power system protection	IS 3231 : 1986
Code of Practice for selection, installation and Maintenance of switchgear& control gear	IS 10118 : 1982
Low voltage switchgear & control gear assemblies	IS 8623 : 1993

3. SWITCHGEAR

3.1 Medium Voltage Air Circuit Breakers

3.1.1 Technical Parameters

The circuit breaker shall be of the air break type, robust and compact design suitable for indoor mounting and

shall comply with the requirement of IS : 13947 : 1993. Rupturing capacity shall be 31 MVA at 415 Volts or as per schedule of quantities.

3.1.2 Constructional Features o The Circuit Breaker shall be flush front, metal clad, horizontal draw – out pattern, three/four pole as required and fully interlocked. Each Circuit Breaker shall be housed in a separate compartment enclosed on all sides.

o The Circuit Breaker cradle shall be designed and constructed to permit smooth with drawl and insertion. The movement shall be free of jerks, easy to operate and positive.

o All current carrying parts in the breaker shall be silver plated and suitable arcing contacts shall be provided to protect the main contacts which shall be separate from the main contacts and easily replaceable. In addition. Arc chutes shall be provided for each pole and these shall be suitable for being lifted out for the inspection of the main and the arcing contacts.

o Self aligning cluster type isolating contacts shall be provided for the Circuit Breaker, with automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle, Sliding connections including those for the auxiliary contacts and control wiring shall also be of the self aligning type. The fixed portion of the sliding connections shall have easy access for maintenance purposes.

o The cubicle for housing the Breaker shall be free standing dead front pattern fabricated from the best quality sheet steel.

3.1.3 Operating Mechanism

o The Circuit Breaker shall be trip free with independent manual spring operated or motor wound spring operated mechanism as specified and with mechanical ON/OFF indication. The operating mechanism shall be such that the circuit breaker is at all times free to open immediately the trip coil is energized.

o The operating handle and mechanical trip push button shall be at the front of and integral with the Circuit Breaker.

o The Circuit Breaker shall have the following four distinct and separate positions which shall be indicated on the face of the panel.

“Service” – Both main and secondary isolating contacts closed

“Test” – Main isolating contacts open and secondary isolating contacts closed

“Isolated” – Both main and secondary isolating contacts open

“Maintenance” – Circuit Breaker fully outside the panel ready for maintenance

3.1.4 Circuit Breaker Interlocking

o Sequence type strain free interlocks shall be provided to ensure the following: oIt shall not be possible for the Breaker to be withdrawn from the cubicle when in the “ON” position . To achieve this, suitable mechanism shall be provided to lock the Breaker in the tripped position before the Breaker is isolated.

o It shall not be possible for the Breaker to be switched “ON” until it is either in the fully inserted position or for testing purposes, it is in the fully isolated position.

o It shall not be possible for the circuit breaker to be plugged in unless it is in the OFF position.

o A safety catch shall be provided to ensure that the movement of the Breaker, as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due its weight.

o Mechanical and electrical antipumping devices shall be incorporated in the ACB’s as required.

3.1.5 Circuit-Breaker Auxiliary Contacts

The circuit Breaker shall have minimum 6 N.O. and 6 N.C. auxiliary contacts rated at 16 amps. 415 volts 50 Hz. These contacts shall be approachable from the front. They shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is drawn out of the cubicle.

3.1.6 Protective Devices

o The Circuit Breaker shall have protective devices as specified in the Schedule of Quantities. These will in general be :

o C.T. operated thermal overlaod releases with magnetic instantaneous short circuit release. The overload releases shall be such that each phase can be individually set depending on the phase unbalanced currents. The releases shall have inverse time current characteristics and the magnetic release shall be time delayed with a minimum setting of 25 ms varying upto 300 ms for discrimination without effecting the breaking current capacity of the ACB.

- Over voltage relay.
- Under/no voltage trip coil or Relay as required. o Over current and earth fault IDMT relays with shunt/series trip coil operation as specified.
- The circuit breakers shall be suitable to accommodate one or more types of protection as specified.

3.1.7 Instrument Transformers

The Circuit Breaker shall have the required Current Transformers as specified for metering and protection mounted outside the circuit Breaker compartment but within the free standing cubicle. The transformers shall comply to the relevant Indian Standards and the Class of Accuracy required for metering and protection. Separate sets of Current transformers shall be provided.

3.1.8 Metering

The metering required to be provided for each Circuit Breaker shall be as per the Schedule of Quantities. Such metering shall not be provided on the front panel of the Circuit Breaker compartment. A separate compartment shall be provided for the metering and Protective relays as required.

Square pattern flush mounting meters complying with the requirements of the relevant Indian Standards shall only be used.

Selector switches of the three way and OFF pattern complying to the relevant Indian Standards shall be used.

3.1.9 Indicating Lamps

Neon type indicating lamps shall be provided for indication of phases and Breaker position as required in the Schedule of Quantities.

3.1.10 Control Wiring

All wiring for relays and meters shall be of copper conductor PVC insulated and shall be colour coded and labeled with appropriate plastic ferrules for identification. The minimum size of control wires to be used shall be 1.5 sqmm.

All control circuits shall be provided with protective H.R.C. fuses. Instrument testing plugs shall be provided for testing the meters.

3.1.11 Earthing

The frame of the Circuit Breaker shall be positively earthed when the Circuit Breaker is racked into the cubicle.

3.1.12 Type Test Certificates

The contractor shall submit type test certificates from a recognized test house for the Circuit Breakers offered.

3.2 Switch Fuse Units

Switch fuse units, incorporated in switchboards wherever required shall conform in all respects to IS 13947 : 1993. Switch fuse units shall be suitable for 415 Volts 3 Phase 40 HZ AC supply.

Unit housing shall be of robust Construction designed to withstand ardous conditions. Sheet steel used shall be given rigorous rust proofing treatment before fabrication and painting . Units shall have double break per phase in order to isolate fuse links when the switch is in OFF position.

Operating mechanism of units shall be crisp and positive in action with quick – make and quick –break silver plated contacts. Operating handle shall be suitable for rotary operation unless otherwise specified. Position of handle such as ON and OFF shall be clearly indicated.

All live parts inside the switch fuse unit shall be shrouded to prevent any accidental contact.

All the terminals shall be liberally designed. All units above 100 A shall be provided with integral cable sockets.

All switch units shall be provided with suitable interlocks such that the door of the switchboard panel shall not open unless the switch is in OFF position. Provision for padlocking the switch in OFF position shall also be provided. Routine and type tests as per IS 13947 : 1993 shall be conducted at works and test certificates furnished.

3.3 Moulded Case Circuit Breakers

Moulded case circuit breakers (MCCB) or fuse free breakers, incorporated in switchboards wherever required, shall conform to IS 13947 : 1993 in all respects . MCCBs shall be suitable either for single phase 240 Volts or 3 Phase 415 Volts AC 50 Hz supply.

MCCB cover and case shall be made of high strength heat resisting and flame retardant thermosetting insulating material. Operating handle shall be quick make/break, trip-free type. Operating handle shall have suitable ON, OFF and TRIPPED indicators. Three phase MCCBs shall have a common handle for simultaneous operation and tripping of all the three phases. Suitable are extinguishing device shall be provided for each contact. Tripping unit shall be of thermal/ magnetic type provided on each pole and connected by a common tripe bar such that tripping of any one pole causes three poles to open simultaneously. Thermal/magnetic tripping device shall have IDMT characteristic for sustained over loads and short circuits.

Contact trips shall be made of suitable are resistant sintered alloy. Terminals shall be of liberal design with adequate clearances.

MCCBs shall be provided with following accessories, if specified in drawings/schedule of quantities:

- Under voltage trip
- Shunt trip
- Alarm switch
- Auxiliary switch

MCCBs shall be provided with following interlocking devices for interlocking the door a switch board.

- Handle interlock to prevent unnecessary manipulations of the breaker
- Door interlock to prevent door being opened when the breaker is in ON position.
- Deinterlocking device to open the door even if the breaker is in ON position.

MCCBs shall have rupturing capacity as specified in drawings/schedule of quantities.

All MCCB shall be provided with adapter terminal for facilitates higher sizes of cable/links

3.4 Metering, Instrumentation And Protection.

Ratings, type and quantity of meters, instruments and protective devices shall be as per drawings and schedule of quantities.

Current Transformers

C/Ts shall confirm to IS 2705 (part-I, II and III) in all respects. All C/Ts used for medium voltage application shall be rated for 1 kV C/Ts shall have rated primary current, rated burden and class of accuracy as specified in schedule of quantities/drawings. Rated secondary current shall be 5A unless otherwise stated. Minimum acceptable class for measurement shall be class 0.5 to 1 and for protection class 10 C/Ts shall be capable of withstanding magnetic and thermal stresses due to short circuit faults of 31 MVA on medium voltage. Terminals of C/Ts shall be paired permanently for easy identification of poles. C/Ts shall be provided with earthing terminals for earthing chassis, frame work and fixed part of metal casing (if any) Each C/T shall be provided with rating plate indicating.

- Name and make
- Serial number
- Transformation ratio
- Rated Burden
- Rated voltage
- Accuracy class

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

Potential Transformer

PTs shall confirm to IS 3156 (Part-I, II and III) in all respects.

Measuring Instruments

Direct reading electrical instruments shall conform to IS 1248 or in all respects. Accuracy of direct reading shall be 1.0 of voltmeter and 1.5 for ammeters. Other instruments shall have accuracy of 1.5 Meters shall be suitable for continuous operation between – 10º C and +500 C Meters shall be flush mounting and shall be enclosed in dust tight housing. The housing shall be of steel or phenolic mould. Design and manufacture of meters shall

ensure prevention of fogging of instrument glass. Pointer shall be black in colour and shall have Zero position adjustment device operable from out side. Direction of deflection shall be from left to right. Selector switches shall be provided for ammeters and volt meters used in three phase system.

Ammeters

Ammeters shall be of moving iron type. Moving part assembly shall be with jewel bearings. Jewel bearings shall be mounted on a spring to prevent damage to pivot due to vibrations and shocks. Ammeters shall be manufacture and calibrated as per IS 1248

Ammeters shall normally be suitable for 5 A secondary of current transformers.

Ammeters shall be capable of carrying substantial over loads during fault conditions.

Voltmeters

Voltmeters shall be of 3 phase electro dynamic type and shall be provided with a maximum demand indicator if required.

Watt meter

Wattmeter shall be of 3 phase elector dynamic type and shall be provided with a maximum demand indicator if required.

Power factor meters

3 phase power factor meters shall be of electro dynamic type with current and potential coils suitable for operation with current and potential transformers provided in the panel. Scale shall be calibrated for 50% lag-100% - 50% readings. Phase angle accuracy shall be +40. **Energy and reactive power meters**

Trivector meters shall be two element, integrating type, KWH, KVA . KVA hour reactive meters. Meters shall confirm to IEC 170 in all respects. Energy meters, KVA and KVARH meters shall be provided with integrating registers. The registers shall be able to record energy conception of 500 hours corresponding to maximum current at rated voltage andunity power factor. Meters shall be suitable for operation with current and potential transformers available in the panel.

Relays

Protection relays shall be provided with flag type indicator s to indicate cause of tripping. Flag indicators shall remain in position till they are reset by hand reset. Relays shall be designed to make or break the normal circuit current with which they are associated. Relay contacts shall be of silver or platinum alloy and shall

be designed to withstand repeated operation without damage. Relays shall be of draw out type to facilitate testing and maintenance. Draw out case shall be dust tight . Relays shall be capable of disconnecting faulty section of network without causing interruption to remaining sections. Analysis of setting shall be made considering relay errors, pickup and overshoot errors and shall be submitted to architect/owner for approval.

Over Current relays

Over current relays shall be induction type with inverse definite minimum time lag characteristics. Relays shall be provided with adjustable current and time setting. Setting for current shall be 50 to 200 % insteps of 25% . The IDMT relay shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be adjustable form 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5 Amps.

Earth fault relay

Same as over current relay excepting the current setting shall be 10% to 40% in steps of 10%.

Under voltage relay

Under voltage relays shall be of induction type and shall have inverse limit operation characteristics with pickup voltage range of 50 to 90% of the rated voltage.

3.5 Power Factor Correction capacitors

Power factor correction capacitors shall conform to IS 2834 in all respects. Approval of insurance association of India shall be obtain if called for. Capacitors shall be suitable for 3 phase 415 volts 50 Hz supply and shall be available in single and three phase units of 5, 10, 15, 20, 25 and 50 k VAR sizes. Capacitor shall be usable for indoor use, permissible overloads being as below.

- Voltage overloads shall be 10% for continuous operation and 15% for six hours in a 24 hours cycle.
- Current overloads shall be 15% for continuous operations and 50% for six hours in a 24 hours cycle.
- Over load of 30% continuously and 45% for six hours in a 24 hours cycle.

Capacitors shall be hermetically sealed in sturdy corrosion proof sheet steel containers and impregnated with non inflammable synthetic liquid. Every element of each capacitory unit shall be provided with its own built in silvered fuse. Capacitors shall have suitable discharge device to reduce the residual voltage from crest value of the rated voltage of 50 volts or less within one minute after capacitor is disconnected from the source of supply. The loss factor of capacitor shall not exceed 0.005 for capacitors with synthetic impregnants . The capacitors shall withstand power frequency test voltage of 2500 volts AC for one minute. Insulation resistance between capacitors terminals and containers when a test voltage of 500 volts DC is applied shall not be less than 50 meg.ohms.

4. MEDIUM VOLTAGE SWITCH BOARDS

4.1 General

- All medium voltage switchboards shall be suitable for operation at three phase/ three phase 4 wire, 415 volt, 50 Hz, neutral grounded at transformer system with a short circuit level withstand of 31 MVA at 415 volts or as per schedule of quantities.
- The Switch Boards shall comply with the latest edition with upto date amendments of relevant Indian Standards and Indian Electricity Rules and Regulations.

4.2 Switch Board Configuration The Switch Board shall be configured with Air Circuit Breakers, MCCB's and other equipment as called for in the Schedule of Quantities.

- The MCCB's shall be arranged in multi-tier formation whereas the Air Circuit Breakers shall be arranged in Single or Double tier formation only to facilitate operation and maintenance.
- The switch Boards shall be of adequate size with a provision of 25% spare space to accommodate possible future additional switch gear.

4.3 Equipment Specifications

All equipment used to configure the Switch Board shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and to the detailed technical Specifications as included in this tender document.

4.4 Constructional Features

- The switch Boards shall be metal enclosed, sheet steel cubicle pattern, extensible, dead front, floor mounting type and suitable for indoor mounting.
- The switch boards shall be totally enclosed , completely dust and vermin proof. Synthetic rubber gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust and vermin proof to provide a degree of protection of IP 54. All doors and covers shall also be fully gasketed with synthetic rubber and shall be lockable.
- The switch boards shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be constructed from CRCA sheet steel of thickness not less than 1.6 mm joints of any kind in sheet metal shall be seam welded and all welding slag round off and welding pits wiped smooth with plumber metal.
- All panels and covers shall be properly fitted and square with the frame. The holes in the panel shall be correctly positioned.
- Fixing screws shall enter holes tapped into an adequate thickness of metal of provided with hank nuts. Self threading screws shall not be used in the construction of the Switch Boards.
- Panel Mounted Lock to be provided on each compartment.

4.5 Switchboard Dimensional Limitations

- A base channel 75mm x 5mm thick shall be provided at the bottom.
- A minimum of 200mm blank space between the floor of switch board and bottom most unit shall be provided.
- The overall height of the Switch board shall be limited to 2300mm
- The height of the operating handle, push buttons etc. shall be restricted between 300mm and 2000mm from finished floor level.
- Panel mounted lock to be provided on compartment.

4.6 Switch Board Compartmentalization

The switch Boards shall be divided into distinct separate compartments comprising

- A completely enclosed ventilated dust and vermin proof bus bar compartment for the horizontal and verticalbusbars.
- Each circuit breaker, and MCCB shall be housed in separate compartments enclosed on all sides.
- Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker/switch fuse unit in “on” and “off” position.
- For all circuit breakers separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contractors and control fuses etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.
- A horizontal wire way with screwed cover shall be provided at the top to take interconnecting control wiring between vertical sections.
- Separate cable compartments running the height of the Switch Boards in the case of front access Boards shall be provided for incoming and outgoing cables.
- Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top.
- Adequate and proper support shall be provided in cable compartments to support cables.

4.7 Switch Board Bus Bars

- The Bus Bar and interconnections shall be of Aluminium and of rectangular cross sections suitable for full load current for phase bus bars and half rated current for neutral bus bar. Aluminium shall be 0.8 amp per Sq.mm and suitable to withstand the stresses of a 31 MVA fault level or at 415 volts for 1 second or as per schedule of quantities.
- The bus bars and interconnections shall be insulated with insulation tape/ fiber glass.
- The bus bars shall be extensible on either side of the Switch Board.
- The bus bars shall be supported on non- breakable, non-hygroscopic insulated supports at regular intervals, to withstand the forces arising from a fault level of 31 MVA at 415 volts for 1 second.
- All bus bars shall be colour coded.
- All bus bar connections in Switch Boards shall be bolted with brass bolts and nuts. Additional cross section of bus bars shall be provided wherever holes are drilled in the bus bars.

4.8 Switch Board Interconnections

- All connections between the bus bars/Breakers/cable terminations shall be through solid copper strips of adequate size to carry full rated current and PVC/ fibre glass insulated.
- For unit ratings upto 100 amps PVC insulated copper conductor wires of adequate size to carry full load current shall be used. The terminations of all such interconnections shall be crimped.

4.9 Drawout Features

Air Circuit Breakers shall be provided in fully drawout cubicles. These cubicles shall be such that drawout is possible without disconnection of the wires and cables. The power and control circuits shall have self aligning and self isolating contacts. The fixed and moving contacts shall be easily accessible for operation and maintenance. Mechanical interlocks shall be provided on the drawout cubicles to ensure safety and compliance to relevant Standards. The MCCB’s shall be provided in fixed type cubicles.

4.10 Instrument Accommodation

- Instruments and indicating lamps shall not be mounted on the Circuit Breaker Compartment door for which a

separate and adequate compartment shall be provided and the instrumentation shall be accessible for testing and maintenance without danger accidental contact with live parts of the Switch Board.

- For MCCB's instruments and indicating lamps can be provided on the compartment doors.
- The current transformers for metering and for protection shall be mounted on the solid copper / aluminium busbars with proper supports.

4.11 Wiring

All wiring for relays and meters shall be with PVC insulated copper conductor wires. The wiring shall be coded and labeled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 1.5 sqmm

4.12 Cable Terminations

- Knockout holes of appropriate size and number shall be provided in the Switch Board in conformity with the location of incoming and outgoing conduits/cables.
- The cable terminations of the Circuit Breakers shall be brought out to terminal cable sockets suitably located at the rear of the panel.
- The cables terminations for the MCCB's shall be brought out to the rear in the case of rear access switchboards or in the cable compartment in the case of front access switch boards.
- The Switch Boards shall be complete with tinned brass cable sockets, tinned brass compression glands, gland plates, supporting clamps and brackets etc. for termination of 1100 volt grade aluminium conductor PVC/PVCA cables.

4.13 Space Heaters.

The Switch board shall have in each panel thermostatically controlled space heaters with a controlling 15amp 230 volt switch socket outlet to eliminate condensation.

4.14 Earthing

A main earth bar of G.I./ Copper as required shall be provided throughout the full length of the Switch Board with a provision to make connections to the sub-station earths on both sides.

4.15 Sheet Steel Treatment And Painting

- Sheet Steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognized phosphating process . The steel work shall then receive two costs of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.
- All sheet steel shall after metal treatment be spray or powder painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stored and the paint thickness shall not be less than 50 microns.

4.16 Name Plates And Labels

Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

4.17 Installation

The foundations prepared as per the manufacturers drawings shall be leveled, checked for accuracy and the Switch Board installed. All bus bar connections shall be checked with a feeler gauge after installation. The cable end boxes shall be sealed to prevent entry of moisture. The main earth bar shall be connected to the sub-station earths.

A 15mm thick rubber matting of approved make on a 100mm high timber platform shall be provided in front of and along the full length of the Switch Board. The width of the matting shall be 1000mm . The rubber mat shall withstand 15 KV for I minute and leakage current shall not exceed 160 mA/sq metre. After installation the Switch Board shall be tested as required prior to commissioning.

TECHNICAL SPECIFICATIONS

RISING MAINS BUS TRUNKING SYSTEM

1.1 MATERIALS

1.1.1 Enclosure

The enclosure shall be made form CRCA sheet steel of 2m thickness for side channel and 1.6mm thickness for the front and covers.

Bus trunking system should conform to IEC-139 Part 1 & 2 and shall be suitable for 415 volt 3 phase 4 wire 50 Hz supply, insulation voltage 660 volts.

1.1.2 Busbars

Busbars shall be made of electrical grade E-9/E aluminium busbars. The rating of busbar shall be as specified in drawing/Bill of quantities.

Maximum temperature rising of the Rising Mains Bus trunking System shall be as per IEC standards and temperature rise shall not exceeding 50ºC above 40ºC ambient.

1.1.3 Bus bars shall be of sufficient cross section so that a current density of 0.8 A/Sq mm is not exceeded at nominal current.

1.1.4 The cross section of the neutral busbar shall be the same as that of the phase busbar for busbars of capacities.

Each busbar shall be individually insulated by means of heat shrinkable PVC sleeves.

1.2 BUSBARS SUPORTS

Busbar support/insulators shall be made of thermal resistant epoxy resin as insulation material and shall be of suitable size and spacing to withstand dynamic stresses due to short circuit currents in the system.

1.3 MOUNTINGS

1.3.1 Tap off boxes shall be located at specified intervals and shall be installed at a height of 1.5m to 5 m above the floor level. These shall be permanently connected to the busbars of the rising mains bus trunking system.

1.3.2 An end feed unit for connecting to the incoming cables shall be provided at the bottom end of the rising mains bus trunking system.

1.3.3 Tap off boxes shall be suitable for mounting over rising mains bus trunking system. The rating shall be as specified in the BOQ and on drawings

1.3.4 The tap off unit shall be complete in all respect having moulded case circuit breaker as protective switching devices with rotary handles. The rating shall be as specified in drawing and tender document.

1.3.5 The tap off unit shall be bolted type as required.

2.0 CONSTRUCTION

2.1 Enclosure

2.1.1 The rising mains bus trunking system shall be manufactured in convenient sections to facilitate easy transportation and installation. The sections shall be connected to form a horizontal/ vertical run at site.

Each section shall be provided with suitable wall strips/fixing arrangement at convenient intervals for fixing to the wall.

2.1.2 The enclosure shall be sturdy so as to withstand the internal and external forces resulting from the various operating conditions.

2.1.3 The entire bus trunking system shall be designed for dust and vermin proof construction. The enclosure shall have degree of protection not less than IP-42 in accordance with IS – 2147

2.1.4 Built in fire proof barriers shall be provided to restrict the spread of fire through the bus trunking system from one section to the adjacent section. The fire barriers comply with resistance class F-120.

Neoprene rubber gaskets shall be provided between the covers and channels to satisfy the operating conditions imposed by temperature, weathering durability etc.
Necessary earthing arrangement shall be made alongside the rising mains enclosure by means of a GI strip of adequate size bolted to each section and shall be earthed at both ends . The rising mains enclosure shall be bolted type.
2.1.5 The enclosure shall be treated with anti corrosion paint and shall be coated with powder spray paint. The power spray paint shall be applied electro-statically and baked on to the enclosure.

3. BUSBARS AND SUPPORTS

3.1 Busbars joint shall be thoroughly cleaned and a suitable oxidizing grease shall be applied before making joints.
3.2 The rising mains bus trunking shall have four busbar. Busbar shall be supported every 250mm along the length on class B fire retardant insulating supports.
3.3 High tensile, bolts, plain and spring washers shall be provided to ensure good contacts at the joints.
3.4 Expansion joint made of aluminium strips shall be provided wherever necessary to take care of expansion and contraction of the busbars under normal operating conditions. This shall be invariably provided wherever the length of the rising mains bus trunking exceed fifteen meter.
3.5 The busbar shall be provided with thrust pads so that the expansion of the conductor is upwards only.
3.6 The busbar clamps and insulator shall be designed to withstand the forces due to short circuit current. They shall also permit free vertical movement of the busbars during expansion and construction.

4. INSTALLATION

4.1.1 Rising Mains Bus trunking shall be installed on walls to which suitable supports shall be provided by the contractor without extra payment.
4.1.2 All opening in floors provided by the client shall be closed by the contractor after installing rising mains bus trunking system by any suitable means as approved by Engineer-in-charge without any extra payment.

4.2 Mountings
The accessories used with the rising mains bus trunking system for tapping and distribution shall be as per clause 1.4

4.3 Earthing
Two no earth strip shall be provided for body earthing of the rising mains bus trunking system. Earth strip shall be terminated on the earth strip(coming from mains LT panels) at the bottom end/end feed units of the rising mains bus trunking system Metallic body of all mounting shall be bonded to the earth strip. Earth continuity conductor for further distribution shall also be taped from the earth strip.

4.4 The entire installation including mounting shall be provided in such a manner that there are no chances of entry of insects into the rising mains bus trunking system.

4.5 Danger notice board
Danger notice board shall be provided on the rising mains bus trunking system at every floor level.

4.6 Commissioning
Before connecting mains supply after installation, pre-commissioning checks comprising megger test, checking the tightness of the connections body earth connection etc. shall be carried out and recorded.

4.7 Test and test reports
Type test reports for the rising mains shall be furnished along with the bid and routine test according to IS-8623 Part II shall be given with the supply. The routing test shall comprise of :-
a) Heat run test
b) High voltage test
c) Insulation resistance test using 1.1 kV megger
d) Any other visual test as per the relevant IS at the time of inspection

e) Impedance Test

TECHNICAL SPECIFICATIONS

EARTHING

1. GENERAL

All the non-current carrying metal parts of electrical installation shall be a earthed properly. All metal conduits, trunking cable sheaths, switchgear, distribution fuse boards, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system . All earthing shall be in conformity with Indian Electricity Rules.

The Earthing System shall in totally comprise the following:
a) Earth Electrodes
b) Earthing Leads
c) Earth Conductors

All three phase equipment shall have two separate and distinct body earths and single phase equipment shall have a single body earth.

2. STANDARDS

All equipments components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and / or IEC Standards shall be applicable.
Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.
It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents.

3. EARTHING MATERIAL

Materials of which the protective system is composed shall be resistant to corrosion or be adequately protected against corrosion.

The material shall be as specified in the schedule of quantities and shall comply to the following requirements :

Copper- when solid or stranded copper wire is used it shall be of the grade ordinarily required for commercial electrical work generally designated as being of 98% conductivity when annealed, conforming to Indian standard specifications.

Galvanized Steel – Galvanized steel used shall be thoroughly protected against corrosion by hot dipped Zinc coating. The material coating shall withstand the test specified in IS 2309:1969

The strips to be used shall be in maximum lengths available as manufactured normally avoiding unnecessary joints.

EARTH ELECTRODES

Plate Earth Electrode- The plate electrodes shall be of copper/ GI as called for in the schedule of quantities. The minimum dimensions of the electrodes shall be 600mm x 600mm Thickness of copper electrodes shall not be less than 3mm and of GI electrodes not less than 6mm. The electrode shall be buried in ground with its face vertical and top not less than 4 meters below ground level.

Earth Electrode Pit Method of Installing Watering Arrangement In the case of plate earth electrode, a watering pipe of 20mm dia of medium class G.I. Pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided at the top of this pipe for watering the earth. The watering funnel attachment shall be housed in masonry enclosure of not less than 1000 x 500 x600mm A precast RCC frame & cover shall be suitably embedded in the masonry enclosure.

Location of Earth Electrode

The following guidelines shall be followed for locating the earth electrodes An earth electrode shall not be situated less than 5 meters from any building.

The excavations for electrode shall not affect the column footings or foundations of the buildings. In such cases electrode may be further away from the building.

The location of the earth electrode shall be such where the soil has reasonable chance of remaining moist, as far as possible.

Entrances, pavements and road ways shall not be used for locating the earth electrode.

Number of Earth Electrodes

In all cases the relevant provision of rule 33, 61 & 67 of the Indian Electricity Rules 1956 as amended shall be complied with Metallic covers or supports of all medium or H.T. apparatus or conductors shall , in all cases be connected to not less than two separate and distinct earth electrodes.

5. **EARTHING LEADS**

The strip earthing leads shall be connected to the Earth Electrode at one end and to the metallic body of the main equipment at the other end. The earthing lead shall connect to the earthing network in the installation.

- Earthing Lead Sizes

Strip earthing leads shall be of copper / GI and as per specifications.

- Earthing Lead Installation

The length of buried strip earthing lead shall be not less than 15 metres and shall be buried in trench not less than 0.5m deep.

If conditions necessitates use of more than one earthing lead they shall be laid as widely distributed as possible preferably in a single straight trench or in a number of trenches radiating from one point.

- Method of connecting earthing Lead to Earth Electrode

In the case of plate earth electrode the earthing lead shall be securely bolted to the plate with two bolts, nuts checknuts and washers as required by IS 3043 : 1987.

All materials used for connecting the earth lead with electrode shall be GI in case of GI Pipe and GI plate earth electrodes or tinned brass in case of copper plate electrode.

- Protection of Earthing Lead

The earthing lead from electrode onwards shall be suitably protected from mechanical injury and corrosion by a 15 mm dia GI pipe in case of wire and 100/40 mm dia medium class GI pipe.

The portion the G.I. pipe within ground shall be buried at least 30cm deep (to be increased to 60cm in case of road crossing or pavements). The portion within the building shall be recessed in walls and floors to adequate depth.

6. EARTHING CONDUCTORS

Earthing conductors shall form the earthing network throughout the installation for earthing of all non-carrying metal parts.

Connection of Earthing Conductors

- Main earthing conductor shall be taken from the earth connections at the main switch boards to all other switchboards in the network.
- Sub-mains earthing conductor shall run from the main switch board to the sub distribution boards and to the final distribution boards.
- Loop earthing conductors shall run from the distribution boards and shall be connected to any point on the main/sub-main earthing conductor, or its distribution board or to an earth leakage circuit breaker.
- Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to switch boards at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing . Switches, accessories, lighting fitting etc shall be effectively connected to the loop earthing Conductor. These though rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered earthed, even though the run of metallic conduit is earthed.

Earthing Conductor Installation

- The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size.

Joints shall be riveted and brazed in approved manner.

Sweated lugs of adequate capacity and size shall be used for termination. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned.

- Sizing of Earthing Conductors

All fixtures, outlet boxes and junction boxes shall be earthed with Bare copper wires as specified.
All 3 phase switches and distribution boards upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 4mm dia copper/6 mm dia GI wires. All 3 phase switches and distribution boards upto 100 amps rating shall be earthed with 2 Nos distinct and independent 6mm dia copper 8 mm dia GI wires. All switches, bus bar, ducts and distribution boards of rating 200 amps and above shall be earthed with a minimum of 2 Nos separate and independent 25 mm x 3 mm copper / 25mm x 6mm GI tape.

7. PROHIBITED CONNECTIONS

Neutral conductor, sprinkler pipes, or pipes, conveying gas, water, inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system.

8. RESISTANCE TO EARTH

No earth electrode shall have a greater ohmic resistance than 3 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be upto 5 ohms. The electrical resistance measured between earth connection at the main switchboard and any other point on the complete installation shall be low enough to permit the passage of current necessary to operate fuses or circuit breakers, and shall not exceed 1 ohm.

TECHNICAL SPECIFICATIONS

LIGHTNING PROTECTION SYSTEM

1.1 STANDARDS

The following Indian Standards Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of the Contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall apply. Wherever appropriate Indian Standards are not available relevant British and / or IEC Standards shall be applicable.
BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.
It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.
Code of Practice for the Protection of buildings and Allied Structures

Against lightning	IS 2309 : 1989
Code of Practice for Earthing	IS 3043: 1987

1.2 GENERAL

The Lightning Protective System shall comprise of Air Terminations, Down Conductors, Earth Terminations etc. as required. The system shall preferably use the same conducting material throughout and will comply to the detailed specifications detailed hereinafter.
The entire lightning system should be mechanically strong to withstand the mechanical forces produced in case of a lightning stroke.

1.3 MATERIALS

The materials of which the protective system is composed shall be resistant to corrosion or be adequately protected against corrosion. The material shall be as specified in the Schedule of Quantities and shall comply to the following requirements.
a) Copper- When solid or stranded copper wire is used it shall be of the grade ordinarily required for commercial electrical work generally designated as being of 98% conductivity when annealed, conforming to Indian Standard Specifications :
b) Galvanized Steel – Galvanized steel uses shall be thoroughly protected against corrosion by hot dipped Zinc coating. The material coating shall withstand the test specified in IS 2309 :
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c) The strips to be used shall be in maximum lengths available as manufactured normally avoiding unnecessary joints.

1.4 AIR TERNINATIONS

1.4.1 Vertical Air Terminations

Vertical air termination shall comprise of finials made of 25mm dia GI tube with single or multiple prongs at the top. Vertical terminations where provided shall project 30 cms above the project salient point or net work on which it is fixed.

1.4.2 Horizontal Air Terminations

Horizontal air terminations should be so interconnected that no part of the roof is more than 9m away from the nearest horizontal conductor. For a flat roof horizontal air termination along the outer perimeter of the roof is to be used. For a roof of larger area a net work of parallel horizontal conductors shall be installed. Horizontal air terminations should be coursed along contours such as ridges, parapets and edges of the flat roofs and where necessary over flat surfaces in such a way as to join each air termination to the rest and should themselves form a closed network.

All metallic finials, chimneys duct, vent pipes, railings, gutters, and the like on or above the main surface of the roof of the structure should be bonded to and form part of the air termination network.

1.5 DOWN CONDUCTORS

The down Conductors shall be of material as specified in the Schedule of Quantities. These shall be distributed around the outside walls of the structure and shall preferable be run along the corners and other projections. Life shafts shall not be used for fixing the Down Conductors.

The routing of the Down conductors shall be such that it is accessible for inspection, testing and maintenance .

1.6 TESTING JOINTS AND BENDS

The lightning protective system should have as few joints in it as possible.

Wherever joints in the down conductor above ground level are necessary they shall be mechanically and electrically effective.

In the down conductor below ground level there shall be no joints.

The joints may be clamped, screwed, bolted, riveted, sweated braced or welded. Bolted joint should be used on test points or on bonds to existing metal.

Each down conductor should be provided with a testing joint in a position convenient for testing but inaccessible for interference.

1.7 FASTENERS

Conductors shall be securely attached to the building by fasteners which shall be substantial in construction, not subject to breakage.

These shall be of galvanized steel or other suitable materials with suitable precautions to avoid corrosion.

The method and nature of the fixing should be simple, solid and permanent. The lightning conductors shall be secured at not more than 1.20m apart for horizontal run and 1.0 m for vertical run.

1.8 EARTH TERMINATION

Each down conductor shall have an independent earth termination and all earth terminations should be interconnected.

1.9 EARTH ELECTORDS

Earth electrodes shall be constructed and installed as laid down in the IS 3043.

1.9.1 Plate Earth Electrode

The plate electrodes shall be of copper or G.I. as called for in the Bill of Quantities. The minimum dimensions of the electrode shall be G.I. 600mm x 600mm x 6m thick and for copper 600mm x 600mm x 3mm

The electrode shall be buried in ground with its face vertical and top not less than 4m belowground level.

1.9.2 Earth Electrode Pit

In the case of plate earth electrode , a watering pipe of 20mm dia of medium class GI pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided at the top of this pipe for watering the earth. The watering funnel attachment shall be housed in masonry enclosure of not less than 300 x 300 x 300 mm A pre-cast RCC cover shall be suitably embedded in the masonry enclosure.

1.9.3 Location of Earth Electrode

The following guidelines shall be followed for locating the earth electrodes

- An earth electrode shall not be situated less than 2 metres from any building.
- The excavations for electrode shall not affect the column footing for foundations of the buildings. In such cases electrode may be further away from the building.
- The location of the earth electrode shall be such where the soil has reasonable chance of remaining moist, as far as possible.
- Entrances, pavements and road ways shall not be used for locating the earth electrode.

1.10 EARTH RESISTANCE

The whole of the lightning protective system should have a combined resistance to earth not exceeding 1 ohms before any bonding has been effected to metal or on a surface for to surface below ground.

DG Work

TECHNICAL SPECIFICATIONS

PART – I - GENERAL REQUIREMENTS

SCOPE OF WORK

The general character and the scope of work to be carried out under this contract are illustrated in Specifications and Schedule of Quantities. The Vendor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Client's site representative. The vendor shall furnish all labor, materials and equipment (except those to be supplied by the Client) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the Equipment/System as described in the Specific requirements and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract, The vendor shall take care of all the statutory compliances and necessary approval before commissioning and handing over the system.

The vendor should be authorized by the approved manufacturer for this project.

RATING

Rating of all equipment shall be appropriate for the conditions on the location where the equipment will be installed and operated. All the equipment shall be suitable for continuous operation under the most severe conditions of site and shall be rated for the ambient conditionmentioned hereinafter.

SHOP DRAWINGS

All shop drawing shall be prepared on computer through AutoCAD system based on Architectural drawings and site measurement within one weeks of award of work with relevant IS codeannexure. Vendor shall submit all civil coordinated drawings like foundation for theequipment within 2 days after receiving LOI. Vendor shall furnish for the approval of the Consultant, **Four** sets of detailed shop drawings of all equipment and material. Vendor shall be responsible for all co-ordinations with other agencies at site.

These shop drawings shall contain all information required to complete the said work as per specifications and as required by the Consultant/Client. These Drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other vendors. Each shop drawing shall contain tabulation of all measurable items of equipment / materials / works and progressive cumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all shop drawings.

Minimum **Four** sets of drawings shall be submitted before final approval along with soft copy.

Each item of equipment / material proposed shall be a standard catalogue product of an established manufacturer strictly from the manufacturers listed in Appendix-I.

When the Consultant makes any amendments in the above shop drawings, the vendor shall supply two fresh sets of drawings with the amendments duly incorporated along with check prints, for approval.

The vendor shall submit further **Four** sets of shop drawings to the Consultantfor the exclusive use by the Consultant and all other agencies.

No material or equipment may be delivered or installed at the job site until the vendor has in his possession, the approved shop drawing for the particular material, equipment or installation.

No claims for extension of time shall be entertained because of any delay in the work due to Vendor failure to produce shop drawings at the right time, in accordance with the approved program.

Manufacturer's drawings, catalogues, pamphlets and other documents submitted for approval shall be in four sets. Each item in each set shall be properly labeled, indicating the specific services for which material or equipment is to be used, giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.

Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the vendor of the responsibility or requirement to furnish material and perform work as required by the contract.

Where the vendor proposes to use any item equipment, other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundation, piping, wiring or any other part of the mechanical, electrical or architectural layouts; all such re-design, and all new drawings and detailing required therefore, shall be prepared by the vendor at his own expense and got approved by the Consultant. Any delay on such account shall be at the cost of and consequence of the Vendor.

Where the work of the vendor has to be installed in close proximity to, or shall interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Consultant, the vendor shall prepare composite working drawings and sections at a suitable scale, not less than 1:50, clearly showing how his work is to be installed in relation to the work of other trades. If the Vendor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make all the necessary changes without extra cost to the Client.

COMPLETION DRAWINGS

Vendor shall periodically submit completion drawings as and when work in all respects is completed in a particular area. These drawings shall be submitted in the form of two sets of CD's and four portfolios (300 x 450 mm) each containing complete set of drawings on approved scale indicating the work as - installed.

OPERATING INSTRUCTION & MAINTENANCE MANUAL

Upon completion and commissioning of the system the vendor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the vendor shall submit four (4) complete bound

sets of typewritten operating instructions and maintenance manuals; one each for retention by Consultant and Consultant and two for Clients Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 5 year period of maintenance of each equipment. These manuals shall include:

i. Description of the work carried out / installed.
ii. Operating instructions.
iii. Maintenance instructions including procedures for preventive maintenance.
iv. Manufacturers catalog.
v. Spare parts list.
vi. Trouble shooting charts.
vii. Drawings
viii. Type and routine test certificates of major items.
ix. Certified & approved test reports

INSPECTION AND TESTING

The Client / consultant may carry out inspection and testing at manufacturer's works & on site.No equipmentshall be delivered without prior written confirmation from Consultant/Client. Vendor shall furnish his QualityAssurance Plan (QAP) enlisting entire shop test mentioned below in addition to his quality checks. Such QAPshall be furnished by Vendor for Client's review and comments. Client's shall have all the rights to carry out stage inspection without any pre-intimation. The instrument used during quality checks shall have valid calibration certificates.

No material shall be dispatched without inspection/ waiver certificate from Client's in writing.Vendor shall issueinspection call before 15 days for the subject in writing, allowing Client's to schedule the deputation of hisrepresentative at Manufacture's premises. The copy of internalinspection carried out by Manufacture's shall be enclosed along with the inspection call. Inspection call without such test certificate will not be entertained.

The Equipment shall be tested in the presence of Client's representative at Manufacture's works in accordance with latest prevailing standards and codes. The successful passing of any such tests will not however prejudice the right of Client to reject the Equipment and its accessories, if they do not comply with specifications when erected or perform complete satisfactory operation as intended. Supplier shall provide the test certificate for the bought out items used, if any in the assembly of the Equipment.

PRE-COMMISSIONING CHECKS

All standards checks including the ones elaborated in the specifications to ensure that the installation of the Equipment and associated systems has been carried out satisfactorily shall be done on completion of installation. These shall include:-

Upon completion of work the performance test shall demonstrate the following among other things:

1) Equipment installed complies with specification in all respects and is of the correct rating for the duty and site conditions.
2) All items operate efficiently and quietly to meet the specified requirements.
3) All circuits are correctly protected and protective devices are properly coordinated.

4) All non current carrying metal parts are properly and safely grounded in accordance with the specifications and appropriate codes of practice.

Performance Testing

Equipment shall be tested at varying loads at manufacturers works prior to dispatch of the sets to site. The performance tests at the works shall be carried out in presence of authorized representative from the Clients. Due notice for the program of performance testing at works shall be given to the Clients and arrangement thereof for their representatives for this inspection to be at manufacturers works/site and testing.

The performance test on each equipment shall be of minimum 8 hours duration or as specified in the relevant IS Codes and Standards.

All instruments, materials, consumables (fuel oil, lube oil etc.) load and labor required for carrying out of the test shall be provided by the Vendor.

Vendor to carry out performance test including part load & full load with mentioning fuel efficiency, consumption of fuel, power generation in KW as per the designed conditions. Type test

Copies of manufacturer's type test for Equipment (< 5 years old) shall be enclosed along with the offer as well as quotation for carrying out these tests in the presence of the Client, if required.

In case the Client agrees to pay the charges for additional type test certificate, these tests shall be conducted as specified in this specification.

The vendor shall provide all necessary instruments and labor for testing. He shall make adequate records of test procedures and readings and shall repeat any tests requested by the Client / Consultant. Test certificate duly signed by an authorized person shall be submitted for scrutiny.

If it is proved that the installation or part thereof is not satisfactorily carried out then the vendor shall be liable for the rectification and retesting of the same as called for by the Consultant/Client. All tests shall be carried out in the presence of Client's representative.

The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere. All tests shall be carried out by a test house approved by the Client.

MATERIALS AND EQUIPMENT

Quality

All materials and equipment used in work shall be new and of best available quality conforming to the relevant Indian Standard Specifications and to these specifications. Clients reserve the right to reject any item which in their assessment is second hand.

Samples

All materials and equipment used on work shall be got approved form Consultant/Client prior to use on work Samples / literature of items, as directed, shall be got approved from Consultant/Client prior to use on work.

List of approved make

A list of approved makes in respect of important items is enclosed which shall form part of this contract. Only makes approved as per appendix-I of this document shall be used in the work.

Manufacturers Instruction

Where manufacturers have furnished specific instructions, relating to the materials used in this job, covering points not specifically mentioned in these documents, manufacturer's instructions shall be brought to the notice of the Consultant for further instructions in the matter.

COMPLETION CERTIFICATE

On completion of the Generator installation, a certificate shall be furnished by the vendor countersigned by the licensed electrical supervisor under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local supply authority/ies such as PWD, Electrical Inspection, Central / Electrical dept etc. duly scrutinized & recommended by the Consultant. Vendor to take virtual completion certificate from Consultant mentioning performance is satisfactory.

TRAINING OF CLIENT'S PERSONNEL FOR O & M

Upon completion of all work and all tests, the Vendor shall furnish necessary operators, labor and helpers for operating the entire installation for One month from the date of Virtual completion or handing over whichever is later so as to enable the Client's staff to get acquainted with the operation of the system. During this period, the vendor shall train the Client's personnel in the operation, adjustment and maintenance of all equipment installed**.**

GUARANTEE

In addition to the guarantees specified in the contract document the following also shall be catered to by the Vendor.

The vendor shall hold himself fully responsible for reinstallation and / or replacement, free of cost to Client for the following:

- Any defective work or material or equipment supplied by the Vendor.

  Any material or equipment supplied by the Client which is damaged or destroyed as result ofdefective workmanship by the vendor.

- In case of failure of the Vendor, to get any defect rectified within forty eight (48) hours, the Client reserves the right to get necessary repairs done on his own at the Vendor's cost.

- The guarantee period will be started after successful completion certified through Consultant and on Rs. 100/- non-judicial stamp paper duly notarized on draft approved by the Client.

SAFETY REGULATIONS

The following safety regulations are to be followed in addition to the detailed safety requirements given in the contract document.

The Vendors shall, at their own expense, arrange for safety provisions as per safety codes of Indian Standards Institution, Indian Electricity Act and such other Rules, Regulations and Laws as may be

applicable, as indicated below, in respect of all labor, directly or indirectly employed in the work for performance of the Vendors' part of this agreement.

No inflammable materials shall be stored in places other than the rooms specially constructed for this purposes in accordance with the provisions of Indian Explosives Act. If such storage is unavoidable, it should be allowed only for a short period and in addition, special precautions, such as cutting off the supply to such places at normal items, storing materials away from wring and switch boards, giving electric supply for a temporary period with due permission of Engineer-in-charge shall be taken.

Protective and safety equipment such as rubber gauntlets or gloves, earthing rods, line men's belt, portable artificial respiration apparatus etc. should be provided in easily identifiable locations. Where electric welding or such other nature of work is undertaken, goggles shall also be provided.

Necessary number of caution board such as "Man on Line, Don't switch on" should be readily available in easily identifiable locations.

Standard first aid boxes containing materials as prescribed by the St. John Ambulance Brigade or Indian Red Cross should be provided in easily identifiable locations and should be readily available. Periodical examination of the first aid facilities and protective and safety equipment provided shall be undertaken and proper records shall be maintained for their adequacy and effectiveness.
Charts (one in English and one in regional language) displaying methods of living artificial respiration to a recipient of electrical shock shall be prominently displayed at appropriate places.

A chart containing the names, addresses and telephone numbers of nearest authorized medical practitioners, hospitals, Fire Brigade and also of the officers in charge shall be displayed prominently along with the First Aid Box.

Steps to train supervisory and authorized persons of the Engineering staff in the First Aid Practices, including various methods of artificial respiration with the help of local authorities such as Fire Brigade, St. John's Ambulance Brigade, Indian Red Cross or other recognized institutions equipped to impart such training shall be taken, as prompt rendering of artificial respiration can save life at time of electric shock.

No work shall be undertaken on live installations, or on installations which could be energized unless one another person is present to immediately isolate the electric supply in case of any accident and to render first aid, if necessary.

No work on live L.T. busbar or pedestal switchboards should be handled by a person below the rank of a Wireman and such a work should preferably be done in the presence of the Engineer-in -charge of the work. When working on or near live installations, suitably insulated tools should be used, and special care should be taken to see that those tools accidentally do not drop on live terminals causing shock or dead short.

Before starting any work on the existing installation, it should be ensured that the electric supply to that portion in which the work is undertaken is preferably cut off. Precautions like displaying "Men at Work" cautions boards on the controlling switches, removing fuse carrier from theses switches and these fuse carriers being kept with the person working on the installation, etc. should be taken against accidental energization. "Permit to Work" should, be obtained from the Engineer-in-charge. No work on H.T. main should be undertaken unless it is made dead and discharged to earth with an earthing lead of appropriate size. The discharge operation shall be repeated several times and the installation connected to earth positively before any work is started.

Before energizing on an installation after the work is completed, it should be ensured that all tools have been removed and accounted, not person is present inside any enclosure of the switch board etc. any earthing connection made for doing the work has been removed, “Permit to Work” is received back duly signed by the person to whom it was issued in token of having completed the work and the installation being ready for re-
energizing and “Men at Work” caution boards removed.

In case of electrical accidents and shock, the electrical installation on which the accident occurred should be switched off immediately and the affected person should be immediately removed from the live installation by pulling him with the help of him coat, shirt, wooden rode, broom handle or with any other dry cloth or paper. He should be removed from the place of accident to a nearby safe place and artificial respiration continuously given as contained in BIS. Code and Standard prescribed by St. John Ambulance Brigade or Fire Brigade.

Caution boards

Affixing / pointing caution boards / danger plates as statutorily required for electrical safety.

Name plates

Providing engraved anodized aluminum or approved equivalent name plates of suitable sizes on Switchboards / panels / equipments etc.

Circuit identification

All incoming and outgoing cables and wires shall be properly labeled as per the layout/schematic drawings for easy identification.

PART – II - SPECIFIC REQUIREMENTS

SECTION 1.

TECHNICAL REQUIREMENTS

SCOPE

The scope of work mainly includes but not necessarily limited to the following:

- Diesel Generator complete with controller ,base plate, anti-vibration isolators and all fixing accessories as required. The DG should have built in battery charging facility through alternator.
- Exhaust piping, duly insulated with mineral wool and aluminum sheet cladding.
- Residential type silencer, complete with GI supports, brackets hardware etc and approved by CPCB.
- Low Maintenance lead acid battery.
- Day oil tanks complete with supporting stand, all accessories, filters, valves, fittings, level indicators, and level controllers with contacts.
- MS pipes for fuel, and generator cooling system, including all valves accessories, fittings, painting of pipes and supports etc.
- Hoisting and handling facilities such as cranes, tools and tackles specially required for this kind of Equipment and for lowering equipment wherever it is to be installed.
- Providing of manual change over switch complete with cables and termination.

Provide manufacturer's factory representative's services, including coordination and supervision.

Carryout performance testing and commissioning

ASSOCIATED CIVIL WORKS

Following civil works associated with Power Generating set installation are excluded from the scope of this tender. These shall be executed by other agencies in accordance with approved shop drawings

- RCC Foundation. (If required)
- RCC basin & Supports.

Cut out in walls and floors, opening for cable / bus ducts etc if required shall be given by DG Vendor prior to installation of D.G.set.

APPROVALS

It is the absolute responsibility of the DG set Vendor to carry out the work in accordance with the regulations of the Indian Electricity Act, Fire Insurance Regulations, Local Electrical Inspecting Authorities, Pollution Control Board (PCB) and the Electricity supply authorities and to prepare and get necessary drawings approved. No extra cost will be admissible to the Vendor for liasioning or any other work on this account, all those services shall be deemed to have been included in the unit rates.

However statuary fees born will be reimburse against Bills\Receipts furnished by the Vendor.

However, any statutory payment to the Govt. bodies paid by the Vendor on behalf of the client will be reimbursed on production of original payment receipts made by the Vendor.

AMBIENT CONDITIONS

Rating of all equipment shall be appropriate for the conditions on the location where the equipment will beinstalled and operate. All the equipment shall be suitable for continuous operation under the most severeconditions of site and shall be rated for the following ambient condition.

Ambient Temperature

Maximum : 47 deg. C
Minimum : 2 deg. C

Notes: All equipment shall give required output under the above conditions

RATING

The requirement of power through generator is as per BOQ.

DESCRIPTION OF EQUIPMENT

ENGINE

Each engine shall be multiple cylinder vertical, 4 stroke cycles, radiator cooled, turbo charged after cooled, 1500 RPM, with the following accessories:

Fly wheel to suit flexible coupling. Dry type air cleaner.
Exhaust silencer Residential type with flexible connections and thermal lagging.
Instrument panel comprising of:

a. Starting switch with key.

b. Lube oil temperature gauge

c. Lube Pressure Gauge

d. Water temperature gauge

e. Battery charger with ammeter & voltmeter

f. High Lube oil temperature Cut-out

g. Hours run meter

h. RPM indicator

i. Safety control for low lube, oil pressure, high water temperature and over speed
Cooling System: including necessary equipments& piping etc (Inbuilt sets)

Jacket water system complete with engine driven pump, jacket water heat exchanger, necessary piping, fittings, valves, filters, strainers, instruments, alarm initiating devices and accessories as required .

Interlocking with lube oil pressure gauge such that the engine can be switched on only when the lube oil pressure is adequate.

Lube oil system

Lube oil system comprising

a. Lube oil cooler

b. Lube oil filter.

c. Lube oil pump with starter

Fuel Oil System

Fuel oil system comprising.

- 5 mm thick (Epoxy coated from inside) MS Steel sheet daily service fuel tank of 990 litres capacity including glass type level indicator and level controllers with M.S. support for tank including all accessories outside painting etc. complete.

- All instrumentation and level control for day tank.

- Fuel oil filter

ELECTRONIC GOVERNER

Exhaust System

Air intake and exhaust systems with filters, residential silencers, ducts, pipes, turbo charger, dampers, fittings, supports and other necessary accessories.

The exhaust gas expulsion system shall be in accordance with requirements of the local authorities/statutory authorities. The exhaust piping shall be fitted with Residential type silencer in order to limit the sound level. Expansion joints shall take care of thermal deformations. The pressure drop in exhaust piping including silencer, bends, expansion joints etc., shall be compatible with exhaust gas leaving the engine. The exhaust piping shall be duly covered throughout the length from engine outlet up to the outlet point inside the room with mineral wool insulation and aluminium sheet cladding. The exhaust piping shall be independent for each engine and shall be with minimum bends. The bending radius of bends shall be not less than 3-internal diameters of chosen piping. A drain plug shall be fitted at the lowest point of piping for condensate extraction. Suitable supports shall be provided for proper installation of exhaust pipes.
Exhaust pipes from D.G. Sets shall be taken to a required height as per norms and regulations.
Design, supply, installation of the stack along-with suitable foundations and approvals shall form part of this contract. Vendor shall also furnish shop drawings for Consultant approval prior to procurement/construction.

ALTERNATOR

- The alternator shall be brush less synchronous type 1500 RPM.

- The alternator shall be suitable for coupling directly to the diesel engine. It shall be drip proof screen protected as per IP23.The alternator shall be double bearing type.

- The alternator shall be continuously rated and shall have class "H" insulation designed and built to

withstand tropical conditions. It shall be confirming to BS: 5000 (Part-99) or IS:4722-1992. The output of the alternator shall be as per BOQ, 3 φ, rated output at 50HZ, 0.8 PF and shall be suitable
for sustaining of 10% overload for 1 hour in any 12 hours period without damage.

- Three nos. embedded Resistant Temperature Detector (RTDs) of platinum, 100 ohms resistance at 0
degree to measure the winding temperature and 2 Nos. BIDS to measure bearing temperature shall be provided.
- The leads of embedded RTDs shall be wired up to the terminal block in a separate terminal box.
- Manufacturer shall indicate the setting values for each RTD / BTD for alarm and trip.
- On line greasing facility with grease nipples and grease relief device shall be provided.
- All external nuts and bolts shall be of high tensile steel only.
- Alternator shall be provided with anti-condensation space heater of adequate rating suitable for 240 V,
50 Hz, 1 Phase AC supply and shall be wired upto a separate terminal box. The independent earth
terminal son the skid complete with nuts, spring washer and plain washer shall be provided.
- Alternator shall be provided with suitable adopter box for termination of cables of 300 sq.mm. / phase
and neutral.
- Suitable arrangement shall be provided in the terminal box for formation of star point for Alternator
Neutral Earthing.
- The alternator should be suitable for starting current value for 200% of operating peak load.
- The maximum current loss of alternator should not be more 4% of generating capacity.
- Continuous Damper winding
- Drop kit with CT's as required for Paralleling.
- Terminal box with both ends of each phase winding brought to terminals.
- PMG pilot exciter or separate winding for excitation.
- Phase sensing AVR incorporating to engine load relief features and +/-0.5 voltage regulation.
- All control cable should be in separate terminal box mounted on alternator.

PERFORMANCE CRITERIA

- The alternator shall be suitable for 20 % over speed for two minutes.
- The alternator terminal voltages for any load variation should be maintained within +/- 2 %.
- The transient and steady state frequency variation should be limited to +/-2.0 % for a sudden load Variation up to 70 %. the generator terminal voltages for this load variation should be maintained with +/- 2%.
- The alternator should be capable of carrying 50 % overload for a duration of 1 Minute.
- The alternator shall withstand a 3 Phase short circuit at the terminals for a period of 3 seconds.

EXCITATION SYSTEM

- The alternator shall be provided with a complete rotating diode type brushless excitation system, capable of supplying the excitation current of the generator under all conditions of output from no load to full load and capable of maintaining voltage of the generator constant at one particular value.

- The exciter shall have class' H' insulation.
- The excitation system shall comprise a shaft driven AC exciter with rotating rectifiers. The rectifiers shall have in-built protection for over voltage.
- The exciter shall be fast response type and shall be designed to have a low time constant to minimize voltage transients under severe load changes. The excitation voltage response ratio shall be at least 0.8.
- The rated current of the main exciter shall be at least 10% more than the alternator rated exciter current and it shall have 40% overload capability for 10 seconds.
- No external supply shall be required during starting and normal running of the alternator.

AUTOMATIC VOLTAGE REGULATOR

An Automatic High Speed, Dead Band Type Voltage Regulator shall be provided, complete with all accessories. The regulation system shall be provided with equipment for automatic and manual control.

a)The regulator shall regulate the output voltage of the generator current through potential signals. Series compounding transformer shall be provided to enablemaintaining adequate terminal voltage in the event of terminal faults. Alternatively excitation system shall be provided with arrangement for field forcing.
Vendor shall coordinate suitability of protection relays for generator with the operational characteristics of automatic voltage regulator, especially under short circuit conditions.

b) Voltage regulation and steady state modulation shall be within i: I % of the line voltage.

c) Necessary equipment for field suppression and surge protection shall be provided.

d) The response time of exciter and the generator shall be properly matched to avoid hunting.

e) AVR system shall be provided with equipment for automatic and remote operation / control.

f) Necessary equipment shall be furnished for the following.

- To prevent automatic rise of field voltage in case of failure of potential supply.
- To initiate transfer from automatic to manual control of excitation on fuse failure on the generator potential signal.

NOTE: ALL MOVING PARTS TO BE MECHANICALLY GUARDED TO MINIMIZEHAZARD TO PEOPLE AROUND.

BATTERY

Maintenance free VRLA (Voltage Regulated Lead Acid) Batteries in series and parallel connection to make
12/24volts. Batteries of suitable rating to provide 5 starting attempts without charging along with rack.

POWER PROTECTIVE DEVICE

ACB / MCCB device shall be provided on the generator outgoings with all the relays and instruments as mentioned in schedule of quantities.

MOUNTING ARRANGEMENT

The engine and the alternator shall be coupled by means of High torque sustaining flexible coupling and both shall be mounted on the same base frame to ensure perfect alignment of the engine and the alternator with rigid construction to ensure minimum vibration. The base frame shall be provided with lifting facilities and pre-drilled foundation holes for permanent installation on RCC slab Anti vibration mounts as per manufacturer recommendation shall be provided so that minimum vibration is transferred to the floor slab.
Vendor shall indicate in his offer static & dynamic loading to ensure adequacy of RCC slab.

ACOUSTIC TREATMENT

The DG sets shall be provided with suitable size canopy so that, the sound levels with the D.G sets operating will be within 75dBA at 1.0 meters from the DG sets and less than 70dBA at 6 Meter distance from DG during night time and less than 75dBA at 6 Meters distance from DG during day time.

All necessary measures to attain this shall be indicated separately by the Vendor. Vendor shall note that the specified acoustic performance shall be guaranteed by him & the same should be approved by PCB.

Measures involving civil works will be implemented by the Owner.

Other measures involving mechanical items (such as ducting, hoods, silencers etc.) will be implemented by the Vendor.

Cost of all such measures, (i.e. other than civil works). Recommended by the DG set Vendor involving civil works shall be listed separately.

Acoustic enclosure should be having Electrical Distribution board with light fitting and ventilation Arrangement**.** The sound absorbing material used is “Mineral wool” whose density is 64 kg/m3.

DETAIL SPECIFICATION OF AUXILLARY EQUIPMENTS

Earthing.

a. Each Neutral of DG shall be solidly earthed to 2 different earth pits through insulated copper strip of suitable size & Via Neutral Contactor. Control scheme shall be provided to ensure that one neutral only of one generator in the group shall be connected to the earth to avoid problem during synchronizing. Also when generator neutral is connected to earth supply transformer earth should be disconnected and vice-versa.
b. On equipment on the skid shall be bonded to the base frame of the skid and the skid shall be connected to the grid earthing by 2 independent parts with GI strips in accordance with IS : 3043.
c. Similarly day tank, panel, battery rack, Electrical panels shall also be grounded by 2no. GI strips.
d. Terminations at equipment shall have flexibility for movement of equipment.
e. Earth Pit: As per detailed in Schedule of quantities.
f. Earth Electrodes in Earth Pits:
g. Earth Bus and Earth Continuity Conductor as required.
h. Artificial Treatment of Soil

If the earth resistance is too high and the multiple electrode Earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be

reduced by adding sodium chloride, calcium chloride, sodium carbonate, copper sulphate, salt and soft coke or charcoal in suitable proportions.

i. Entire earth system shall confirm to the Code of Practice as per IS 3043
j. The resistance of Earthing Grid shall not exceed 1.0 ohm.
k. Each body of the DG / Electrical panels shall be connected to minimum 2 nos of earth pits

DRAWINGS & DOCUMENTATION

With offer (2 sets):

a) Vendor to submit 2 sets of outline dimensions, panel dimensions etc.

b) GA Drawing of DG with static & dynamic Loading

c) Drawing of control panel

d) Material List

e) Confirmation of technical details and parameters as per annexure duly filled, stamped and signed.

f) Technical Catalogues

After receipt of order (4 sets):

a) Outline dimensional drawings with general arrangement
b) Piping flow sheets and piping layout.
c) Electrical wiring and schematic diagram along with cable schedule and general arrangement drawing for control panel.
d) Foundation drawings with Static and Dynamic Loads
e) Fuel oil system with instrumentation and control with write-up
f) Lub. oil system with instrumentation and control with write-up
g) Jacket water scheme with instrumentation and control with write-up.
h) Governor system and voltage regulator write-up
i) D.G. Set instrumentation and control system with write-up (if any)
j) Gland plate detail drawings
k) Sectional Views
l) Control Schematics
m) Wiring Diagrams
n) Fuel piping diagram along with storage tank.
o) Cooling system details along with equipment layout &PID.
p) Exhaust piping including Chimney & connection details.

Prior To Commissioning (2 sets)

i) Final copies of (i) to (xiv) above
ii) Operational & Maintenance Manual (O& M)
iii) Certified test reports (duly signed by client & consultant)

For Record (4 Sets)

All above documents duly amended to incorporate all modifications, settings etc., carried out at Site during the Commissioning, Test Reports of Commissioning Tests. And other notes and important observations.

O & M Manual

The manual shall contain the following (but not limited to) information/data

a. Description of the Equipment's Key Features and Operational Logic
b. Operational Instructions and Safe – Guards

c. Details of Maintenance with Time – Schedules
d. Fault Diagnostic and Rectification Chart
e. Parts List with Cat. Nos. for Ordering Spares
f. Contact Details of Agency of nearest Dealer.
g. Set of reduced size Final Drawings with settings.
h. Copy of Type, Factory and Commissioning Test Reports.
i. Copy of Technical Catalogues.
j. Special Notes and Instructions.

CABLES

Cables shall be aluminum / copper conductor cross linked polyurethane (XLPE) insulated as per schedule of quantities shall be supplied, inspected, laid tested and commissioned in accordance with drawings, specifications, relevant standard specifications and cable manufacturer's instructions. The LV cables shall be supplied, inspected, laid, tested and commissioned in accordance with relevant Standard Specifications and cable manufacturer's instruction.

TESTING

Factory tests

The CLIENT / CONSULTANT or his authorized representative may visit the works during manufacture of equipment to assess the progress of work as well as to ascertain that only quality raw materials are used for the same. They shall be given all assistance to carry out the inspection. Detailed quality assurance plan shall be furnished to the Client prior to visit.

Detailed test procedures along with the facilities available at Vendor's/Manufacture's works shall be submitted along with the bid. Client's representative shall be given minimum Two weeks advance notice for witnessing the final testing. Test certificates including test records and performance curves etc, shall be furnished by the Vendor.

Following minimum tests shall be carried out on the generators for all DG sets as per IS 4722.

1) Measurement of cold resistance.

2) Remnant voltage measuring.

3) Voltage balance.

4) Rotating field control.

5) Load characteristic of P.F = 0.8

6) Vibration

7) Excitation system Fuel efficiency with respect to power generation.

8) AVR

a) Adjustment of voltage regulator

b) Under speed protection adjustment

9) Short-time overload with P.F. = 1 or SC.

10) Winding test.

11) Over speed test at 120% rated speed.

12) High voltage test

13) Measurement of insulation resistance

14) Adjustment of additional units for voltage regulators.

Type Test

The report on type test conducted for generator not more than 5 Years old as per IS 4722 shall be submitted before dispatch of DG set.

Alternator

a. Open Circuit characteristic test

b. Short Circuit characteristic test

DG Set

Temperature rise test

a. Over load test
b. Over speed test
c. Vibration measurement test

The Vendor shall submit authenticated test certificate for the type test carried out by manufacturer and if required the CLIENT / CONSULTANT can insist for a type test to be carried out on the Generator in the presence of CLIENT / CONSULTANT. Vendor shall indicate in offer cost of carrying out active type Testing
(separate cost for each test).

FINAL CHECK

After installation at site the following checks and tests shall be conducted

a) Checking of piping interconnections.
b) Checking electrical interconnections.
c) Checking of insulation resistance.
d) Checking of Earthing.
e) Checking of instruments and controls.
f) Checking of alignment.
g) Checking of vibration transmission to building a structure.
h) Checking of expansion joints.
i) Pressure testing of piping.

SITE TESTS

The following tests shall be carried out after installation at the site:

- Load Test
- 50 % load 15 minutes
- 100 % load 15 minutes
- 110 % load 15 minutes (as required)

All Necessary resistive loads shall be provided by the vendor at his own expenses.

- Functional testing of all alarm devices
- Checking of the starting time and time up to taking over the full load.
- Testing of noise level at 1 M and 6 M distances.
- Load rejection test.

Free Maintenance and Defects Liability Period

Following are the works which shall be carried out during the free maintenance period.

- Emergency call back service
- Inspect, clean, oil and grease where necessary.
- Adjustment of machinery.
- Replacement of any defective part.

Exhaust system

a) Checking of silencer operation
b) Checking of surface temperature of exhaust piping
c) Checking of emission as per PCB norms.

Fuel System

(A) Fuel Day Tank
Metal fuel day tank (Capacity sufficient for 08 hours operation at full load but not less than 990 Litres) shall be installed at the generator room. The tank shall be provided with all necessary fittings including

fill, vent, drain and overflow line, level indication and access for inspection and maintenance. Level switches shall be provided for the following services. For Testing & Commissioning of DG set, the fuel shall be in Vendor's scope of work. The Vendor shall fill up full tank of DG set specially, day oil tank at the time of handing over the set to the client. Also at the time of handing over DG set to the client, DG Vendor has to fill new Lubricating oil with brand new filters.

(a) Low level alarm.

(b) High level alarm.

(c) Low level start of transfer pump. (d)High levels stop to transfer pump.

Testing on D.G. Package to establish conformity to the following parameters.

Sr.	Test	Allowed Variation
1.	Fuel consumption at 50%, 75%, 100% and 110% Load.	+ 5% of guaranteed performance. Actual alternator efficiencies as determined in the manufacturers works tests shall be used as the basis of calculation of Specific fuel consumption ratio.
2.	Voltage regulation from no load to full load	+ 1%
3.	Frequency regulation from no Load to full load	+ 0.5%
4.	Maximum water temperature	+ 5% of guaranteed performance
5.	Maximum lube oil temperature	+ 5% of guaranteed performance
6.	Minimum lube oil pressure	+ 5% of guaranteed performance
7.	Lub Oil consumption	+ 5% of guaranteed performance

COMPLETION CERTIFICATE AND GUARANTEE.

After the complete testing the Vendor shall furnish the certificate confirming that the installation has been fully completed and as is in conformity with the technical specification BOQ and all requirements of local Authorities and Statutory Bodies.

Vendor shall guarantee that the equipment shall satisfy the requirements of its intended use and be free from latent defects. Vendor shall repair and replace any equipment, which proves to be defective within 12 months from the date of commissioning and handing over the installation. If any defect is noticed during the guarantee period it shall be rectified / replaced at no extra cost. Theguarantee period will again commence from the date of such rectifications / replacement.

Specifications

Hydrant System

STANDARD / CODES

IS-638	: Sheet rubber joining and rubber insertion joining.
IS-778	: Gunmetal gate, globe and check valves for general purpose.
IS-780	: Sluice valves for water works purpose (50 to 300 mm)
IS-901	: Couplings double male and double female instantaneous Patter for fire fighting.
IS-903	: Fire hose delivery couplings, branch pipe, nozzles and nozzle.
IS-2643	: Dimension of pipe threads for fastening purposes.
IS-2906	: Sluice valves for water works purpose (350 – 1200 mm size)
IS-3589	: Electricity welded steel pipes for water (200 – 2000 mm)
IS-4927	: Unlined flax canvas hose for Fire Fighting.
IS-5290	: Landing valves (internal hydrant)
IS-1239	: Mild steel tubes , tubular and other wrought steel fittings.
IS-5306	: Code of practice for fire extinguishing installations and Equipment on premises.
IS-1646	: Code of practice for fire safety of building
(General)	: Electrical Installation
IS 3844 – 1984	: Code of practice for installation of internal fire hydrants in multistoried building.

FIRE PUMPS

Quantity of pumps	2 Nos
Type	Horizontal centrifugal and suction
Capacity	171 cu.m./hr.
Total head	70 MNC
RPM	2900
Casing	CI
Impeller	Bronze
Shaft	C-40
Shaft sleeve	C-40

JOCKEY PUMP

Quantity of pump 1 No.

Type	Horizontal centrifugal

Capacity	3 LPS
Total head	70 WC
R.P.M.	2900
Casing	C.I.
Impeller	Bronze
Shaft	C-40
Shaft sleeve	C-40

ELECTRIC MOTOR FOR BOTH JOCKEY & FIRE PUMPS :

i) Rated output as specified in bill of quantity
ii) Speed To suit the pump
iii) Voltage 415 Volts
iv) No. of phase 3 pH AC.
v) Frequency 50 Hz
vi) Tolerance of Voltage + /- 10%
vii) InsulationClass F
viii) Rating Continuous
ix) Duty SI (The motor shall be used to run the fire service water Pump & Jockey pump).
x) Type of enclosure TEFC
xi) Maximum cooling temp. 45 DC.
xii) Standard As per IS : 325
xiii) Type of motor Squirrel cage
xiv) Method of starting Star Delta

FIRE PUMPS ENGINE DRIVEN

Quantity of pumps	1 Nos
Type	Horizontal centrifugal type split casting
Capacity	171 cu.m. /hr.
Total head	70 MNC
RPM	1500
Casing	CI
Impeller	Bronze
Shaft	C-40
Shaft sleeve	C-40

ENGINE FIRE PUMPS :

i) Rated output as specified in bill of quantity

ii)	Speed	To suit the pump
iii)	Fuel	Diesel
iv)	Cooling	Water / Air
v)	Battery	12 V

MS PIPES WITH PIPE FITTING & LAYING

All the underground piping work for the fire suppression should be a Mild Steel pipe of heavy grade of approved make conforming to IS standard. All the joints will be welded joints. Underground piping should be inclusive of anti corrosive treatment by tape of 4mm. Thick of approved quality. Over ground piping should be provided with two coats of red enamel paints of approved quality over two coats of corrosion resistant primer. The pipe should be cleaned properly by wire brass before applying coat of primer. The coated rate should include the cost of primer and paint and the same will not be separately payable. All the fittings should be conforming to IS standard and have approved make. Pipes used should plain end pipes without threading to facilitate welding.

C.I GATE VALVE / SLUICE VALVE (C:I)

Manufacturing standard	IS 780
End connection	Flanged End
Rating	PN 1.6
Body & Bonnet	CI
Steam	Non Rising Spindle
Test Pressure	a) Body - 16 Kg/cm2
	b) Seat- 24 kg/cm2

NON -RETURN VALVE

Manufacturing standard IS 5312
End connection Flanged End
Body/cover/disc CI
Type Swing check type
Disc seat ring 13% Cr. Steel

HYDRANT/ LANDING VALVE

The general arrangement of the indoor hydrant valves shall be as approved by the tariff Advisory committee. This landing valve should be single head type. The general design of hydrant valve shall conform to IS; 5290. The quoted rate should include fixing the same with the connection line by nut and bolt and 3mm thick rubber gasket. The landing valve should be provided with lid with chain locking. The valve should be made of stainless steel and shall be installed on hydrant riser and a height of 1.0 meters from the floor level.

HOSE PIPE

All hose shall be of 63 mm diameter rubber lined woven jacketed complying with type II (Reinforced Rubber Lined) as per IS : 636.

The hose should be fitted with instantaneous spring lock type ISI Marked coupling (Stainless Steel) at both ends. Hose shall be fixed to the coupling ends by copper rivets and the joint shall be reinforced by 1.5 mm galvanized mild steel wire and leather bands. The hose should be capable of withstanding an internal pressure not less than 35 kg. Cm.2 without brushing.

HOSE REEL

Hose reel should be swinging wall mounted with 36 meters long 20 mm bore high pressure hose conforming to IS : 884 with stop valve conforming to IS : 778 with shut off nozzle 6 mm bore. The hose reel should be complete

M.S. wall bracket, G.M. globe valve , G.M. swivel joint, M.S. side reel, M.S. supporting bracket, M.S. pipe S.S.. shut off nozzle of 6mm bore high pressure rubber tube . The hose reel will have to be painted 2 coats of red enamel paint over a coat of primer. The rubber hose should be as per IS : 5132 and should have an inner tube or lining, reinforcement pipes, and abrasion resistant cover. It should be flexible and as lightweight as possible without sacrificing the durability.

HOSE CABINET

Hose cabinet shall be glass (4mm thick) fronted with double hose cabinet shall be made of hinged door and lock. The cabinet shall be made of 18 gauge M.S. sheet and spray painted to scarlet red color with Block capital lettered word FIRE . The hose cabinet should be so suitable size to accommodate the followings:

a) 63 mm dia Hose pipe of 15 m leanth-2Nos.
b) Branch pipe and nozzle (one set).

THE BRIGADE INLET

2 way male coupling type of fire brigade connection shall be provided to each riser and reservoir. Each inlet will be of 63mm dia. The inlet should be provided at 1 meter above the road in the wall of the building.

BRANCH PIPE AND NOZZLE :
Branch pipe shall be stainless steel to fit into the instantaneous coupling. Nozzle shall be diameter of not less than 20 mm. Branch pipe and nozzle shall be of instantaneous pattern and conforming to IS : 903.

STAND POST HYDRANT :
Stand post hydrant shall comprise of 80 mm dia. MS flanged stand pipe, 63 mm dia. SS instantaneous landing valve.
The buried pipe protection shall be of anticorrosive treatment as per specification and drawing .

PRESSURE GAUGE
The pressure gauge shall be Borden type 150 mm dial size. The dial range shall be 0- 15 kg. / cm2. It should be possible to remove the gauge without interruption to the water supply.

PRESSURE SWITCH
The pressure switch should by diaphragm type with NO / NC contacts and pressure adjustments.

AUDIO AND WINDOW TYPE VISUAL ANNUNCIATION REQUIRED AT PANEL BOARD.

i) Mains metering with electronic ammeter / voltmeter / frequency meter
ii) Power healthy
iii) Electrical Fire Pump ON
iv) Jockey Pump ON
v) Diesel Pump ON
vi) Battery Charge indicator with metering

Penalties & Maintenance during Defects Liability Period (DLP):
In case maintenance work has not been attended to / detect has not been set right the penalty shall be imposed during Defects Liability Period as per following:

S. No.	Description	Penalty (in `)
1	Water Supply, Sewerage, Civil, ACP & Sanitary Fitting	500/day

2	DG Set	
3	Transformer, HT/LT Panel	500/day
4	If fire pump/ panel etc are under breakdown for more than 24 hours	500/day
5	If valves are leaking/ pressure switches/ air vessel etc are not working	100/day

Contractor will provide us the name and details of their personal, looking after the maintenance of above installation. Contractor will have to obtain Bank of Baroda approval for the workmen being deputed at above sites. Person who has not been authorized by bank of Baroda shall not be deputed on the job.

After expiry of the contract period, Contractor shall handover entire installation with all complete equipments in good working condition as detailed in BOQ of this tender to the department/ new Contractor as instructed. Balance Security Deposit retained during Defects Liability Period shall be settled only after handing over of above installation in good working condition/ operational condition. If system is found in operational the cost for making the system operational shall be recovered from the pending dues to the contractor.

LIST OF APPROVED MAKES

List of Approved Makes for Fire Protection Works

Sr.No.	Description	Makes
1	Pump (Pump)	Kirloskar/Mather & Platt
2	Pump (Dewatering sump pump)	CRI/ Kirloskar/ KSB /Grundfos
3	Sluice Valve	Advance /Audco /Venus /Zoloto /JD Controls
4	Butterfly Valve	Advance /Audco /Venus /Zoloto /JD Controls
5	Non-Return Valves	Advance /Audco /Venus /Zoloto /JD Controls
6	MS Pipes	Jindal (Hissar) /Tata
7	Fire Hose Pipe	Jyoti
8	Fire Hose Reel Drum	Shah Bhogilal/Safex/Newage
9	Hydrant Landing valves	Shah Bhogilal/Safex
10	Branch Pipe, Nozzle, M/F Coupling	Shah Bhogilal/Safex
11	Fire Brigade Inlet	Shah Bhogilal/Safex/Newage
12	Wrapping Coating Tape	IWL
13	Pressure Gauge	Guru
14	Starter Control Accessories	MG/ L&T/ ABB/ Siemens
15	Flow Switches	Indfoss/as approved/ System Sensor
16	Cable	Havells/ Skytone/Polycab/Rallision/ISI Marked
17	Fire Alarm Control Panel	AGNI/ DAKSH
18	Stand By Battery	CSB/EXIDE/HITTACHI/ORCHID
19	Smoke Detectors	APOLLO / SYSTEM SENSOR
20	MCP	AGNI/ DAKSH
21	Hooter	AGNI/ DAKSH
22	Cable	LAPP
23	PVC Conduit	CAP/SIECO/POLYPAC

List of Materials of Approved Brand and/or Manufacture for Furnishing, Civil and Sanitary Works

Sl. No.	Particular	Make
1.	Cement	1. Ultratech 2. ACC 3. Jaypee, or approved
2	Steel(Fe 500 grade)	1. Kamdhenu, 2. Tisco/TATA 3. Balmukund or approved
3	Tile fixing Adhesive	1. Sika 2. Pidilite 3. Roff 4. Fosroc or approved equivalent
4	Plywood	1. Century 2. Sharabdi 3. Duro. or approved equivalent
5	BWR grade phenol bonded plywood	1. Greenply 2. Century 3. Kit/Kenwood, or approved equivalent.

6	**Particle Board Nova Teak Super**	by Indian Plywood Mfg. Co. or approved equivalent
7	**Block Board.**	by Indian Plywood Mfg. Co. or approved equivalent
8	**Flush doors**	1. Century 2. Greenply 3. Duro or approved equivalent
9	**Fibre Board (MDF, LDF).**	1. Century 2. Shatabdi 3. Duro or approved equivalent
10	**P.O.P. Board.**	1. Century 2. Novapan, 3. Swastik, 4. Anchor, or approved equivalent
11	**Laminates**	1. Century Mica 2. Greenlam, 3. Merino or approved equivalent.
12	**Handles**	1. Dorma, 2. Hafele 3. Hettich or approved equivalent.
13	**Glass.**	1. Saint Gobain, 2. Asahi 3. Modigaurd or approved equivalent
14	**Screws**	1. IW. nettle fold, 2. Oxidised or approved equivalent.
15	**Hardware**	1. Earl Bihari (EBCO), 2. Hettich 3. Hafele or approved equivalent.
16	**Adhesive for fixing laminate**	1. Fevicol SH, 2. Araldite of Ciba Geigy, 3. Bal Endura or approved equivalent
17	**Door Closers**	1. Dorma 2. Everite, 3. Godrej 4. Hyper 5. Hardwyn or approved equivalent
18	**Locks**	1. Dorset, 2. Hafele 3. Hettich or equivalent approved.
19	**Wood preservative**	1. Bison by British paints or equivalent approved
20	**Glass Wool Fibre**	1. Crown 2. Rock wool or approved equivalent

21	**Cement Primer**	1. Asian paints 2. Berger 3. ICI Dulux paints 4. Nerolac First quality or approved equivalent
22	**Acrylic Emulsion paints**	1. Asian, 2. Berger 3. ICI Dulux, 4. Nerolac First quality or approved equivalent
23	**Enamel paints**	1. Asian, 2. Berger 3. ICI Dulux 4. Nerolac First quality or approved equivalent
24	**Wood primer**	1. Asian 2. Berger 3. ICI Dulux, 4. NerolacFirst quality or approved equivalent
25	**Aluminium sections**	1. Asian 2. Berger 3. ICI Dulux, 4. NerolacFirst quality or approved equivalent
26	**Cast Iron Pipes and fittings**	1. Hindalco/Jindal or equivalent approved
27	**S.S. Pipes & Fittings**	Standard approved manufacturers of any brand of fittings having ISI marking.
28	**G.I. Pipes**	Tata /Jindal or approved -with Teflon tape or equivalent approved
29	**G.I. Fittings**	Standard approved manufacturers of any approved brand of fittings having ISI marking
30	**Gun Metal Valves**	1. Leader Engineering Works, Calcutta 2. Bombay Metal Co., 3. Annapurna Metal Work, Calcutta or equivalent approved
31	**Brass Fittings**	1. Leader Engineering Works, Calcutta, 2. L & K Mathura, 3. Annuapurna Metal Works, Calcutta or equivalent approved
32	**C.P. Fittings**	1. Jaquar 2 Kohlar 3. Any approved equivalent BY Bank/architect
33	**W.C. Pan Wash basin, Urinals E.I.D.**	Hindware /Kohler/Grohe or equivalent approved
34	**E.W.C. Seats**	1. Parry ware/Cera 2. Hindwareor equivalent approved
35	**Flushing Cisterns**	1. /Parry ware 2. Cera 3. Hindwareor equivalent approved
36	**Mirrors**	1. Atul Glass Works, 2. Vallabh Glass Works, 3. Modi Glass. or equivalent approved

37	**Vitrified tiles**	1. Vermura 2. Johnsons 3. Kajaria Premium quality only be accepted or equivalent approved
38	**Ceremic tiles**	Verumar, Johnson, Kajaria or equivalent approved
39	**Water Tank**	Sintex or equivalent or equivalent approved
40	**Grass Crete Pavers**	ACC or equivalent approved
41	**Sewage Treatment Plant**	Ion-Exchange or equivalent as approved by Bank/Architect
42	**Vertical Blinds**	Mac Décor/Vista Levelor equivalent approved
43	**Chair**	Amardeep/HNI/Rockworthor equivalent approved

List of Approved Manufacturers for ACP and Structural Glazing Work:

Sr.No.	Description	Manufacturers/Make
1.	**ACP Panels**	Alucobond/ Reynobondor equivalent approved
2.	**Aluminum Section**	Jindal/Hindalco or equivalent approved
3.	**Glass/Toughened Glass**	Saint Gobain/Modi/Asahi or equivalent approved
4.	**EPDM Rubber Gasket**	BIS approved quality
5.	**Floor Spring**	Hettich/Hatim/DLCO/Dorma/Hardwynor equivalent approved
6.	**Hardware**	Hettich/Hatim/DMD or equivalent approved
7.	**Silicon Sealant**	Miffeng/Dow Corning/GE or equivalent approved
8.	**Patch Fittings, Spiders**	Dorma / Hatim/DLCO/Kin Long or equivalent approved
9.	**G.I.Sheet**	TATA, SAIL Jindal or equivalent approved
10.	**Door Closer**	Hettich, Dorma, Hatim or equivalent approved

Note –

Contractor to submit sample of above makes and Architect/Bank will approve the sample and it will be binding on contractor to use approved materials only. If make of any material are not provided then BANK /architect will decide the make/brand of materials and decision in this regard will be final and binding on Contractor. Premium quality only be accepted.

List of Approved Make for Electrical Works

S. No.	Item	Make
A	**Panel , Switch gear & related Item**	
1	**LT Panels/Bus Duct**	By any Panel manufacturer who possess C.P.R.I. certificate for specified fault level & IP level protection
2	**MCCB / MCB**	L&T / Schneider/ Legrand or equivalent approved
3	**Fuse Disconnector Switch / Switch Fuse Unit**	L&T / Schneider or equivalent approved
4	**Ammeter ,Voltmeter**	CONZERV/ Secure or equivalent approved
5	**Digital Meters / Intelligent Multifunctional Digital meter**	CONZERV/ Secure or equivalent approved
6	**Selector Switch, Push button Switch / Emergency Switch**	KAY CEE / L&T / Schneider or equivalent approved
7	**Indication Lamp**	L&T / AE/ Schneider or equivalent approved
8	**CT's**	Secure/ Kappa or equivalent approved
9	**ATS**	L&T / Schneider / Legrand or equivalent approved
B	**Transformer & Related items**	
1	**Distribution Transfomer**	ABB/Schneider or equivalent approved
2	**11 or 33 KV VCB**	ABB/ Crompton or equivalent approved
3	**HT Termination & Jointing kit**	Ray Chaem / Mahindra / ELMEX or equivalent approved
4	**Cable Glands**	Dowell / Siemens / Braco or equivalent approved
5	**Lugs & Thimbles**	Dowells / Jhonsons or equivalent approved
6	**Upto& including 11 KV Cables (ISI Marked)**	finolex/ polycab/ Skytone / Gloster / Havells or equivalent approved
7	**Insulating Mats**	ISI Marked
8	**Capacitor Bank (ISI Marked)**	neptune EPCOS / L&T or equivalent approved
9	**Lightning Arrestor**	Atlas / Alsthom or equivalent approved
10	**Protection & other Relay**	ABB / Schneider / L&T or equivalent approved
C	**DG Set & Related Items (Not Applicable)**	
1	**Diesel Engine**	Cummins / Kirloskar or equivalent approved
2	**Alternator**	Cummins / Kirloskar or equivalent approved
3	**Batteries**	Exide / Amaron /manufacturer or equivalent approved

D	**Internal wiring related works**	
1	**MCB / RCCS / Isolators {ISI} marked MCB DB**	Legrand / Schneider or equivalent approved
2	**PVC Conduit**	AKG/ Setia or equivalent approved
3	**PVC Insulated Copper wire {ISI Marked}**	Finolex / Poly Cab or equivalent approved
4	**Telephone cable**	Delton / NICCO / Polycab /Finolex/ Skytone or equivalent approved
5	**Switch , TV & Telephone socket & Boxes {Modular Type}**	MK/ CPL / Legrand/ Anchor or equivalent approved
E	**Light Fixture & Fans**	
1	**Light Fixtures**	Philips/ Wipro/Panasonic or equivalent approved
2	**Lamps for fittings**	Philips/ Wipro/Panasonic or equivalent approved
3	**Ceiling Fans**	Philips/Usha / Crompton / Bajaj or equivalent approved
4	**Exhaust fans**	Crompton / Usha / Bajaj or equivalent approved
F	**Miscellaneous Items**	
1	**Lightning Protection unit**	Altec/ Mitsubishi or equivalent approved
2	**Relays**	ABB /L&T or equivalent approved
3	**Contactors**	L&T/ ABB or equivalent approved
4	**Changeover Switch**	HPL or equivalent approved
5	**KWH, PF, Frequency meter**	secure / L&T or equivalent approved
6	**Push Buttons**	L&T / Schneider or equivalent approved
7	**Timers**	L&T / Le grand / Schneider or equivalent approved
8	**Timer Switch**	L&T / Le grand or equivalent approved

PROFORMAS & ANNEXURES

ANNEXURE – A	EMPLOYING CONTRACT LABOUR
ANNEXURE – B	REGISTER OF CONTRACTOR/S
ANNEXURE – C	NOTICE OF COMMENCEMENT /COMPLETION OF CONTRACT WORK
ANNEXURE – D	MONTHLY PROGRESS REPORT
ANNEXURE – E	RECEIPT OF MATERIALS AT SITE (MONTHLY)
ANNEXURE – F	MEASUREMENT BOOK
ANNEXURE – G	RUNNING A/C BILL
ANNEXURE – H	SECURED ADVANCE
ANNEXURE – I	R. A. BILL CERTIFICATE
ANNEXURE – J	PROFORMA OF UNDERTAKING IN CONNECTION WITH PAYMENTS OF ADVANCE ON MATERIALS BROUGHT BY THE CONTRACTOR/S TO THE SITE
ANNEXURE – K	CERTIFICATE OF PAYMENT BY CONSULTANT
ANNEXURE – L	HINDRANCE REGISTER
ANNEXURE – M	EXTENSION OF TIME LIMIT
ANNEXURE – N	CONTRACTOR/S LIABILITY AND INSURANCE SUMMARY
ANNEXURE – O	FORM OF GUARANTEE FOR WATERPROOFING
ANNEXURE – P	INTEGRITY PACT

ANNEXURE – A

PROFORMA OF APPLICATION FOR REGISTRATION OF ESTABLISHMENT EMPLOYING CONTRACT LABOUR

1. Name and location of the establishment

2. Postal address of the establishment.

3. Full Name and address of the principle Employer

4. Full name and address of the manager or the person responsible for the supervision and control of the establishment.

5. Nature of work carried on in the establishment

6. Particulars of Contractor/s and contract labour
a. Names and address of the Contractor/s
b. Nature of work in which contract labour is employed or is to be employed

c. Maximum number of contract labour to be employed on any day through each contractor.

d. Estimated date of commencement of each contract work under contractor.

e. Estimated date of termination of employment of contract labour under each contractor.

7. Particulars of treasury receipt enclosed. (Name of the treasury, amount and date)

I hereby declare that the particulars given above are true to the best of my knowledge and belief.

Principal Employer
Seal and Stamp
******

ANNEXURE- B

PROFORMA OF REGISTER OF CONTRACTOR/S

1. Name and Addresses of The Principal Employer

2. NAME and address of the establishment

Sr. No.	Name and address of contractor	Nature of work on Contract	Location of contract	Period From	Period To	Maximum Number of workmen employed by the contractor
1						
2						
3						
4						
5						

ANNEXURE - C

PROFORMA OF NOTICE OF COMMENCEMENT/ COMPLETION OF CONTRACT WORK

1. Name of principle employer & address
2. No. and date of certificate of registration
3. I /we hereby intimate that the contract work_____ (Name of work) given to _____ (Name and address of the Contractor) having License No. _____ dated _____ has commenced/ has been completed with effect from _____(date)/ on _____ (date).

Signature of the Principle Employer

The Inspector,

_____

_____

_____

ANNEXURE-D

PROFORMA OF MONTHLY PROGRESS REPORT

Name of work

Progress report for the month

Report No.

Sr. No.	Description of work	Details of location where works is done	Approximate quantity executed

Sr. No.	Description of work	Date of commencement	Percentage of progress achieved

ANNEXURE-E

RECEIPT OF MATERIALS AT SITE

Sr. No.	Description of work	Opening Balance	Receipt during month	Consumption during month	Closing balance	Total received quantity till date

ANNEXURE -F
MEASUREMENT BOOK

Item. No.	Description	Measurements No.			Quantity
		L	B	D / H	

Measurement Book shall be provided by the Employer through Architect. suitable modification in Measurement book shall be carried out in consultation of Architect/ Consultant/ Bank

ANNEXURE-G

RUNNING A/C BILL

1. Name of Contractor / Agency
2. Name of work
3. Sr. No. of this bill
4. No. and date of previous bill
5. Reference to Agreement No.
6. Date of written order to commence
7. Date of completion as per agreement

Sr. No	Item	Description	Unit	Rate (Rs.)	As per Tender
1	2	3	4	5	6

Up to previous R/A Bill		Up to date till this Bill		Present Bill		Remarks
Qty.	Amount (Rs.)	Qty.	Amount (Rs.)	Amount (Rs.)	Qty.	
7	8	9	10	11	12	13

Note:

1) If part rate is allowed for any item, it should be indicated with reasons for allowing such a rate

2) If adhoc payment is made, it should be mentioned specifically

Net values since Previous bill

ANNEXURE -H

ACCOUNT OF SECURED ADVANCE, IF ADMISSIBLE ON MATERIALS HELD AT SITE BY THE CONTRACTOR

Sr. No.	Item	Quantity	Unit	Amount	Remarks
1					
2					
3					
4					
5					

Total value of material at site

Secured Advance @ _____ % of the above value

CERTIFIED
(i) that the materials mentioned above have actually been brought by the Contractor/s to the site of the work and no advance on any quantity of any of this item is outstanding on their security,
(ii) that the materials are of imperishable nature and are all required by the Contractor/s for use in the work in connection with the items for which rates of finished work have been agreed upon.

Dated

Signature of Site Engineer Consultant Preparing the bill

Designation _____

Dated signature of Bank's Architects

_____
(Name of the Architects)

_____
Dated signature of Contractor/s

ANNEXURE-I

R.A. BILL CERTIFICATE

The measurements on the basis of which the above entries for the running bill no _____ were made have been taken jointly on _____ and are recorded at pages _____ to _____ of measurement book No. _____

Signature and date of Consultant's representative Signature and date of Contractor (seal)

The work recorded in the above-mentioned measurements has been done at the site satisfactory as per tender drawings, conditions and specification.

Architect/Consultant P&E Officer

ANNEXURE-J

PROFORMA OF UNDERTAKING IN CONNECTION WITH PAYMENTS OF ADVANCE ON MATERIALS BROUGHT BY THE CONTRACTOR/S TO THE SITE

The undertaking made this _____ day of _____ 2022 _____ between the Bank of Baroda _____ and having its _____ office at (hereinafter called the Employer) of the one part and _____ (hereinafter called the Contractor/s of the other part).

The Employer and the Contractor/s have entered into an Agreement dated _____ hereinafter called as the said agreement and in terms of clause no. _____ of the conditions in the agreement, the Employer has agreed that the Contractor/s will be paid an advance of 75 % of the cost of non-perishable trade materials brought by the Contractor to the site for consumption in the works at the discretion of the Employer.

The Contractor/s have applied to the Employer that they be allowed advances on the security of materials absolutely belonging to them and brought by them to the site of work. The Employer has agreed to do so on the terms and hereinafter set out.

Now this Letter of Undertaking witnesses that in consideration of the said agreement and in consideration of the amount paid/ payable to the Contractor/s by the Employer and/or any further advances as may be made to the Contractor/s as aforesaid, the Contractor/s hereby agree with the Employer and undertake as under:

i) The amount advanced by the Employer to the Contractor/s as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the Contractor/s in or towards expediting the execution of the said works and for no other purpose whatsoever.

ii) That the materials which have been offered to and accepted by the Employer as security are absolutely the Contractor/s own property and free from encumbrances of any kind and the Contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his/their own property and free from encumbrances of any kind and the Contractor/s indemnify the Employer against all claims to any materials in respect of which an advance has been made to them as aforesaid.

iii) That the materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractor/s solely in the execution of the said works in accordance with the directions of Consultant of the Employer and accordance with the terms of the said agreement.

iv) That the Contractor/s shall take their own cost all the necessary and adequate arrangement for the proper watch, safe custody and protection against all risks of the site of the said works in the Contractor/s custody and on their own responsibility and shall at all times be open to inspection to the Employer's Engineers or any Officer authorized by the Employer. In the event of the materials or any part thereof being stolen, destroyed or damaged, the Contractor/s will further replace the same with other materials of like quality or repair and make good the same as required by the Employer.

v) That the said materials shall not on any account be removed from the site of the said works except with the written permission of the Consultant of Bank of Baroda.

vi) That the advances made by the Employer shall be adjustable as far as possible towards the price payable to the Contractor/s for the above said works under the terms and the provisions of the said agreement provided that if any intermediate payments are made to the Contractor/s on account of work done, then on occasion of each such payment, the Employer will be at liberty to make a recovery from the Contractor/s bill for such payment by deducting there from the value of the said materials then actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amount of the advances made under these presents were calculated.

vii) That if the Contractor/s shall at any time make any default in the performances or observance in any respect of any of the terms and provisions of the said agreement or of these presents, the total amount of advance or advances that may still be owing to the Employer, shall immediately on the happening of such default be repayable by the Contractor/s to the Employer together with interest thereon at 12 % per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the Employer in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor/s and the Contractor/s hereby covenant and agree with the Employer to repay and pay the same respectively to him/them accordingly.

viii) That the Contractor/s hereby charge all the said materials with the repayment to the Employer of the sum or sums advanced as aforesaid and all costs, charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice.

ix) Powers contained therein if and whenever the covenant for payment and repayment hereinabove contained shall become enforceable and the money owing shall not be paid in Accordance therewith, the Employer may at any time thereafter adopt all or any of the following courses as he/they may deem best:

a) Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the
Contractor/s in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor/s Account in this regard with the actual cost of effecting such completion and the amount due in respect of advances under these presents and crediting the Contractor/s Account with the value of work done as if he/they had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor/s, they are bound to pay the same to the Employer on demand.

b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale, retain all the sums aforesaid repayable or payable to the Employer under these presents and pay over the surplus (if any) to the Contractor.

c) Deduct all or any part of the money owing out of the Security Deposits or any sum due to the Contractor under the said agreement.

x) That except in the event of such default on the part of the Contractor/s as aforesaid, no interest shall be payable on the said advance.

xi) That in the event on any conflict between the provisions of these presents and the said agreement, the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction of effect of these presents the settlement of which has not been herein before expressly provided for the same shall be referred to the General Manager whose decision shall be final and no appeal shall lie against his/their decision before any court, arbitrator or authority. The provision of this Undertaking shall be deemed to be supplemental to the said agreement.

IN WITNESS WHEREOF the Contractor/s have set their hands to these presents the day and year first hereinabove written.

Signed, sealed and delivered by the said Contractor/s in the presence of

Witness:
Signature _____
Name _____
Address _____

(on Rs 100/- stamp paper)

ANNEXURE-K

PROFORMA OF CERTIFICATE OF PAYMENT BY CONSULTANT

Certificate No. Interim	Dated	
Client:	Project No.	Building Work/ Interior
	Particulars:	
Contractor:	Contract / Letter No.	Dated:
	Contract's Bill No.	Dated

This is to certify that the amount given below (*) is due to your Contractor/s for the work done by them and / or against materials delivered at site and/or for advance towards contract on the above referred project.
Advance against contract:

Less: Advance adjusted to date

Balance Advance

Advance against material delivered at site

Amount of work done to date

Total
Less: Retention on work done

Less: Previously certified upto

Present Certificate (*)

Rupees _____

The cost of material supplied by you or payments made by you directly if any, and not covered herein above, should be adjusted before making the payment of the certified amount (*) Necessary Deduction U/S 194C of the Income Tax 1961 and sales tax may be made before paying the above certified amount. By a copy of this letter, we are intimating the Contractor/s to call on you for the necessary payment.

Remarks, if any

The details of insurance policy are enclosed.

Enclosures: Bill

Signature of Architect/Consultant

ANNEXURE-L

PROFORMA OF HINDRANCE REGISTER

Name of the work: Date of state of work:

Name of Contractor: Period of Completion:

Agreement No. : Date of completion

Sr. No	Nature of Hindrance	Date of occurrence of hindrance	Date of which hindrance was removed	Period of hindrance	Signature Of Architect	Remarks

Consultant/ Architect

ANNEXURE-M

APPLICATION OF PROFORMA FOR EXTENSION OF TIME LIMIT

1. Name of Contractor
2. Name of the work as given in the agreement
3. Agreement No.
4. Estimated Tender amount.
5. Date of Commencement of work as per Agreement.
6. Period allowed for completion of work as per agreement.
7. Date of completion stipulated in Agreement.
8. Period for which extension of time has been given previously:

a) 1 extension vide Architects/ bank letter no. dated, month, days st

b) 2 extension vide Architects/ bank letter no. dated, month, days nd

c) 3 extension vide Architects/ bank letter no. dated, month, days rd

d) 4 extension vide Architects/ bank letter no. dated, month, days th

9. Total extension previously given.
10. Reasons for which extensions have been given (copies of the previous application should be attached)
11. Period for which extension is applied for:
12. Hindrances on account of which extension is applied for with dates on hindrances occurred and the period for which these are likely to last:

a) Serial No.

b) Nature Of Hindrance:

c) Date of Occurrence:

d) Period for which is likely to last :

e) Period for which extension required for this particulars hindrance:

f) Overlapping period if any, with to item (e) above

g) Net extension applied for:

h) Remarks if any

13. Extension of time required for extra work
14. Details of extra work and amount involved:

i) Total value of extra work:

j) Proportionate period of extension time on estimated amount put tender

15. Total extension time required for 11 &12 :

Submitted to the Consultant/Architects/Bank

---------- Signature of contractor

ANNEXURE-N

CONTRACTOR'S LIABILITY AND INSURANCE SUMMARY

Sr No	Nature and Scope of Risk	Value of Insurance	Validity Period of Insurance	Name of the Insurer	Insurance Policy No.
1.	Loss of damage to works or any part thereof materials at site from any cause whatsoever including Fire (CAR)	100 % Contract Amount	The policy shall be valid till actualCompletion of work.	The Policy shall be in joint names of Employer and Contractor	
2	Damage, Loss or Injury to any Person of the Employer or Consultants including their representatives and third Party	15.00 lacs per claim upto 3 claims	The policy shall be valid till actual completion of work	The Policy shall be in joint names of Employer and Contractor	
3	Claims under the Workmen's Compensation Act, 1923	As per Govt Rules	The policy shall be valid till actual completion of work	The Policy shall be in joint names of Employer and Contractor	

Signature of Contractor

Witnesses: Address:

ANNEXURE-O

FORM OF GUARANTEE FOR WATER PROOFING.

Name of the Project

Free Maintenance Guarantee- Waterproofing work

By ----------

We hereby guarantee that the surfaces treated by us for waterproofing in the above work for M/s.---------- the general building Contractor for the above work, shall remain water tight , should however due to any unforeseen defect left out in the work carried out by us at the time of execution of the work , there be any leakage from any surface treated by us during the period of ten years from the date of virtual Completion of the work i.e. from ---------- to ---------- the same shall be rectified by us without any extra cost to the ---------- (Name of the Bank).

However we shall not be responsible in any way if our work is tampered with or if the body of the structure is damaged due to sinking, cracking and or by any other act of god beyond our control.

Signature of Contractor

ANNEXURE - P

INTEGRITY PACT (IP)

MODEL PRE CONTRACT INTEGRITY PACT
(MAY BE MODIFIED AS PER PROJECT)

General

This pre-bid pre-contract Agreement (hereinafter called the Integrity Pact) is made on _____ day of _____ Month,
20____, between, on one hand, Bank of Baroda, a body corporate constituted under the Banking Companies (Acquisitions and Transfer of Undertakings) Act, 1970 having its head office at Mandvi Baroda, and its corporate office at Baroda Corporate Centre, C-26, G-Block, Bandra Kurla Complex, Bandra East, Mumbai-400051 (hereinafter called the "BUYER", which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns) of the First Part and M/s _____ represented by Shri _____, Chief Executive Officer (hereinafter called the "BIDDER/Seller" which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part.

WHEREAS the BUYER proposes to procure (Name of the Stores/Equipment/Item/Services) and the BIDDER/Seller is willing to offer/has offered the said stores/equipment/item/services and

WHEREAS the BIDDER is a private company/public company/Government undertaking/partnership/registered export agency, constituted in accordance with the relevant law in the matter and the BUYER is a Public Sector Undertaking performing its functions on behalf of the President of India.

NOW, THEREFORE, To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to :-

Enabling the BUYER to obtain the desired said stores/equipment at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

Enabling BIDDERs to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the BUYER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

1. Commitments of the BUYER

1.1 The BUYER undertakes that no official of the BUYER, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

1.2 The BUYER will, during the pre-contract stage, treat all BIDDERs alike, and will provide to all BIDDERs the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERS.

1.3 All the officials of the BUYER will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

1.4 In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the BUYER with full and verifiable facts and the same is prima facie found to be correct by the BUYER, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the BUYER and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the BUYER the proceedings under the contract would not be stalled.

2. Commitments of Bidders

The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following:-

2.1 The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BUYER, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

2.2 The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour , any material or immaterial benefit or other advantage , commission, fees, brokerage or inducement to any official of the BUYER or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the Government for showing or forbearing to show favour or disfavour to any person in relation to the contract or any other contract with the Government.

2.3 BIDDERS shall disclose the name and address of agents and representatives and Indian BIDDERs shall disclose their foreign principals or associates.

2.4 BIDDERs shall disclose the payments to be made by them to agents/brokers or any other intermediary, in connection with this bid/contract.

2.5 The BIDDER further confirms and declares to the BUYER that the BIDDER is the original manufacturer/integrator/authorized government sponsored export entity and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the BUYER or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

2.6 The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the BUYER or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

2.7 The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

2.8 The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

2.9 The BIDDER shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information · provided by the BUYER as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

2.10 The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

2.11 The BIDDER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

2.12 If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or indirectly, is a relative of any of the officers of the BUYER, or alternatively, if any relative of an officer of the BUYER has financial interest/stake in the BIDDER's firm, the same shall be is closed by the BIDDER at the time of filing of tender. The term 'relative' for this purpose would be as defined in Section 6 of the Companies Act 1956.

2.13 The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the BUYER.

3. Previous Transgression

3.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify BIDDER's exclusion from the tender process.

3.2 The BIDDER agrees that if it makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

4. Earnest Money (Security Deposit)

4.1 While submitting commercial bid, the BIDDER shall deposit an amount (shall be specified in RFP) as Earnest Money/Security Deposit, with the BUYER through any of the following instruments:

(i) Bank Draft or a Pay Order in favour of Bank of Baroda

(ii) A confirmed guarantee by an Indian Nationalized Bank other than Bank of Baroda, promising payment of the guaranteed sum to the BUYER on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever. The demand for payment by the BUYER shall be treated as conclusive proof of payment.

(iii) Any other mode or through any other instrument (to be specified in the RFP).

4.2 The Earnest Money/Security Deposit shall be valid upto a period of one years or the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and the BUYER, including warranty period, whichever is later.

4.3 In case of the successful BIDDER a clause would also be incorporated in the Article pertaining to Performance Bond in the Purchase Contract that the provisions of Sanctions for Violation shall be applicable for forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

4.4 No interest shall be payable by the BUYER to the BIDDER on Earnest Money/Security Deposit for the period of its currency.

5. Sanctions for Violations

5.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the BUYER to take all or any one of the following actions, wherever required:-

5.1.1 To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.

5.1.2 The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is signed) shall stand forfeited either fully or partially, as decided by the BUYER and the BUYER shall not be required to assign any reason therefore.

5.1.3 To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.

5.1.4 To recover all sums already paid by the BUYER, and in case of an Indian BIDDER with interest thereon at 2% higher than the prevailing Base Rate of Bank of Baroda, while in case of a BIDDER from a country other than India with interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the BIDDER from the BUYER in connection with any other contract for any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.

5.1.5 To encash the advance bank guarantee and performance bond / warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the BUYER, along with interest.

5.1.6 To cancel all or any other Contracts with the BIDDER. The BIDDER shall be liable to pay compensation for any loss ·or damage to the BUYER resulting from such cancellation/ rescission and the BUYER shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

5.1.7 To debar the BIDDER from participating in future bidding processes of the Government of India for a minimum period of five years, which may be further extended at the discretion of the BUYER.

5.1.8 To recover all sums paid in violation of this Pact by BIDDER(s) to any middleman or agent or broker with a view to securing the contract.

5.1.9 In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the BUYER with the BIDDER, the same shall not be opened.

5.1.10 Forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

5.2 The BUYER will be entitled to take all or any of the actions mentioned at para 6of this Pact also on the Commission by the BIDDER or any one employed

5.3 By it or acting on its behalf (whether with or without the knowledge of the BIDDER), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

5.4 The decision of the BUYER to the effect that a breach of the provisions of this Pact has been committed by the BIDDER shall be final and conclusive on the BIDDER . However, the BIDDER can approach the Independent Monitor(s) appointed for the purposes of this Pact.

6. Fall Clause

The BIDDER undertakes that it has not supplied/is not supplying similar product/systems or subsystems at a price lower than that offered in the present bid in respect of any other Ministry/Department of the Government of India or PSU and if it is found at any stage that similar product/systems or sub systems was supplied by the BIDDER to any other Ministry/Department of the Government of India or a PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER to the BUYER, if the contract has already been concluded.

7. Independent Monitors

7.1 The BUYER will be appointing Independent External Monitors (hereinafter referred to as Monitors) for this Pact in consultation with the Central Vigilance Commission. The name and e-mail address of the IEM is as follows:

Name: Shri HarishwarDayal
E-mail: dayalagra@gmail.com

7.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this Pact.

7.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.

7.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement, including minutes of meetings.

7.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the BUYER.

7.6 The BIDDER(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the BUYER including that provided by the BIDDER. The BIDDER will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

7.7 The BUYER will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.

7.8 The Monitor will submit a written report to the designated Authority of BUYER/Secretary in the Department/ within 8 to 10 weeks from the date of reference or intimation to him by the BUYER I BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

8. Facilitation of Investigation

In case of any allegation of violation of any provisions of this Pact or payment of commission, the BUYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER and the BIDDER shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

9. Law and Place of Jurisdiction

This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the BUYER.

10. Other Legal Actions

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

11. Validity

The validity of this Integrity Pact shall be from date of its signing and extend upto 5 years or the complete execution of the contract to the satisfaction of both the BUYER and the BIDDER/Seller, including warranty period, whichever is later. In case BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.

11.1 Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

12. The parties hereby sign this Integrity Pact at _____ on _____

BUYER	BIDDER
Name of the Officer:	Chief Executive Officer
Designation:	Department:
Witness	Witness
1. _____	1. _____
2. _____	2. _____

1.Photographs :
During construction, the date stamp photographs shall be taken by the contractor each month and submitted to the Engineer-In-charge, showing details of specific requirements / measures being taken by the contractor towards above for documentary compliance and records.