

State Bank of India



PREMISES & ESTATE DEPARTMENT,
2nd FLOOR, LOCAL HEAD OFFICE,
PLOT NO-53A, SBI TOWER,
GIFT CITY, GANDHINAGAR

Technical Bid

NOTICE INVITING TENDER

Tender ID - SBI/AHM/2024-25/008

For the work of:

Construction works of Civil, Plumbing, Sanitary, Electrical, Firefighting, LIFTS, External Development and Allied Services, etc. for the Proposed Construction Of A Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor : Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)

ARCHITECT , INTERIOR DESIGNER & PROJECT MANAGEMENT CONSULTANTS**Mamta Shah & Associates**

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Email : mamta@msain.com

Tender Submitted By :

Name of Vendor : _____

Address of Vendor : _____

GSTN No. of Vendor : _____

Date : _____

The Assistant General Manager (Premises & Estate),
STATE BANK OF INDIA
Premises & Estate Dept.,
Local Head Office, 2nd FLOOR, PLOT NO-53A, SBI TOWER,
GIFT CITY, GANDHINAGAR Tel No. 079-25507187

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1. Notice Inviting Tender (e-NIT)

Item Rate e-Tenders are invited by M/s. Mamta Shah & Associates, Vadodara for & on behalf of State Bank of India, from Bidders, for the work of Proposed Composite Construction Of A Multi-Storey Building (Lower basement + Upper basement + Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)”

The details of the tender are as under:

S.No.	Particulars	Description
1	Name of the work	Construction works of Civil, Plumbing, Sanitary, Electrical, Firefighting, LIFTS, External Development and Allied Services, etc. for the Proposed Construction Of A Multi-Storey AO Building (Lower basement + Upper basement + Ground floor to sixth floor : Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)
2	Estimated Project Cost put to tender	Rs .24,34,80,441/- Plus GST i) Civil work, Plumbing work, Internal/External development work etc.- Rs.20,44,29,805/- ii) Electrical Internal & External work, DG set, Lifts, panels, HT/LT cables etc.- Rs.2,43,45,771/- iii) Fire fighting work, Fire alarm, PA system- Rs.1,47,04,865/-
3	Time allowed for Completion of Work	24 Months Including Monsoon & holidays from the 15th day of the date of award of work.
4	Earnest Money	₹.24,34,800 (Rupees Twenty-Four Lakh Thirty Four Thousand Eight Hundred Only) in the form of Demand Draft or Banker's Cheque drawn in favor of State Bank of India Payable at Gandhinagar of any scheduled bank in India. (Valid for a period of 90 Days from the last date of submission of the tender) EMD to be deposited on or before the time and last date of submission of the tender. Note: It is sole responsibility of the bidder to ensure submission of their EMD Physically by stipulated date and time as specified failing

		which they will not be allowed to participate in E-Tendering. The proof of the same is to be uploaded www.tenderwizard.in , mentioning UTR no. / transaction ID.
5	Initial security Deposit	The amount of initial security deposit shall be 2% of the accepted tender amount including the EMD in the same form as of EMD (issued by the scheduled Bank) or Bank Guarantee (issued by the scheduled Bank other than SBI). The initial security deposit is to be paid by the contractor to the Bank within 15 (fifteen) days of intimation to him of the acceptance of his tender. No interest will be pay on retention amount.
6	Date and Time where tenders are Available.	From 15.11.2024 to 12.12.2024 up to 15:00 Hours at https://www.tenderwizard.com/SBIETENDER & www.sbi.co.in/web/sbi-in-the-news/procurement-news
7	Time and last date of submission of online e-tender	Up to 15:00 on 12.12.2024
8	Place, Time & Address for submission of e-tender/ contact person / telephone no/ email address.	Up to 15:00 on 12.12.2024 https://www.tenderwizard.com/SBIETENDER <u>EMD and Original Integrity Pact to be sent at the Address:</u> The Assistant General Manager (Premises & Estate), PREMISES & ESTATE DEPARTMENT, 2 nd FLOOR, LOCAL HEAD OFFICE, PLOT NO-53A, SBI TOWER, GIFT CITY, GANDHINAGAR 079-29090149, e-mail: agmpe.lhoahm@sbi.co.in
9	Pre-Bid Meeting (Contractor to email queries in advance at least 2 days before Pre-Bid Meet)	On 03.12.2024 at 1500 hrs at office : The Assistant General Manager (Premises & Estate), PREMISES & ESTATE DEPARTMENT, 2 nd FLOOR, LOCAL HEAD OFFICE, PLOT NO-53A, SBI TOWER, GIFT CITY, GANDHINAGAR

<p>10</p>	<p>Date, Time, and Place of opening e- tender</p>	
	<p>(a) Technical Bid</p>	<p>On 12.12.2024 at 16:00</p>
	<p>(b) Indicative Price Bid</p>	<p>To be intimated to qualified contractors on their provided email-IDs after scrutiny /approval of technical bids.</p>
	<p>(c) Date and time for E-reverse Auction</p>	<p>To be intimated to qualified contractors on their provided email IDs after scrutiny/approval of online Indicative Price bids.</p>
<p>11</p>	<p>Validity period of the tender.</p>	<p>03 months from last date for receipt of tender</p>
<p>12</p>	<p>Submission of Technical bid</p>	<p>1) Contractors shall Download the entire Technical Bid, annexures to get acquainted with the terms and conditions and shall upload it after completely filling it along with relevant/supporting documents without fail in the e-tender portal after putting the signature and seal. Failing to upload as stated above, the tender will be rejected. (Participating through e-tender portal they must have class III digital certificate.)</p> <p>Bidder shall submit the original copy of duly executed Pre-Contract Integrity Pact alongwith required EMD as mentioned and seal it in an envelope and mark the envelope as “Technical Bid”. The said envelope shall clearly bear the name of the Tender and name and address of the Bidder. In addition, the last date for bid submission should be indicated on the right and corner of the envelope. Pre-Contract Integrity Pact should be submitted within the bid submission date and time for the Tender at the address mentioned in Notice Inviting Tender, failing which Bid will be treated as non-responsive.</p> <p>2) However, L-1 tenderer should submit the whole technical bid spirally bound securely and in serial order containing all pages duly signed with company seal and date to this Office within 15 days of receipt of confirmation. Failure to submit the hardcopy of tender may render the Contractor disqualified.</p>
<p>13</p>	<p>Agency for arranging e-tender/online bidding, contact numbers :</p>	<p>You are requested to contact the agency for further guidance for e-tendering.</p>

	Name of Auction Agency	M/S. Antares System Limited
	Address	137/3, 'Honganasu' Kengari, Bangalore - 560060.
	Bidder Support	9708966660/9044314492/9073677150/9073677151/9073677152/ 033-46046611
	Email Address	helpdesk857@etenderwizard.com
	Website Address	https://www.tenderwizard.com/SBIETENDER
	Bidder Support :	M/S. Antares System Ltd, Bangalore Contact Person: Mr. Kushal Bose Mobile No: 96747-58719 You are requested to contact the agency for further guidance on E- tendering.
14	Selection procedure for pre-qualification	Contractors shall score minimum 60% marks to Pre qualify / Eligible for participation in tender process as per Scoring Matrix/ Evaluation Sheet (Annexure 'M').
15	For further clarifications, if any	Attend Pre-Bid Meeting at prescribed schedule.
16	Place, Time & Address for submission of original EMD and integrity pact with requisite stamp paper	up to 3.00 PM on on 12.12.2024 Address : The Assistant General Manager. Premises & Estate Dept., Local Head Office, 2nd FLOOR, PLOT NO-53A, SBI TOWER, GIFT CITY, GANDHINAGAR
17	Defects Liability period	12 months except as specifically specified under different items (for example: 10 years for waterproofing works and pre-constructional anti-termite treatment)
18	Liquidated Damages	0.50 % of the Contract value per week subject to maximum of 5% of contract value.
19	Total security deposit	10% of gross value of work in Running bills to a maximum of 5% of the contract value.
20	Period of Commencement	15 days from the date of work order or the date of possession of site, whichever is later
21	Value of Interim Certificate	Minimum 1.0 Crore for first 3 RA Bill and Rs.2.00 Crore, 4th RA Bill onwards and Not More than One Bill Per Month. No advance on materials / plant / machinery or mobilization advance shall be paid under any circumstances.
22	Eligible Taxes	A) Income Tax will be deducted at source as per Govt. Guidelines. B) Payment of GST will be made as applicable. The contractor should comply with the following. Contractor should have GST Registration

		<p>Number.</p> <p>Invoice should specifically/separately disclose the amount of GST levied at applicable rate as per GST provisions/Rules.</p> <p>In case of Correction in the bills after scrutiny, contractor should submit fresh bills for payment.</p> <p>Contractor should timely file his GST return in accordance with GST provisions to enable the bank to claim the credit of GST paid to the contractor.</p>
23	Submission of Price Bid	<p>Item rate Tender System :</p> <ol style="list-style-type: none"> 1. Indicative Price Bid submission. 2. Thereafter e-reverse auction.
24	Any additional Information	<p>The quoted rate should be inclusive of materials, labour, wages, fixtures, transportation, installation, wastages, Octroi, levies, all cess, royalties, all taxes (but excluding GST), machinery, temporary works such as scaffolding, cleaning, overheads, profit, statutory expenses, incidental charges and all related expenses to complete the work. In addition to above contractor shall also consider all preambles mentioned in Tender BOQ while quoting Tender Item rates. GST shall be as applicable on actuals.</p>
25	Additional Performance Deposit (ASD) / Additional Performance Guarantee (APG)	<p>ASD/ APG shall be deposited by the bidder whose bid is accepted only if their bid amount is below by 7.5% or more below to the estimated cost put to tender.</p> <p>The Amount of such ASD / APG shall be the difference amount between 92.50% of the estimated cost and the accepted price / bid .Bank Guarantee drawn on any other nationalized Bank (except SBI) OR Demand draft or Bankers cheque in favour of SBI drawn on any scheduled bank in India will be accepted as ASD / APG. ASD/APG should be deposited/submitted within 15 days of date of issue of letter of Acceptance / work order.</p> <p>Additional security deposit Will be refunded /Bank Guarantee to be released to the contractor without any interest within 15 days after issue of Virtual Completion certificate by the APMCF.</p>
26	Note:-	<ol style="list-style-type: none"> 1.The make of materials should be chosen strictly from the preferred makes as given in the tender. 2.Any clarifications sought after opening of the tenders will not be entertained at any cost 3.Bidder should visit the website till last date of submission for changes/corrigendum, if any 4.Bank reserves the right to cancel or postpone the tenders at any stage without assigning any reasons

		5 Claims for revision of the Quoted price by any bidder after the tender will not be entertained.
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27. The contractor has to provide their E-mail id, contact nos. and postal address in the bid documents. Henceforth, all official communication from Bank shall be through E-mail or letter also. The SBI reserves the right to cancel or postpone or modify the Tender at any stage without assigning any reason.

28. The digitally signed technical bid document, by authorized signatory of contractor, has to be uploaded on specified web portal of M/s Antares Systems Ltd through Website <https://www.tenderwizard.com/SBIETENDER>. It shall be responsibility of the contractor to arrange and ensure that all pages of Tender Document signed with stamp & uploaded.

29. No conditions other than mentioned in the Tender will be considered, and if given bid will be summarily rejected. There should not be any deviation or assumption in terms and conditions as have been stipulated in the tender documents. Prior to the detailed evaluation, the Bank will determine the responsiveness of each Bid to the tender. For purposes of this clauses, a responsive Bid is one, which conforms to all the terms and conditions of the tender in toto, without any deviation or assumption.

30. The SBI reserve their rights to accept or reject any or all the Bids/Tenders either in whole or in part without assigning any reason(s) for doing so and no claim / correspondence shall be entertained in this regard.

31. In case the date of opening of tenders is declared as a holiday, the Tender will be opened on the next working day at the same time.

32. Tenders received without EMD and original Integrity Pact shall be summarily rejected and such tenders shall not be allowed for evaluation or to participate in the online price bidding process.

33. For any clarifications regarding E-Tendering procedure, System requirements etc. please contact M/S. Antares System Limited, Bangalore, whose address is mentioned in the NIT.

Yours Faithfully,

APMCF ,Mamta Shah & Associates
For and on behalf of SBI

2.1) Pre – Requisite for e - Tendering

All documents related to the tender are available on the e-tendering portal

<https://www.tenderwizard.com/SBIETENDER> & www.sbi.co.in/web/sbi-in-the-news/procurement-news

Contractors must note that this, being E- tender, Bids received online on E-tendering portal shall only be considered. To participate, Contractor(s) is/are advised to register with following steps:

Step 1: Contractor’s Registration

•	Go to website: https://www.tenderwizard.com/SBIETENDER & www.sbi.co.in/web/sbi-in-the-news/procurement-news
•	Click on “Register for e-Tender” button.
•	Create your desired User ID and fill in Company Details.
•	Vendor in possession of DSC Class III may insert Digital Signature Certificate token in computer’s USB drive, and click on “Update Digital Signing Certificate Serial No. From USB token”. A new PKI based “Signer Certificate” window will open. Browse your Signer Certificate, enter token password and click on Register.
•	For those without DSC, it is advised to apply for the DSC.
•	Do not enter special character(s) in any field except “Email Address”, “Website (URL)” and “Alternative Email Address”.
•	Then click on “Create profile”.
•	You will be forwarded to “Document Upload” screen. Upload documents as specified in previous page. After uploading is completed, click on “Finish Upload”.
•	The User ID and system generated password with payment confirmation
•	will appear on the next screen which can be printed for future reference.
•	Check registered email ID. Click in the link “Click to verify” to validate the email ID.
•	To enable the User ID, forward the registration acknowledgment copy to help desk from registered email ID.

Step 2: Digital signature (known as “Digital Signature Certificate”)

•	Applying Class III Digital Signature Certificate: (token issued upon registration)
•	It is mandatory for all the Contractors to have class-III Digital Signature Certificate (DSC) (in the name of person who will sign the Bid) from any of the licensed certifying agency to participate in this TENDER. DSC should be in the name of the authorized signatory. It should be in corporate capacity (that is in Contractor capacity).
•	Contractor’s manual & system requirement is available on website https://www.tenderwizard.com/SBIETENDER
	Contractors may contact e-tendering representative at 9708966660/9044314492/9073677150/9073677151/9073677152/ 033-46046611 for any assistance.

3) BRIEF PARTICULARS OF THE WORK

- a. SBI proposes Construction of a Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat), approximate **Built-up area 65000 sq.ft.**, The Estimated cost of the project is 24.34 Crore inclusive of Foundation, Composite Construction works of Civil, Plumbing, Sanitary, Electrical, LIFT, Firefighting, External Development and Allied works, etc.
- b. **Brief Scope of Work:** The scope of work comprises of composite construction works of civil, plumbing, sanitary, electrical, firefighting, External development and other allied work for the "Proposed Construction of Multi-Storey Building (Lower basement + Upper basement +Ground floor to sixth floor : Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat).
- c. The proposed work has to be completed in all respect on FAST TRACK. The **time allowed** for completion of the project is **24 months** including monsoon & [Holidays](#) period from the date of work order + 15 Days (Mobilization period) or handing over of site to the Contractor, whichever is earlier.
- d. SBI intends to pre-qualify the competent Building Contractors having requisite qualifying experience and infrastructure and financial capability to undertake the work as specified in the pre-qualification documents for completion of the project in the prescribed scheduled time.
- e. **The salient features of the captioned project are as under: -**
- (i) The project is proposed to be setup on Plot No. 116, T.P. Scheme No – 3, "State Bank of India at Vasna – Bhayali Road, Vadodara, Gujarat.
 - (ii) Proposed Civil, Structural and Finishing work for State Bank of India has been designed as per the Architectural Controls of VUDA for **PLOT NO.116, T.P. SCHEME NO. 3, BHAYALI, VASNA-BHAYALI ROAD VADODARA (GUJARAT).**
 - (iii) Proposed Office Building has been designed in accordance with National Building Code and relevant IS Standards for Seismic Safety.
 - (iv) Total Built-up area of the building is approx. 65000 Sq.ft. with TWO basements + GF+ 6 floors having height of 25 meter from ground level.
 - (v) Civil & Finishing works will comprise of Excavation, Anti-termite treatment, Structural & RCC, Masonry, Plastering, Waterproofing, Flooring & Dado, Painting, Doors, SS Railings, Glass Railings, Structural glazing, ACP and Site Development etc.

- (vi) The building is designed in order to achieve IGBC Gold Rating certification. Contractor shall appoint a green building consultant from the beginning and shall oblige / incorporate all the measures/ guidelines mentioned in the code in order to achieve and shall be liable to pay charges for the same. Contractor shall submit the Gold Rating certificate to client prior to handing over the building

1. OFFICE BUILDING

- a. Proposed Office Building shall have Lower & Upper Basement, Ground Floor, six Upper Floors and Terrace Floor.
- b. Office Building shall have Column Footings, Raft Slab, Retaining wall(Lower & Upper Basement), Columns, Tie Beams, Beams, Slabs, Lift Shear wall, RCC, Under Ground (UG) & Over Head (OH) Tank.
- c. Complete Office Building has Lower & Upper Basement with retaining wall around the periphery for double Basement.
- d. Height of Lower & Upper Basement is 3.45m & 3.85 respectively. Entire areas of all basements to be excavated and shall have parking. (4 wheeler).
- e. Lower Basement shall comprise of Lift Lobbies, Staircase Blocks, Services, PumpRoom, UG tank and Car Parking along with stackable parking.
- f. Intermediate Basement shall comprise of Lift Lobbies, Staircase Blocks, Services and Car Parking.
- g. Lower Basement shall comprise of Lift Lobby, Staircase Blocks, Sewage treatment plant, UGWT and 4-wheeler Parking.
- h. Basements shall have RCC retaining wall with waterproofing treatment to RCCretaining wall.
- i. UG Tank shall have Waterproofing treatment along with White Glazed Tile Dado frominside.
- j. Staircase Block shall have Granite Stone Treads & Risers.
- k. Ground Floor shall comprise of large open office space, common toilets, lift lobby, staircase, pantry and record room.
- l. Typical Floor shall have common toilets, pantry and large open office space

1. MAIN & SERVICE CORE

- a. Lift Lobby in Main & Service Core area shall have 2 nos lift each of 10-12 passenger's capacity.
- b. Lift Lobby on ground floor shall have Italian marble Flooring & Italian Dado. Typical floors lift lobby will have granite flooring and dado.
- c. Toilet Block shall have specialized waterproofing treatment, Vitrified Tile flooring.Toilet Block shall have exhaust fan ventilation system.
- d. Ground Floor shall have Italian Marble flooring in Reception and Entrance Lobby area.
- e. All Service Shafts shall have 2 (two) hour Fire Rated (Factory Manufactured) Galvanized Steel Frame and 46mm thick Shutter finished with Epoxy paint of approved shade with accessories such as Door Handle, Door Closer, S.S. Hinges as per requirement.
- f. Glass/ Glazing will be Structural Glazing System planned with shading fins to cutoff the glair with Double Glazing Unit (DGU) and Single Glazing Unit (SGU) system with solar efficient glass fixed on aluminum framing.
- g. Canopy will be provided at main entrance.

2. TERRACE FLOOR

- a. Terrace floor shall comprise of covered lift lobby & Staircase Block.
- b. OH Tank shall have Waterproofing treatment along with China mosaic frominside.

3. SITE DEVELOPMENT

- a. Site Development Comprises of Driveway, Pedestrian Pathways, Soft landscape and Entry& Exit Gates with security cabin, 2 wheeler parking & Fire escape staircase.

b. Driveway & Pedestrian Pathway shall have natural cobble stone.

4. Electrical Services Electrical Load Estimates

Total Connected Load: **773 KW** Total

Demand Load: **541 KW** Power factor

Considered: **0.8 Lag** Demand Load in

KVA: **676.8 KVA**

Selection of Transformer: 1x750 KVA Compact Substation, with HT Panel, Indoor Oil Type 11/0.433KV Transformer are proposed such that under normal condition.

a) **PROVISION FOR POWER**

DISTRIBUTION

- a) Lt Panel Rooms with DB Location and Duct provisions are provided.
- b) Conduit Provisions for Light Points & Power Points for Basement are provided.
- c) Floor Trunking for Floor Wiring Provided.

a) **Emergency Lighting**

UPS with 1 Hrs Battery Backup is provided for Emergency lighting and power load and shall be provided in accordance with National Building code 2005.

a) **Emergency and Life Safety Loads**

Back up shall be provided for Critical loads 100% Backup DG Provision is provided. 750KVA DG Set.

a) **Earthing and Bonding**

A Dedicated Earthing System will be provided for power supplies to IT equipment/EPABX/Security, UPS (within the individual offices) and elevators.

Earthing will be designed to achieve 01 Ohm.

5. Plumbing Services

a)

Water Demand Calculation

- Domestic water storage in UGWT is 67.7% & in OHT 33% of 1day Requirement
- Flushing water storage in UGWT is 67.7% & in OHT 33 % of 1 day Requirement

Sr. no.	UG Tank Details	Capacity	Unit
1	Fire fighting Underground Water Tank	150	KLD
2	Domestic Underground Water Tank	20	KLD
3	Flushing Underground Water Tank	15	KLD

Sr. no.	OH Tank Details	Capacity	Unit
1	Fire fighting Overhead Water Tank	20	KLD
2	Flushing Overhead Water Tank	5	KLD
3	Domestic Overhead Water Tank	10	KLD

a) Domestic Water Distribution:

- The total water is stored in UGWT located in 2nd basement.
- The potable water from Borewell water supply shall be collected in fire static water tank and over flow to Domestic water tank, to keep water fresh, clean & to prevent stagnation of water in fire fighting UGWT provide baffle wall in fire tank.
- Through a set of a single stage double suction system water transfer pump shall pump water from Domestic UGWT to Fire fighting OHT.
- Water from Domestic water tank flows through gravity to the ring main at the Terrace level and in turn the same will feed to Utility with control valve.

a) Flushing Water Distribution:

- Through a set of a single stage double suction system water transfer pump shall pump water from Flushing UGWT to Flushing OHT.
- Water from flushing water tank flows through gravity to the ring main at the Terrace level and in turn the same will feed to Utility with control valve.
- For flush application, the topmost two floor have concealed flushing tank and rest of floors are served by flush valve.

a) Water Pump

- Pump of following capacities are proposed :

Sr. No.	Pump Description	Head (M)	Flow (LPM)	Working	Stand-by
1	Domestic Water Supply Pump	40	200	1	1
2	Flushing Water Supply Pump	40	150	1	1

6. Fire Fighting System

- Fire fighting system shall be provided as per National Building Code 2016 & as per NFPA.
- Combination of Sprinkler, Hydrant and Hose reel system is provided in entire building.
- Provision of Fire Buckets and Fire Extinguishers are made as per NBC 2016
- Total underground fire tank provided 150 KLD with two compartment each one have 75 KLD .& 20 KLD overhead tank provide at the terrace level .
- There will be a fire department inlet connections with 4 Nos. 63mm dia male outlets, located externally near main gate. This inlet will have connections to the fire static storage tank.

Following Are Pump Provided As Per NBC Requirement:

1. 2# Fire Main Pump 2280 LPM @ 56M Head
2. Fire Diesel Pump 2280 LPM @ 56M Head.
3. 2# Jockey Pump 180 LPM @ 56M Head

4. DECLARATION

(TO BE GIVEN BY THE APPLICANT WHO HAVE DOWNLOADED THE TENDER DOCUMENT FROM THE WEB ON THE COMPANY LETTERHEAD)

To,

The Assistant General Manager (Premises & Estate),
State Bank Of India
Premises & Estate Dept.,
2nd FLOOR, LOCAL HEAD OFFICE,
PLOT NO-53A, SBI TOWER,
GIFT CITY, GANDHINAGAR

Sub: Submission of Tender for the Construction Of A Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical, LIFT and Other Services (Green Building With Gold Rating in Leed /Griha) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)”

Dear Sir,

It is to certify that:

1. I / We have submitted the tender document in the proforma as down-loaded directly from the web site & there is no change in formatting, number of pages etc.
2. I / We have checked that no page is missing and all pages as per the index and checklist are available & that all pages of tender document submitted by us are clear & legible.
3. I / We have signed (with stamp) all the pages of the tender document before submitting the same.
4. I /We have read carefully & understood the instructions to the applicants.
5. I / We have not made any modification / corrections / additions /deletions etc in the tender documents downloaded from web by me / us. In case at any stage later, it is found there is difference in our downloaded tender documents from the original and / or any documentation, SBI shall have the absolute right to disqualify / reject the application out- rightly and also debar me / us in participating in any future Tender / TENDER without any prior intimation to me / us and EMD/ISD will be forfeited including Security Deposit.

Place :

Date :

Sign & Stamp of Authorized Signatory/Applicant

5.ELIGIBILITY CRITERIA FOR PREQUALIFICATION:

The intending contractor should comply the following minimum eligibility criteria for pre- qualification for the proposed project which is to be supported by all valid documentary proofs: -

❖ The bidder should have one office in Gujarat OR else will have to open their office in Gujarat within two (02) months on issuance of Work Order.

5.1 EXPERIENCE: The applicant should be a well-established and reputed establishment (for a minimum period of 7 years) engaged in the works of building construction including *Civil, Plumbing, Sanitary, Electrical, Fire Fighting, LIFTS, External Development and Allied Services, etc.* for **minimum one commercial/Institutional/residential building having more** than 15 metre height from Ground Level and **minimum 1 Basement for Central Govt. Dept./State Govt. Dept./ Semi Govt. Dept. /PSU /Public sector Banks /Public limited Company/LLP/ Partnership/ Trust / Co-op. Body / Society, may apply.**

5.2 The applicant should have satisfactorily completed “similar” works of magnitude as specified below during the last 7 years **upto 31.10.2024** should be either of the following:

5.2.1 Three similar completed works each costing not less than Rs. 9.73 Crore (Exclusive of GST).

- i) **Civil Works** costing not less than Rs. 8.17 Crore
- ii) **Electrical Works** costing not less than Rs. 0.97 Crore
- iii) **Fire Fighting Work** costing not less than Rs. 0.59 Crore

OR

5.2.2 Two similar completed works each costing not less than Rs. 12.16 Crore (Exclusive of GST)

- i) **Civil Works** costing not less than Rs. 10.22 Crore
- ii) **Electrical Works** costing not less than Rs. 1.21 Crore
- iii) **Fire Fighting Work** costing not less than Rs. 0.73 Crore

OR

5.2.2 One similar completed works costing not less than Rs. 19.46 Crores (Exclusive of GST)

- i) **Civil Works** costing not less than Rs. 16.35 Crore

- ii) Electrical Works costing not less than Rs. 1.94 Crore
- iii) Fire Fighting Work costing not less than Rs. 1.17 Crore

5.3 : DEFINITIONS

5.3.1 **“Similar works” under this clause shall mean “successful completion of construction of minimum one commercial/Institutional/residential building having more than 15 metre height from Ground Level and minimum 1 Basement for Central Govt. Dept./State Govt. Dept./ Semi Govt. Dept. /PSU /Public sector Banks /Public limited Company// LLP/ Partnership/ Trust / Co-op. Body / Society, may apply.**

Project executed under single contract covering all major works from each trade headed as under;

- I) **Civil Works: means all Structural RCC, Civil, Plumbing, Fabrication, Civil Finishes, Landscaping etc.**
- ii) **Electrical Work: means all Electrical, Solar PV Works, LIFT WORKS etc.**
- iii) **Fire Fighting Works: means all Fire Detection works, fire fighting works,**

5.3.1.1 **If The applicant submits documents of Specialized Contractor/Associate for “Similar fire-fighting and Electrical works” shall provide a documentary proof of the same along with NOC (As applicable) obtained for the works executed. For such case, all the documentary proof as required of the proposed associate party meeting the eligibility criteria should be enclosed. However, the applicant will be the lead partner in MOU and responsible to the Bank, in case his firm gets pre- qualified and awarded the work.**

5.3.1.2 **In case at the time of execution of above specilised works of Electrical and Firefighting Works Contractor Desires to carry out the said specilised work through other associate than above given associate then new associate’s credentials should meet minimum required criteria mentioned in clause points no 5.2 above. For such case, all the documentary proof as required of the proposed associate party meeting the eligibility criteria should be submitted to SBI/APMCF and take approval of the same before starting the execution on site.**

5.3.2 **“Cost of work” shall mean actual gross value (Excluding GST) of completed “similar’ work including all the components executed under the contract as mentioned above. The applicant shall submit the documents as per clause 5.3.2.1 and clause 5.3.2.2 as mentioned below, of each project executed by them, during the said period duly supported by performance certificates of clients.**

5.3.2.1 **A copy of Tax invoice of Final Bill Submitted to their client and completion certificate.**

or

5.3.2.2 **A copy of Final Bill submitted to the Client (With receipt) and Virtual Completion certificate.**

5.3.3 Virtual Completion/Completion Certificate, Performance Certificate should be certified by an Officer not below the rank of Executive Engineer / Chief Project Manager or equivalent of the Organization or to be certified by Director / Partner / Proprietor, in case of Private Clients, for whom the work has been done.

5.3.4 "Applicant" means proprietary concern, partnership firm, private or public limited company applying for pre-qualification for the tender.

5.3.5 "Employer" or "Client" means State Bank of India, abbreviated as SBI.

5.4 **TURNOVER:** The applicant should have average minimum annual financial turnover of **Rs. 7.30 Crore** during the last 3 financial years ending **31/03/2024**. This should be duly audited and certified by a Chartered Accountant (Copy to be attached). Year in which no turnover is shown would also be considered for working out the average.

5.4.1 The applicant should not have incurred loss in last three or more consecutive years during the last five years ending 31.03.2024, duly certified by a Chartered Accountant (Copy to be attached). The firm should not be under liquidation, court receivership or similar proceedings.

5.4.2 The applicant should have a solvency of **Rs. 7.30 Crore** certified by a Scheduled Bank (Original copy to be attached). The Solvency Certificate should not have been issued earlier than 31.03.2024.

5.5 The applicant should have adequate in-house plant and machinery required for the proper and timely execution of the job. The details of the same shall be furnished duly authenticated as per the format enclosed in Form G.

5.5.1 The applicant should have sufficient number of Technical and Administrative employees on their roles for the proper execution of the contract as per the format enclosed in the Form F.

5.6 Contractor applying for this tender should have Registration of GST, PAN No., EPF and ESIC and Prof. tax (as applicable) submit proof of the same.

6. EVALUATION CRITERIA FOR PRE-QUALIFICATION:

For the purpose of pre-qualification, applications will be evaluated in the following manner:

- 6.1 Pre-Qualification bid shall be opened only for the Bidders who have successfully submitted EMD amount and Original Integrity Pact in required form.
- 6.2 The eligibility criteria prescribed herein above (in respect of experience of similar class of works completed) shall be scrutinized and the applicant's eligibility for pre-qualification for the work be determined. Only the applicants who meet the eligibility criteria specified as above will be further evaluated on the basis of details furnished by them.
- 6.3 If necessary, the authorized representatives of SBI & Architect will visit Projects sites which are completed in all respect by the applicants, in order to evaluate the performance of the applicants and quality of work. In such case, the applicant will be required to obtain/give them necessary permission / facilities and arrangements for site visit as required.
- 6.4 On the basis of the prequalification criteria mentioned above and after the evaluation of the applicants based on the site visit report, credentials submitted by the applicants, satisfactory Virtual Completion / completion certificates in respect of "Similar work" as spelt out above, confidential reports obtained from various clientele (wherever necessary) etc., applications will be shortlisted. Thus, shortlisted applicants will be considered as the pre-qualified vendors subject to verification of relevant documents.
- 6.5 Merely fulfilling the prescribed minimum prequalification criteria does not entitle the applicant for short listing, which is subject to the verification of documents/information furnished by the applicants, inspection of work, quality and timely execution of project, seeking confidential performance reports from the client, etc.
- 6.6 The broad criteria inter-alia for prequalification will also include the following parameters:
 - Quality Consciousness.
 - Quality of finishes.
 - Timely execution.
 - Integrity as regards working.
 - Ease in setting extra work, if any.

- Litigation, if any, involving Arbitration/court of Law.
- Financial soundness.
- Magnitude of work undertaken.
- List of work executed.
- Establishment, plant and equipment.
- Performance report from other employers

5.7 Bank reserves the right to accept or reject any or all applications without assigning any reason thereof. This prequalification does not bind SBI to award any job/project to the prequalified vendors.

5.8 Contractors shall score minimum 60% to Pre-qualify / Eligible for participation in further stage as per Selection Matrix at Annexure 'K'.

Note:- To validate the work Completed, SBI may ask additional documents like TDS Certificates, Original Invoices copies etc. against bills produced by the Bidders to their respective clients.

7.INSTRUCTIONS TO APPLICANTS**7.1 GENERAL INSTRUCTIONS:**

- i. Please read these instructions carefully before filling up the application form.

The application must be submitted in the proforma to be downloaded from:

<https://www.tenderwizard.com/SBIETENDER> & www.sbi.co.in/web/sbi-in-the-news/procurement-news without editing the text whatsoever.

Any violation of this condition shall render the application invalid.

- i. Letter of Transmittal along with all the annexures and necessary documents / details as sought supported by prescribed annexures containing other details etc. as mentioned to be uploaded.
- ii. In accordance with the compliance of adoption of Integrity Pact (As per CVC order No.41/12/07) an Independent External Monitor (IEM) will monitor and review the entire Tendering and procurement process. The details of the IEMs are as under:

NAME	Shri K.Chandahas	Dr. Parvez Hayat,
CADRE	IRS (Retd.)	IPS (Retd)
E-MAIL ID	kchandahas@yahoo.com	phayatips@gmail.com

The applicant shall be bound to execute the integrity pact as per the format attached as **Annexure-XVIII**.

7.2 Contents tender Documents:

- (i) The tender to be submitted online by uploading signed by authorized signatory, stamped & dated scanned copies of tender along with all relevant documents and annexures, in addition to above documents, certified and self attested true copies of following documents too need to be uploaded.
- Proof of establishment / constitution of the Company.
 - List and addresses of their offices.
 - List of works executed during last 7 years as per clause along with details and supporting proof viz., copies of work orders, satisfactory completion certificates, etc.
 - Certificate/ proof of empanelment / enlistment in other Organizations / Govt. / Semi-Govt. / Public sector undertakings / Banks (if any).
 - Satisfactory completion certificate in respect of "Similar work" as mentioned above (during last 7 years) from clients. (To be furnished as per the format enclosed in Annexure D).

- Audited balance sheets and P & L Account - for last 3 years certified by Chartered Accountants.
 - Details of tools and equipment, if any, to be used in the project.
 - Declarations
- (ii) The applicant/authorized signatory should sign & stamp each page of tender document, and its annexures / documents and submit the same online. The duly filled-in documents shall be received up to **1500 hrs. on 12.12.2024** at the below mentioned address in sealed envelope super-scribed "***Pre-Qualification application from intending Building Contractors for the Construction Of A Multi-Storey Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in Leed /Griha) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)***
- The Assistant General Manager (Premises & Estate),
PREMISES & ESTATE DEPARTMENT,
2nd FLOOR, LOCAL HEAD OFFICE,
PLOT NO-53A, SBI TOWER,
GIFT CITY, GANDHINAGAR
- (iii) The applicants are advised to visit the site at his/their own cost to examine the site & local conditions and collect all information that is considered necessary before participating in the tender process.
- (iv) All information called for in the enclosed forms should be furnished against the relevant columns therein. If, for any reason, information is required to be furnished on separate sheet, this fact should be mentioned against the relevant column. Even if no information is to be provided in a column, a "Nil" or "no such case" or "Not Available" entry should be made in that column. If any particulars/queries are not applicable in case of the applicant, it should be stated as "Not Applicable".
- (v) The applicants may please note that giving incomplete/unclear information called for in application forms, or making any changes in the prescribed forms, or deliberately suppressing any information, may result in disqualification of the applicant summarily at any stage and EMD/ISD shall be forfeited in this case.
- (vi) Applications are to be (a) uploaded online on or before final date of submission of tender.

- (vii) Overwriting and using of correcting fluid should be avoided. Corrections, if any, should be made by neatly crossing out and shall be rewritten with initials and date.
- (viii) All Pages of the document have to be numbered. Additional sheets, if any added by the vendor, should also be numbered by him. They should be uploaded as a package with signed letter of transmittal. The documents uploaded should be indexed and numbered. If uplodaed documents are in unstructured and in orderly manner, such applications may be summarily rejected.
- (ix) The applicant may furnish any additional information, which he thinks is necessary to establish his capabilities to successfully complete the envisaged work. He is, however, advised not to furnish superfluous information. No information shall be entertained after submission of Expression of Interest document unless it is called for by the Employer. However, Bank /Architect may request for additional, supporting documents, details in relation to tender process from the applicants during evaluation process.
- (x) References, information and certificates from the respective clients certifying suitability, technical know-how or capability of the applicant should be signed by an officer not below the rank of Executive Engineer / Chief Project Manager or equivalent of the Organization or to be certified by Director/Partner/Proprietor, in case of Private Clients , for whom the work has been done.
- (xi) Documents submitted in connection with tender will be treated as confidential and will not be returned.

7.3 PRE-QUALIFICATION DOCUMENT (TENDER)

7.3.1 The tender document is available on the web site of SBI, www.sbi.co.in under procurement news.

7.3.2 The duly filled-in tender Document should be Uploaded up to 1500 Hrs. up to the last date of submission online on SBI's E- tender Portal www.sbi.co.in/web/sbi-in-the-news/procurement-news

7.4 LETTER OF TRANSMITTAL

The applicant should upload the letter of transmittal on the letter head of the applicant attached/appended with Application form along with annexures of tender document as mentioned / necessitated.

7.5 ORGANISATIONAL INFORMATION - BIODATA

Applicant is required to submit the information in respect of his organization (**in Application form**) and Bio-data of the Directors / Partners / Key associates.

7.6 Miscellaneous Instructions: -

- i) Registration under the contract labour Act : The registration for on-going project may be provided for consideration
- ii) Special awards: Appreciation letters from Govt. client shall be considered in Scoring matrix.
- lii) Joint ventures and/or consortium are not allowed and will not accepted.

7.7 FINANCIAL INFORMATION

Applicant should furnish the following financial information as per the format as mentioned **in Form 'A'**:

- (a) Banker's Details, Chartered Accountant, Annual financial statement for the last seven years. It should be supported by audited balance sheets and profit and loss accounts (of last three years ending on **31.03.2024**) duly certified by a Chartered Accountant, as submitted by the applicant to the Income Tax Department to be supported by respective IT Return Acknowledgment.
- (b) Name and address of the banker's identification of individuals familiar with the applicant's financial standing and a banker's statement on availability of credit.
- (c) Solvency Certificate.

7.8 EXPERIENCE IN SIMILAR WORKS HIGHLIGHTING MAJOR PROJECTS

Applicant should furnish the following:

- i. List of all "Similar" works successfully completed during the last *seven years* (**in Form "B"**). Further supplementary information on completed major works to be submitted in Form B1.
- ii. This list is to be substantiated with the documentary evidences such as certified copies of work orders, certified final bill copy, satisfactory completion certificate obtained from client etc. without which, the projects mentioned in the format **shall**

not be considered for scrutiny.

- iii. List of works completed before seven years may be mentioned in separate sheet if the applicant intends to do so.

The SBI reserves the right to: -

- (a) Reject any or all of the applications without assigning any reason.
- (b) Amend the scope and value of contract to the applicant.
- (c) Verify the particulars furnished by the applicant independently. If any information furnished by the applicant is found incorrect at any stage of the project, the SBI will be at liberty to debar such Contractor(s) from participation in future Tendering / taking up of work in SBI in future, besides cancellation of their TENDER - Application Forms/ Tender. In such a case EMD/ISD shall be forfeited. Moreover, the SBI will not pay any damages/compensation to such vendor or firm or the concerned person. Further, any breach of this condition by the applicant would also render him liable to be removed from the approved list of vendors of SBI.
- (d) Cancel the TENDER process without specifying any reason whatsoever.

7.10 Even though an applicant may satisfy the above requirements, he would be liable for disqualification if he has: -

- (i) Made misleading or false representation or deliberately suppressed the information in the forms, statements and enclosures required in the tender document.
- (ii) Record of poor performance such as abandoning work, delaying the project, not properly completing the contract, or financial failures / weaknesses etc.

7.11 **Corrigendum / addendums (if any) to this notice shall only be available / posted on SBI's website.**

7.12 The applicants who have downloaded the tender document from the website, should read the following important instructions carefully before Uploading the tender documents: -

- i. The applicants should see carefully & ensure that the Downloaded/Uploaded tender document contains all the pages of the tender document.
- ii. The applicant should ensure that no page in the Uploaded tender document is missing.
- iii. The applicant should ensure that all pages in the uploaded tender document are

legible & clear & are printed on a good quality paper.

iv. The applicant should ensure that every page of the Uploaded tender document is signed by applicant with stamp (seal) of the applicant company and all the blanks are filled by the Applicant, suitably.

v. The applicant should ensure that the filled in tender document along with all supporting documents, annexures, certificates, etc. are uploaded in structured manner with proper index and numbering of pages. Any correction / addition / alteration / omission made in the tender document by the applicant, it shall be treated as non – responsive and the application may be summarily rejected.

vi. The applicant shall furnish a declaration as per the format to this effect that no addition / deletion / corrections have been made in the tender document submitted and it is identical to the tender document appearing on Website.

vii. The applicant who has downloaded the tender document from website should read carefully & sign the declaration given on the Annexure before Uploading the tender document.

viii. In case of any doubt in the tender document, the same should be got clarified from the SBI/APMCF before Uploading the tender document.

ix. The Company or firm or any other person shall not be permitted to seek pre-qualification for the work, in case, his near relative(s) (directly recruited or on deputation in SBI /SBI & is / are posted in any capacity either non-executive or executive employee in SBI PAN India. Near relative(s) for this purpose is/are defined as

i) Member of Hindu Undivided family (HUF).

ii) They are Husband and wife.

iii) The one is related to other in the manner as father, mother, son(s) & son's wife (daughter-in-law), Daughters(s), Daughter's husband (son-in- law), brother(s), brother's wife, sister(s), sister's husband (brother-in-law).

x. The applicant (principal vendor) shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him or who are near relative to any executive employee/officer in the SBI.

xi. Efforts on the part of the applicant or his agent to exercise influence or to pressurize the employer would result in rejection of application. Canvassing of any kind is prohibited. In Such case tender shall be summarily rejected.

Date :

Place :

Sign & Stamp of Applicant/
Authorized Signatory.

7.1 APPLICATION FORM

1	Name of the contractor Firm/ company:	
2	Type of Organization (whether Sole Proprietorship, Partnership, private Limited or Co-op. body etc.)	
3	Year of establishment of the Firm/company	
4	Whether registered with the registrar of companies / registrar of firms (if so, mention number & date of registration, and submit supporting documents)	
5	Year since the firm/ company is in the line of business/ activity of construction of multi Storey residential/ commercial buildings.	
6	Official/ registered address of the Firm / Company	
7	Correspondence address of the Firm / Company	
8	Email-ID of the firm/company	
9	Landline number (with STD code) of the office/ firm	
10	Mobile number of the Office/ Firm/ Company	
11	Name, mobile number & email ID of contact persons : i. ii. iii. iv. v.	
12	Name/s of Partners / Proprietor/ Directors/ Key Person of The Firm (Details of address, contact number, qualification etc. to be submitted as per the Bio data form)	
13	Address of office in Ahmedabad/Gandhinagar, if available.	
14	Whether Firm is having ISO Certification? Mention details	
15	Whether member of any professional Body / Association. Please give details & enclose certificate viz. IGBC	
16	GST Registration number (Photocopy to be attached)	

17	PAN No. (Photocopy to be attached)	
18	Registration for EPF/ RPFC (Photocopy to be attached)	
19	Registration for ESIC (Photocopy to be attached)	
20	Registration under the Contract Labour Act	
21	Registration number under Labour Welfare Act	
22	Professional Tax registration no.	
23	Educational qualification of the Proprietor/ Partner/ Director/Key Personal) ii) iii) iv) v)	
24	Average annual turnover of the Company as per Audited Balance Sheets as on 31st March 2022, 2023, 2024. (details of turnover during previous F.Y. to be submitted as per format given in Annexure A)	2021-22: 2022-23: 2023-24: ----- Average:
25	Total number of Similar Works of Residential projects completed in last seven years.	
26	Details of Similar works of Office building Projects completed during the last 7 years, as per format given in Annexure (Copies of work orders & completion certificates must be enclosed).	As per format enclosed
27	Value of Single Largest Project for Similar Work for Office building project completed in the last 7 years.	
28	Details of IGBC certification availed for Similar Work for Office building project completed in the last 7 years upto 31.10.2024 should be either of the following.	
29	Details of Similar work under execution	As per format enclosed

30	Financial Information as per format given at Form A (Enclose copies of audited balance sheet and profit & loss statements and CA Certificate)	As per format Form A.
31	Number of years of experience in the construction of Office buildings.	
32	Name and address of Bankers and position of financial soundness (Enclose solvency certificate or other relevant papers/documents, refer Annexure H).	As per Annexure H.
33	Details of skilled work force provided.	As per format Annexure E.
34	Details of equipment, tools, plants & machinery, etc. available with the firm –	As per format Annexure F.
35	Mention if black listed and / or blacklisting proceedings pending with any client. Details of the same, with reasons, to be furnished.	
36	Details of disputes /litigation, if any, during the period of last 07 years upto 31.10.2024 should be either of the following. If yes, please provide details thereof, with reasons.	
37	Whether any penalty imposed by law enforcing agencies such as Labour Department, Sale Tax, GST, Municipal Corporations, Development Authorities, etc.	
38	Details of penalty / liquidated damage imposed by any client for defective / delayed / non-completion of work or violation of terms of the contract, during the last 7 years upto 31.10.2024 should be either of the following. If yes, please provide details thereof, with reasons.	

39	Whether firm had been barred from participating in the bidding process or kept in cooling period/under suspension by any client, during the last 7 years, upto 31.10.2024 . If yes, please provide details thereof, with	
	reasons.	
40	Please indicate details of any bankruptcy/winding up of proceedings at any point of time in past.	
41	Covering cum declaration / confirmation letter as per Annexure enclosed	
42	If, you are registered in the panel of other organizations/statutory bodies such as CPWD, PWD, MES, Banks, PSU, Public Ltd. Co. (Listed Co.), etc., furnish their Names, category and date of registration.	
43	Names, addresses, email ID & Mobile No. of two or more persons who will be in a position to certify about the quality as well as performance of your organization.	i) ii)
44	Enclose copy of valid Electrical Contractor's License. (Mention Class)	
<p>I/We hereby confirm that all information, particulars, copies of certificates and testimonials in connection with my empanelment/ shortlisting are correct and genuine. I/we am, therefore, liable to face appropriate actions as deemed fit by the Bank in the event of any of the information, particulars, copies of certificates and testimonials are not found correct and genuine.</p>		
<p>Place: Date: Sign & Stamp of Authorized Signatory/Applicant Name : Designation :</p>		
<p>Note: Furnish certified photo copies of all relevant documents in support of the Information furnished above.</p>		

7.2 BIO-DATA OF THE DIRECTORS/PARTNERS/ KEY ASSOCIATES

1.	Name	:	
2.	Date of Birth	:	
3.	Associates with the organization since	:	
4.	Professional Qualification	:	
5.	Professional Experience	:	
6.	Professional Affiliation	:	
7.	Membership in	:	
8.	Details of Published papers in Magazine / Journals (if any)	:	
9.	Details of cost-effective methods/: innovative techniques adopted in the projects	:	
10.	Exposure to new materials/ Technology.	:	
11.	Details of address, email ID & Contact No.	:	

Signature of Applicant/Authorized Signatory

Annexure A

7.3 FINANCIAL INFORMATION

i) Banker Details

Name of the Bank :
 Branch with Address :
 City :
 Contact person in the Bank :
 Contact Details:

ii) Details of Chartered Accountant

Name :
 Address :
 Registration details of accountant :
 Contact Number :
 E-mail address :

iii) Financial Analysis – Details to be furnished of the Annual financial statement for the last seven years. It should be supported by audited balance sheets and profit and loss accounts (of last three years ending on **31.03.2024**) duly certified by a Chartered Accountant, as submitted by the applicant to the Income Tax Department.

	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
(i) Gross Annual turn-over in Construction works							
(ii) Profit/Loss							
(iii) Financial position:							
(a) Cash							
(b) Current Assets							
(c) Current Liabilities							
(d) Working capital (b-c)							
(e) Current Ratio: (Current Assets/Current Liabilities (b/c))							

Technical bid :

Construction of Multi-Storey Building Vadodara

(f) Acid Test Ratio (Quick Asset/Current Liability (a/c))							
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- iv. Income Tax Clearance Certificate

- v. Solvency certificate from Bankers (Schedule Bank) of Applicant.

- vi. Financial arrangements for carrying out the proposed work

Signature of Chartered Accountant
with seal

Sign & Stamp of Authorized Signatory/Applicant

ANNEXURE-A 7.3.1 FINANCIAL YEAR WISE TURNOVER DETAILS FOR THE LAST 7 YEARS.

Sr. No. (A)	Financial year (B)	Turnover Amount of the firm (in Rs.) (C)	Remarks/ reason for abnormal fluctuations in two continuous F.Y. (D)
1	2023-24		
2	2022-23		
3	2021-22		
4	2020-21		
5	2019-20		
6	2018-19		
7	2017-18		

Form 'B'

7.4 DETAILS OF ALL 'SIMILAR' WORKS COMPLETED DURING THE LAST SEVEN YEARS UPTO 31.10.2024

1	2	3	4	5	6	7	8	9	10	11	12
S. No.	Name of work/ project & location	Owner or sponsoring organizations	Date of Agreement with the owner	Scope of work executed	Built up area of the project in sqm.	Cost of project work in Crores	Date of commencement as per contract & actual date of commencement	Stipulated Date of completion & Actual date of completion	Litigation / Arbitration pending / In progress with details (if any)	Name and address with contact No. of Officer of client to whom reference shall be made	Remarks

Note:

Actual date of completion of the project should be within 7 years upto 31.10.2024 for taking into eligibility consideration. The projects mentioned in the above format shall be sorted in the order of cost of the project (Descending order)

Signature of Applicant/ Authorized Signatory

FORM B1 (Sup)**7.5 SUPPLEMENTARY INFORMATION ON COMPLETED MAJOR WORKS**

1. Name of work
2. Location
3. Client's name and address
4. Consultants name and address.
5. Scope of work.
 - a. Number of floors in Basement.
 - b. Number of floors in Superstructure.
 - c. Height of the building (m).
 - d. Built up area. (Sqm)
 - i. Basement.
 - ii. Superstructure
6. Type of power supply system.
7. Type of equipment in substation & for internal works.
8. Time taken for
 - a. Substation.
 - b. Internal works.
 - c. Total Project.

9. Specialized service, if any, provided, with cost details,
10. Specialized Tools & Plant deployed for the project.
11. Project Management organization structure.
12. Number of shift and its duration adopted in execution.
13. Systems adopted for timely completion of the project.

Signature of Applicant/ Authorized Signatory

FORM 'B-2'

7.6 DETAILS OF 'SIMILAR ELECTRICAL WORKS' COMPLETED DURING THE LAST SEVEN YEARS UPTO 31.10.2024

1	2	3	4	5	6	7	8	9	10	11	12
S. No.	Name of work/project & location	Owner or sponsoring organizations	Date of Agreement with the owner	Scope of work executed	Built up area of the project in sqm.	Cost of project work in Crores	Date of commencement as per contract & actual date of commencement	Stipulated Date of completion & Actual date of completion	Litigation / Arbitration pending / In progress with details (if any)	Name and address with contact No. of Officer of client to whom reference shall be made	Remarks

Signature of Applicant/ Authorized Signatory

Note: The projects mentioned in the above format shall be sorted in the order of cost of the project (Descending order)

*FORM- B2.1***7.7 SUPPLEMENTARY INFORMATION ON COMPLETED MAJOR ELECTRICAL WORKS**

1. Name of work
2. Location
3. Client's name and address
4. Consultants name and address.
5. Scope of work.
 - a. Number of floors in Basement.
 - b. Number of floors in Superstructure.
 - c. Height of the building (m).
 - d. Built up area. (Sqm)
 - i. Basement.
 - ii. Superstructure
6. Type of power supply system.
7. Type of equipment in substation & for internal works.
8. Time taken for
 - i. Substation.
 - ii. Internal works.
 - iii. Total Project.
9. Specialized service, if any, provided, with cost details,
10. Specialized Tools & Plant deployed for the project.
11. Project Management organization structure.
12. Number of shift and its duration adopted in execution.
13. Systems adopted for timely completion of the project.

Signature of Applicant/ Authorized Signatory

FORM 'B3'

7.8 DETAILS OF ALL 'SIMILAR FIRE-FIGHTING WORKS' COMPLETED DURING THE LAST SEVEN YEARS UPTO 31.10.2024

1	2	3	4	5	6	7	8	9	10	11	12
S. No.	Name of work/ project & location	Owner or sponsoring organizations	Date of Agreement with the owner	Scope of work executed	Built up area of the project in sqm.	Cost of project work in Crores	Date of commencement as per contract & actual date of commencement	Stipulated Date of completion & Actual date of completion	Litigation / Arbitration pending / In progress with details (if any)	Name and address with contact No. of Officer of client to whom reference shall be made	Remarks

Signature of Applicant/ Authorized Signatory

Note:

Actual date of completion of the project should be within 7 years upto 31.10.2024. The projects mentioned in the above format shall be sorted in the order of cost of the project (Descending order)

Signature & Seal of Contractor

*FORM B 3.1***7.9 SUPPLEMENTARY INFORMATION ON COMPLETED MAJOR FIRE-FIGHTING WORKS**

1. Name of work
2. Location
3. Client's name and address
4. Consultants name and address.
5. Scope of work.
 - a. Number of floors in Basement.
 - b. Number of floors in Superstructure.
 - c. Height of the building (m).
 - d. Built up area. (Sq m)
 - i. Basement.
 - ii. Superstructure
- 6 Type of power supply system.
7. Type of equipment in substation & for internal works.
8. Time taken for
 - iv. Substation.
 - v. Internal works.
 - vi. Total Project.
9. Specialized service, if any provided, with cost details,
10. Specialized Tools & Plant deployed for the project.
11. Project Management organization structure.
12. Number of shift and its duration adopted in execution.
13. Systems adopted for timely completion of the project.

Signature of Applicant/ Authorized Signatory

Signature & Seal of Contractor

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FORM 'C'

7.10 'SIMILAR' PROJECTS ON HAND - UNDER EXECUTION OR AWARDED

1	2	3	4	5	6	7	8	9	10	11	12	13
Sl. No.	Name of work/project & location	Client / Owner or sponsor	Type of Client / Owner (Mention Govt/ Semi Govt / PSU / Autonomous / Private)	Date of Agreement with the owner	Built up area of the project in sqm	Cost of project work in Crores	Date of commencement as per contract & actual date of commencement	Stipulated Date of completion	Up to date percentage of work completed	Delay in progress (if any) and reasons thereof	Name and address with contact No. of Officer to whom reference shall be made	Remarks (Indicate whether any show-cause notice issued or Arbitration initiated during the progress work)

Signature of Applicant/ Authorized Signatory

Note: The projects mentioned in the above format shall be sorted in the order of cost of the project (Descending order)

FORM 'C2

7.11 'SIMILAR ELECTRICAL WORKS' PROJECTS ON HAND - UNDER EXECUTION OR AWARDED

1	2	3	4	5	6	7	8	9	10	11	12	13
Sl. No.	Name of work/project & location	Client / Owner or sponsor	Type of Client / Owner (Mention Govt/ / Semi Govt / PSU / Autonomous / Private)	Date of Agreement with the owner	Built up area of the project in sqm	Cost of project work in Crores	Date of commencement as per contract & actual date of commencement	Stipulated Date of completion	Up to date percentage of progress of work completed	Delay in progress (if any) and reasons thereof	Name and address with contact No. of Officer of client to whom reference shall be made	Remarks (Indicate whether any show-cause notice issued or Arbitration initiated during the progress work)

Signature of Applicant/ Authorized Signatory

Note: The projects mentioned in the above format shall be sorted in the order of cost of the project (Descending order)

Signature & Seal of Contractor

FORM 'C-3

7.12 'SIMILAR FIRE-FIGHTING' PROJECTS ON HAND - UNDER EXECUTION OR AWARDED

1	2	3	4	5	6	7	8	9	10	11	12	13
Sl. No.	Name of work/project & location	Client / Owner or sponsor/organisations	Type of Client / Owner (Mention Govt/ / Semi Govt / PSU / Autonomous / Private)	Date of Agreement with the owner	Built up area of the project in sqm	Cost of project in Crores	Date of commencement as per contract & actual date of commencement	Stipulated Date of completion	Up to date percentage of work completed	Delay in progress (if any) and reasons thereof	Name and address with contact No. of Officer of client to whom reference shall be made	Remarks (Indicate whether any show-cause notice issued or Arbitration initiated during the progress work)

Signature of Applicant/ Authorized Signatory

Note: The projects mentioned in the above format shall be sorted in the order of cost of the project (Descending order)

*FORM 'D'/Annexure-D***7.13 PERFORMANCE REPORT FOR 'SIMILAR' MAJOR COMPLETED WORKS INCLUDING ELECTRICAL & FIRE FIGHTING WORK**

1. Name of the work/ Project & Location-
2. Scope of work. -
4. Agreement No & Date.
5. Estimated Cost / Tendered Cost
6. Actual Value of work done Value of Extra Items Executed
7. Date of commencement
 - a. Stipulated date of commencement.
 - b. Actual date of commencement.
8. Date of completion
 - a. Stipulated date of completion.
 - b. Actual date of completion.
9. Amount of compensation levied for delayed completion if any.
10. Performance report based on

Quality of Work,	: Very Good / Good / Fair / Poor
Time Management,	: Very Good / Good / Fair / Poor
Resourcefulness	: Very Good / Good / Fair / Poor
Financial Soundness	: Very Good / Good / Fair / Poor
Technical Proficiency	: Very Good / Good / Fair / Poor
QA / QC at Works.	: Very Good / Good / Fair / Poor
Safety & Health Measures at Work	: Very Good / Good / Fair / Poor Ability to Work within
Contract's Allotted Cost	: Very Good / Good / Fair / Poor

Superintending Engineer /
Chief Project Manager or Equivalent

Date :

(Name of Organization) :

2. The performance report is to be submitted separately for all major works mentioned in different Forms.
3. The performance report preferably be submitted in the above Performa. In case different proforma is used, the applicant shall ensure that the report / certificate shall contain all the above information / details.

FORM/ ANNEXURE 'E'

7.14 DETAILS OF KEY TECHNICAL AND ADMINISTRATIVE PERSONNEL EMPLOYED IN THE ORGANIZATION

Sr. No.	Designation	Total Number	Names	Educational Qualification	Professional Experience	Length of continuous service with employer in years
1	2	3	4	5	6	7

Signature of Applicant/ Authorized Signatory

Note:

1. Details of Technical personnel shall be provided qualification-wise.
2. Organization chart of the company, additional information about Technical and administrative personnel, if any, may be submitted on separate sheet.

FORM/ANNEXURE 'F'

7.15 DETAILS OF PLANT & MACHINERY, MANUFACTURING UNITS, TOOLS AND EQUIPMENTS LIKELY TO BE USED IN CARRYING OUT THE WORK.

Sr. No	Name of the Tools / Machinery / Equipment	Unit	Make / Model / Capacity or Type	Age in years	Condition of the unit	Ownership Status (mention the quantity)			Current	Remarks
						Presently owned	To be purchased	Leased		
1	2	3	4	5	6	7	8	9	10	11

Signature of Applicant/ Authorized Signatory

7.16 Declaration-Cum- Certificate on the Letter Head of Contractor Regarding Restrictions on Procurement From Contractors From A Country Or Countries, On Grounds Of Defence In India, Or Matters Directly Related Thereto, Including National Security.

Restrictions under Rule 144 (XI) of General Financial Rules 2017 of Ministry of Finance, India order no. F. No 6/18/2019/PPD dated 23rd July 2020

I/We have read the clause regarding restrictions on procurement from a Contractor of a country which shares a land border with India;

I/We, the Contractor (Specify full name) _____

certify that we are NOT from such a country OR, if from such a country, has been registered with Competent Authority.

I/We hereby certify that we fulfil all requirements in this regard and is eligible to be considered.

(Signature of Authorized Signatory along with Seal)

Name of authorized signatory:

Designation of Authorized signatory:

List of Evidences enclosed:

1. Copy of certificate of valid registration with the Competent Authority (Score out if not applicable)
2.
3.
4.

Date: Place:

ANNEXURE -H

7.17 SOLVENCY CERTIFICATE WITH BANK'S DETAIL

This is to certify that M/s _____ address _____ is a customer of our bank and banking with us for the last years. Presently, the firm has availed undernoted banking facility/ies:

Sl. no.	Facility	Type of a/c	Present balance	Average balance during last 6 months

2. The conduct of firm's & key person's account have found to be satisfactory. As per the basis of credit facilities provided to the firm/ turnover in the accounts/ details available with us, the firm can be treated as good for any engagement up to a limit of Rs.____ (Rupees _____).

3. This certificate is issued on the basis of bank's record/ transactions with the bank, without any guarantee or responsibility on the bank or any of the officers, with confirmation that facts mentioned herein as per our record.

(Signature of Branch Manager with Seal)

Note:

1. Banker's certificate should be on the letter head of the scheduled commercial bank.
2. In case of partnership firm, certificate to include names of all partners as recorded with the bank.

FORM 'I'

7.18 PROFORMA ON ISO CERTIFICATION OR OTHERS (IF ANY)

1. Year of Certification
2. Name and Address of Certifying Agency
3. Name of Management Representative
4. Validity of Certificate

Annexure 'J'**7.19 DECLARATION**

I/We have inspected the site, i.e. plots of land at No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara, Gujarat and I/We have made me/ us fully acquainted with the local conditions in and around the sites of works and the proposed work.

I/We hereby declare that I/ We have carefully gone through the conditions laid down in the Pre – Qualification Document Notice Inviting tender- Application Forms, Instructions to Tenderers/ applicants, General Rules, Terms And Conditions Of Contract, Declarations, Technical Details, Forms & Annexures, etc. and have clearly understood the same and on the basis of the same I/ We have applied & submitted our Application Forms & related documents.

We accept all the terms and conditions of Tender - Application Forms documents. We will abide by the same mentioned in the Application Forms.

I/ We hereby declare that, in particular during execution of all works at site; it will be my/ our sole responsibility to strictly adhere to/meticulously follow the Instructions to tenderers, General Rules, Terms And Conditions of Contract, Safety Code, Technical Details, etc.

I/ We hereby declare that I/ We shall obtain necessary permissions in time and also shall uniformly maintain such progress as may be directed by the employer to ensure completion of same within the target date/ time as mentioned in the tender application Forms document.

Date:

Signature and seal of Authorized Signatory/

Applicant Place :

Witness: (with Name)

1.

2.

Annexure 'K'**7.20 Scoring Matrix / Evaluation Sheet**

S. No.	Particulars	Maximum Marks	Marks Obtained
1	Average annual turnover of the Company as per Audited Balance Sheets as on 31st March: 2022, 2023 and of 2024 (Audited). (INR)		
	> 25 crores or above	7	
	> 16 crores or above but <= 25 crores	5	
	> 7 crores or above but <= 16 crores	3	
2	Value of Largest single construction project of commercial/Institutional/residential building minimum having more than 15 meter height from Ground Level and minimum 1 Basement completed in the last 7 years (upto 31.10.2024). (INR)		
	>= 19.46 crores	7	
	>= 14.6 crores < 19.46 crores	5	
	>=9.73 crores < 14.6 crores	3	
3	Construction of project of commercial/Institutional/residential high rise building, with height from Ground Level, completed in the last 7 years (upto 31.10.2024).		
	25mtr & above	7	
	20mtr to <= 25mtr	5	
	> 15mtr to <=20mtr	3	
4	Number of years of experience in the construction.		
	above 15	7	
	above 11 <= 15	5	
	above 7 <= 11	3	

S. No.	Particulars	Maximum Marks	Marks Obtained
5	Availability of in-house engineers, etc. with minimum qualification of BE/B.Tech. Degree		
	QA/QC Civil Engineers (Minimum 10 Yrs experience)	1	
	Safety Engineer/ Officer (Minimum 7 Yrs experience)	1	
	Architect (Minimum 7 Yrs experience)	1	
	Electrical Engineers (Minimum 7 Yrs experience)	1	
	Project Managers (Minimum 15 Yrs experience)	1	
6	No. of Employees in house (On Payroll), who are technically qualified (in case of both diploma and degree holder (eg. Project Managers, Asst Project in-charge Engineers, Site Engineers, QA/QC Engineer, Safety Engineer, Billing Engineer, PHE engineer, etc.		
	> 15 persons with diploma civil/ architecture/Elec./Safety etc. or 5 person with Degree in engineering / architecture/Elec./Safety etc	7	
	> 10 persons with diploma civil/ architecture/Elec./Safety etc or 3 person with Degree in engineering / architecture/Elec./Safety etc	6	
	5 persons with diploma civil/ architecture/Elec./Safety etc or 2 person with Degree in engineering /architecture/Elec./Safety etc	5	
7	Whether the applicant firm had completed works of construction project of commercial/Institutional/residential building minimum having more than 15 meter height from Ground Level and minimum 1 Basement for the under noted types of clients (subject to minimum 1 works).		
	Constitution of the applicant firm		
	Govt./Public Ltd.	6	
	Private Ltd.	4	
	Partnership & Others	3	

S. No.	Particulars	Maximum Marks	Marks Obtained
8	No. of construction contracts executed during last 7 years, with construction project of commercial/Institutional/residential building minimum having more than 15 meter height from Ground Level and minimum 1 Basement. (upto 31.10.2024).		
	above 5	6	
	Above 3 <= 5	5	
	above 1 <= 2	4	
9	Position of financial soundness of the firm on the basis of net worth of the company as per audited Balance Sheet as on 31.03.2024 (Audited).		
	> 15 crores	6	
	>10 crores but <= 15 crores	4	
	> 7.30 crores but <= 15 crores	2	
10	Whether applicant firm has timely completed the work?		
	100% of Similar Eligible work completed within time frame, without giving extension.	6	
	100% of Similar Eligible works not completed within time frame, but extension of time was given by the Client & work completed. (Max up to 2 Nos)	3	
11	No of construction Projects of commercial/Institutional/residential building minimum having more than 15 meter height from Ground Level and minimum 1 Basement completed, where Green Certification was awarded (enclose copy/ies of certificates & completion certificate by LEED /GRIHA etc). (last 7 years upto 31.10.2024).		
	above 3	3	
	above 1 <= 3	2	

	At least 1	1	
	Nil	0	

S. No.	Particulars	Maximum Marks	Marks Obtained
12	Whether applicant firm is having independent office within Ahmedabad / Gandhinagar, with landline number in the name of firm?		
	Yes	1	
	No	0	
13	Whether firm is running in profit (before tax), during last 3 financial years? (ended on 31.03.2024 (Audited)).		
	All 3 Years	6	
	For 2 years Only	5	
	For 1 year Only	4	
14	In the completed qualifying project/s of constructing high rise building, whether electrical work was done in-house or through sub contracting?		
	In-house	6	
	Through sub-contracting	5	
15	In the completed qualifying project/s, whether fire-fighting work was done in-house or through sub-contracting?		
	In-house	6	
	Through sub-contracting	5	
16	Performance Certificate from the Central Govt. Dept./State Govt. Dept./ Semi Govt. Dept. /PSU/ Public sector Banks, Public limited (Listed) Company: (Supporting documents/proofs if any).		
	(a) If Very Good Performance Certificate from more than three Principal Employer have been issued and submitted for Similar projects.	5	
	(b) If Very Good Performance Submitted from two employers for Similar projects.	4	
	(c) If Very Good Performance Submitted from one employers for Similar projects.	3	

17	Special Awards in Last 7 Years (upto 31.10.2024) from third party organizations/ institutions like CREDAI, AESA, BAI, etc. for similar works		
	above 3	5	
	above 1 <= 3	3	
	At least 1	2	

S. No.	Particulars	Maximum Marks	Marks Obtained
18	ISO Certification: QA/QC Policy :		
	Whether the Applicant Company has got any Documented Quality Policy for QA /QC for similar Works & proof of its implementation at Site:		
	Yes	2	
	No	0	
19	ISO Certification: HSE Policy:		
	Health and Safety Related Policies : Whether the Applicant Company has got any Documented Health and Safety Policy for similar works and proof of its implementation at Site :		
	Yes	2	
	No	0	
	Total Max. Marks (100) (qualifying marks: 60%)		

Documentary evidence must be furnished against each of the above criteria. # Documents must be signed by the authorized signatory of the Contractor.

Relevant portions, in the documents submitted in pursuance of eligibility criteria should be highlighted.

8 INFORMATION & INSTRUCTIONS FOR BIDDERS FOR e-BIDDING (IIBeB)

PART-A of INFORMATION & INSTRUCTIONS FOR BIDDERS FOR e-BIDDING:

1. DISCLAIMER:

1. The information contained in this TENDER or information provided subsequently to Bidder(s) whether verbally or in documentary form/email by or on behalf of SBI, is subject to the terms and conditions set out in this TENDER.
2. This TENDER is not an offer by State Bank of India, but an invitation to receive responses from the eligible Bidders qualified through of Prequalification of Bidders.
3. The purpose of this TENDER is to provide the Bidder(s) with information to assist preparation of their Bid proposals. This TENDER does not claim to contain all the information each Bidder may require. Each Bidder should conduct its own investigations and analysis and should check the accuracy, reliability and completeness of the information contained in this TENDER and where necessary obtain independent advices/clarifications. Bank may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement the information in this TENDER.
4. The Bank, its employees and advisors make no representation or warranty and shall have no liability to any person, including any Bidder under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this TENDER or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the TENDER and any assessment, assumption, statement or information contained therein or deemed to form or arising in any way for participation in this bidding process.
5. The Bank also accepts no liability of any nature whether resulting from negligence or otherwise, howsoever caused arising from reliance of any Bidder upon the statements contained in this TENDER.
6. The Bidder is expected to examine all instructions, forms, terms and specifications in this TENDER. Failure to furnish all information required under this TENDER or to submit a Bid not substantially responsive to this TENDER in all respect will be at the Bidder's risk and may result in rejection of the Bid.
7. The issue of this TENDER does not imply that the Bank is bound to select a Bidder or to award the contract to the Selected Bidder, as the case may be, for the Project and the Bank reserves the right to reject all or any of the Bids or Bidders without assigning any reason whatsoever before issuance of purchase order/LOI and/or its acceptance thereof by the successful Bidder as defined in Award Criteria and Award of Contract in this TENDER.

2. COST OF BID DOCUMENT:

- i) The participating Bidders shall bear all the costs associated with or relating to the preparation and submission of their Bids including but not limited to preparation, copying,

postage, delivery fees, expenses associated with any demonstration or presentations which may be required by the Bank or any other costs incurred in connection with or relating to their Bid. The Bank shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by a Bidder regardless of the conduct or outcome of the bidding process.

ii) The Bidder shall also submit PRE-CONTRACT INTEGRITY PACT along with technical Bid as prescribed in Annexure- XVIII duly signed by the Bidder on each page and witnessed by two persons. The Pre-Contract Integrity Pact shall be stamped as applicable in the State where it is executed. Bid submitted without Pre-Contract Integrity Pact, as per the format provided in the TENDER, shall not be considered.

3. CLARIFICATION AND AMENDMENTS ON TENDER/PRE-BID MEETING:

1. Bidder requiring any clarification on TENDER may notify the Bank in writing strictly as per the format given in Annexure XIX at the address/by e-mail within the date/time mentioned in the Notice Inviting Tender (NIT).
2. A pre-Bid meeting will be held in person or online on the date and time specified in the Notice Inviting Tender (NIT) which may be attended by the authorized representatives of the Bidders interested to respond to this TENDER.
3. The queries received (without identifying source of query) and response of the Bank thereof will be posted on the Bank's website or conveyed to the Bidders.
4. The Bank reserves the right to amend, rescind or reissue the TENDER, at any time prior to the deadline for submission of Bids. The Bank, for any reason, whether, on its own initiative or in response to a clarification requested by a prospective Bidder, may modify the TENDER, by amendment which will be made available to the Bidders by way of corrigendum/addendum. The interested parties/Bidders are advised to check the Bank's website regularly till the date of submission of Bid document specified in the Notice Inviting Tender (NIT)/email and ensure that clarifications / amendments issued by the Bank, if any, have been taken into consideration before submitting the Bid. Such amendments/clarifications, if any, issued by the Bank will be binding on the participating Bidders. Bank will not take any responsibility for any such omissions by the Bidder. The Bank, at its own discretion, may extend the deadline for submission of Bids in order to allow prospective Bidders a reasonable time to prepare the Bid, for taking the amendment into account. Nothing in this TENDER or any addenda/corrigenda or clarifications issued in connection thereto is intended to relieve Bidders from forming their own opinions and conclusions in respect of the matters addresses in this TENDER or any addenda/corrigenda or clarifications issued in connection thereto.
5. No request for change in commercial/legal terms and conditions, other than what has been mentioned in this TENDER or any addenda/corrigenda or clarifications issued in connection thereto, will be entertained and queries in this regard, therefore will not be

entertained.

6. Queries received after the scheduled date and time will not be responded/acted upon.

4.0 MODIFICATION AND WITHDRAWAL OF BIDS:

i) The Bidder may modify or withdraw its Bid after the Bid's submission, provided modification, including substitution or withdrawal of the Bids, is received on <https://www.tenderwizard.com/SBIETENDER>, prior to the deadline prescribed for submission of Bids.

ii) No modification in the Bid shall be allowed, after the deadline for submission of Bids.

lii) No Bid shall be withdrawn in the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified in this TENDER. Withdrawal of a Bid during this interval may result in the forfeiture of EMD submitted by the Bidder and other action as per terms of TENDER.

5.0 PERIOD OF BID VALIDITY AND VALIDITY OF PRICE QUOTED IN REVERSE AUCTION (RA):

- i) Technical Bid shall remain valid for duration of 90 days from last the date of submission. If the tenderer withdraws his/her offer during the validity period or makes modifications in his/her original offer which are not acceptance to the Bank without prejudice to any other right or remedy the Bank shall be at liberty to forfeit the EMD.
- ii) Price quoted by the Bidder in Reverse auction shall remain valid for duration of 90 days from the last date of submission
- iii) In exceptional circumstances, the Bank may solicit the Bidders' consent to an extension of the period of validity. The request and the responses thereto shall be made in writing. A Bidder is free to refuse the request. However, in such case, the Bank will not forfeit its EMD. However, any extension of validity of Bids or price will not entitle the Bidder to revise/modify the Bid document.
- iv) Once Purchase Order or Letter of Intent is issued by the Bank, the said price will remain fixed for the entire Contract period and shall not be subjected to variation on any account except as explicitly mentioned in this TENDER. A Bid submitted with an adjustable price quotation will be treated as non-responsive and will be rejected.

6. BID INTEGRITY:

Willful misrepresentation of any fact within the Bid will lead to the cancellation of the contract without prejudice to other actions that the Bank may take. All the submissions, including any accompanying documents, will become property of the Bank. The Bidders shall be deemed to license, and grant all rights to the Bank, to reproduce the whole or any portion of their Bid document for the purpose of evaluation and to disclose the contents of submission for regulatory and legal requirements.

7. WAIVER OF RIGHTS:

Each Party agrees that any delay or omission on the part of the other Party to exercise any right, power or remedy under this TENDER will not automatically operate as a waiver of such right, power or remedy or any other right, power or remedy and no waiver will be effective unless it is in writing and signed by the waiving Party. Further the waiver or the single or partial exercise of any right, power or remedy by either Party hereunder on one occasion will not be construed as a bar to a waiver of any successive or other right, power or remedy on any other occasion.

8. BANK'S RIGHT TO ACCEPT ANY BID AND TO REJECT ANY OR ALL BIDS:

The Bank reserves the right to accept or reject any Bid in part or in full or to cancel the bidding process and reject all Bids at any time prior to contract award as specified in Award Criteria and Award of Contract, without incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Bank's action.

9. CODE OF INTEGRITY AND DEBARMENT/BANNING:

1. The Bidder and their respective officers, employees, agents and advisers shall observe the highest standard of ethics during the bidding Process. Notwithstanding anything to the contrary contained herein, the Bank shall reject Bid without being liable in any manner whatsoever to the Bidder if it determines that the Bidder has, directly or indirectly or through an agent, engaged in corrupt / fraudulent / coercive / undesirable or restrictive practices in the bidding Process.
2. Bidders are obliged under code of integrity to Suo-moto proactively declare any conflicts of interest (pre-existing or as and as soon as these arise at any stage) in TENDER process or execution of contract. Failure to do so would amount to violation of this code of integrity.
3. Any Bidder needs to declare any previous transgressions of such a code of integrity with any entity in any country during the last three years or of being debarred by any other procuring entity. Failure to do so would amount to violation of this code of integrity.
4. For the purposes of this clause, the following terms shall have the meaning hereinafter, respectively assigned to them:
 1. **“Corrupt practice”** means making offers, solicitation or acceptance of bribe, rewards or gifts or any material benefit, in exchange for an unfair advantage in the procurement process or to otherwise influence the procurement process or contract execution.
 2. **“Fraudulent practice”** means any omission or misrepresentation that may mislead or attempt to mislead so that financial or other benefits may be obtained or an obligation avoided. This includes making false declaration or providing false information for participation in a TENDER process or to secure a contract or in execution of the contract.
 3. **“Coercive practice”** means harming or threatening to harm, persons or their property to influence their participation in the procurement process or affect the execution of a contract.
 4. **“Anti-competitive practice”** means any collusion, bid rigging or anti-competitive arrangement, or any other practice coming under the purview of the Competition Act, 2002, between two or more bidders, with or without the knowledge of the Bank, that may impair the transparency, fairness and the progress of the procurement process or to establish bid prices at artificial, non-competitive levels.
 5. **“Obstructive practice”** means materially impede the Bank’s or Government agencies investigation into allegations of one or more of the above mentioned prohibited practices either by deliberately destroying, falsifying, altering; or by concealing of evidence material to the investigation; or by making false statements to investigators and/or by threatening, harassing or intimidating any party to prevent it

from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or by impeding the Bank's rights of audit or access to information;

5. Debarment/Banning

Empanelment/participation of Bidders and their eligibility to participate in the Bank's procurements is subject to compliance with code of integrity and performance in contracts as per terms and conditions of contracts. Following grades of debarment from empanelment/participation in the Bank's procurement process shall be considered against delinquent Vendors/Bidders:

1. Holiday Listing (Temporary Debarment - suspension):

Whenever a Vendor is found lacking in performance, in case of less frequent and less serious misdemeanors, the vendors may be put on a holiday listing (temporary debarment) for a period up to 12 (twelve) months. When a Vendor is on the holiday listing, he is neither invited to bid nor are his bids considered for evaluation during the period of the holiday. The Vendor is, however, not removed from the list of empaneled vendors, if any. Performance issues which may justify holiday listing of the Vendor are:

1. Vendors who have not responded to requests for quotation/tenders consecutively three times without furnishing valid reasons, if mandated in the empanelment contract (if applicable).
2. Repeated non-performance or performance below specified standards (including after sales services and maintenance services etc.).
3. Vendors undergoing process for removal from empanelment/participation in procurement process or banning/debarment may also be put on a holiday listing during such proceedings.

2. Debarment from participation including removal from empanelled list

Debarment of a delinquent Vendor (including their related entities) for a period (one to two years) from the Bank's procurements including removal from empanelment, wherever such Vendor is empaneled, due to severe deficiencies in performance or other serious transgressions. Reasons which may justify debarment and/or removal of the Vendor from the list of empaneled vendors are:

4. Without prejudice to the rights of the Bank under Clause 45(i) hereinabove, if a Bidder is found by the Bank to have directly or indirectly or through an agent, engaged or indulged in any corrupt/fraudulent/coercive/undesirable or restrictive practices during the bidding Process, such Bidder shall not be eligible to participate in any TENDER issued by the Bank during a period of 2 (two) years from the date of debarment.
5. The Vendor fails to abide by the terms and conditions or to maintain the required technical/operational staff/equipment or there is change in its production/service line affecting its performance adversely or fails to cooperate or qualify in the review for empanelment.

6. If Vendor ceases to exist or ceases to operate in the category of requirements for which it is empaneled.
 7. Bankruptcy or insolvency on the part of the vendor as declared by a court of law; or
 8. Banning by Ministry/Department or any other Government agency.
 9. Other than in situations of force majeure, technically qualified Bidder withdraws from the procurement process or after being declared as successful bidder: (i) withdraws from the process; (ii) fails to enter into a Contract; or (iii) fails to provide performance guarantee or any other document or security required in terms of the TENDER documents.
 10. If the Central Bureau of Investigation/CVC/C&AG or Vigilance Department of the Bank or any other investigating agency recommends such a course in respect of a case under investigation.
 11. Employs a Government servant or the Bank's Officer within two years of his retirement, who has had business dealings with him in an official capacity before retirement; or
 12. Any other ground, based on which the Bank considers, that continuation of Contract is not in public interest.
 13. If there is strong justification for believing that the partners / directors / proprietor /agents of the firm/company have been guilty of violation of the code of integrity or Integrity Pact (wherever applicable), evasion or habitual default in payment of any tax levied by law; etc.
3. **Banning from Ministry/Country-wide procurements**
For serious transgression of code of integrity, a delinquent Vendor (including their related entities) may be banned/debarred from participation in a procurement process of the Bank including procurement process of any procuring entity of Government of India for a period not exceeding three years commencing from the date of debarment.

9 INFORMATION & INSTRUCTIONS FOR BIDDERS FOR e-BIDDING: (Part B)

1. Scope of work

Sealed Tenders are invited by M/s. Mamta Shah & Associates, Vadodara for and behalf of State Bank of India for the Construction Of A Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical, LIFT and Other Services (Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)”.

1.1 Site and its location

The proposed work is to be carried out at Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)”.



2.0 Tender documents

2.1 The work has to be carried out strictly according to the conditions stipulated in the tender consisting of the following documents and the most workman like manner.

- Instructions to Tenderers
- General Conditions of Contract
- Special Conditions of Contract
- Technical Specifications
- Drawings
- Price bid

2.2 The above documents shall be taken as complementary and mutually explanatory of one another but in case of ambiguities or discrepancies, shall take precedence in the order given below:

- a. Price Bid
- b. Technical specifications
- c. Special conditions of contract
- d. General conditions of contract
- e. Instructions to Tenderers

2.3 The tender documents are not transferable.

3.0 Site Visit

3.1 The tenderer must obtain himself on his own responsibility and his own expenses all information and data which may be required for the purpose of filling this tender document and enter into contract for the satisfactory performance of the work. The tenderer is requested satisfy himself regarding the availability of water, power, transport and communication facilities, the character quality and quantity of the materials, labour, the law-and-order situation, climatic conditions, local conditions, local authorities' requirement, traffic regulations etc.

The tenderer will be fully responsible for considering the financial effect of any or all the factors while submitting his tender.

3.2 The rates quoted by the Tenderer 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, levies, royalties, cess, 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 APMCF/ Bank. The TDS amount on prevailing rate shall be deducted from Contractor's Running Account/ Final bills and paid to the Government. However, GST will be paid extra as actual.

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

3.4. 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.

3.5 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 APMCF/Bank and the Tenderer prior to the issue of the Letter of Intent and the Letter of Intent awarding the work and acceptance by tenderer shall form the contract.

3.6 The Security Protocol, Systems & Procedures of State Bank of India has to be meticulously followed & complied with during the currency of contract.

4.0 Earnest Money

4.1 The tenderers are requested to submit the Earnest Money of **₹ 24,34,800/- (Rupees Twenty Four Lakh Thirty Four Thousand Eight Hundered Only)** in the form of Demand Draft or Banker's Cheque drawn in favor of State Bank of India drawn at Gandhinagar. On any Bank in India.

EMD to be deposited before the last date of submission of the technical bid.

4.2 EMD in any other form other than as specified above will not be accepted. Tender not accompanied by the EMD in accordance with clause 4.1 above shall be rejected.

4.3 No interest will be paid on the EMD.

4.4 EMD of unsuccessful tenderer will be refunded within 30 days of award of Contract.

4.5 EMD of successful tenderer will be retained as a part of security deposit.

5.0 Initial/ Security Deposit

The successful tenderer will have to submit a sum equivalent to 2% of contract value less EMD by means of DD drawn in favour of State Bank of India Payable at, Gandhinagar within a period of 15 days of acceptance of tender. In case delay in depositing Initial Security Deposit, interest shall be charged to Contractor/Bidder at the applicable Prime lending Rate of SBI.

6.0 Security Deposit / Retention amount:

6.1 Total security deposit shall be 5% of contract value. Out of this 2% of contract value is in the form of Initial Security Deposit (ISD) which includes the EMD. Balance 3% shall be deducted from the running account bill of the work at the rate of 10% of the respective running account bill i.e., deduction from each running bill account will be @10% till total 3% of contract value is reached Total Security Deposit (TSD) including ISD reaches to 5% of contract value. This Retention amount shall be released by the SBI in 2 stages, 50% of the total security shall be paid to the contractors on the basis of architect's certifying the virtual completion. The balance 50% would be paid to the contractors after the defect liability period as specified in the contract. 50% Will be released after issuing of VCC and remaining 50% shall be released after completion of Defect Liability Period ie. one years from the date of virtual completion of work or one complete monsoon seasons and after declaration of closure of Project by APMCF and SBI whichever is later and provided no complaint is received or the defects has been rectified by replacing the same satisfactorily.

6.2 No interest shall be paid to the amount retained by the Bank as Security Deposit & Additional Security Deposit.

6.3 Additional Security Deposit (ASD) Additional Security deposit (ASD)/Additional performance Guarantee (APG) shall be applicable if the bid price is below by 7.5 % or more below of the estimated cost put to tender. The amount of such ASD/ APG shall be the difference between 92.5 % of estimated cost put to tender and the quoted price.

7.0 Signing of contract Documents

The successful tenderer shall be bound to implement the contract by signing an agreement and conditions of contract attached herewith with the respective Department of SBI within 15 days from the receipt of intimation of acceptance of the tender by the SBI. However, the written acceptance of the tenders by the Bank will constitute a binding agreement between the Bank and successful tenderer whether such formal agreement is subsequently entered into or not.

8.0 Completion Period

The time period allowed for completion of the project shall be 24 Months from the date of commencement of work or 15 days from the date of issuance of work order, whichever is earlier.

9.0 Validity of Tender -

Tenders shall remain valid and open for acceptance for a period of 3 (Three) months from the last date of submission. If the tenderer withdraws his/her offer during the validity

period or make modifications in his/her original offer which are not acceptance to the Bank without prejudice to any other right or remedy the Bank shall be at liberty to forfeit the EMD

10. Liquidated Damages

If the contractor fails to maintain the required progress in terms of contract or to complete the work and clear the site including vacating their office on or before the contracted or extended date or completion without justification in support of the cause of delay, he may be called upon without prejudice to any other right of remedy available under the law to the SBI on account of such breach to pay a liquidated damages at the rate of 0.5% of the final value of work per week subject to a maximum of 5% of the final value of work.

11. Rate and prices:

11.1 In case of item rate tender

11.1.1 The tenderers shall quote their rates for individual items both in words and figure. In case of discrepancy between the rate quoted in words and figures, the unit rate quantity in words will prevail. If no rate is quoted for particular one or more tender items, the contractor shall not be paid for that item when it is executed. In such case if these items executed on site no payments shall be done and contractor shall execute those items free of cost.

The amount of each item shall be calculated, and the requisite total is given. In case of discrepancy between the unit rate and the total amount calculated from multiplication of unit rate and the quantity the unit rate quoted will govern and the amount will be corrected.

11.1.2 The tenderers need not quote their rates for which no quantities have been given. In case the tenderers quote their rates for such items those rates will be ignored and will not be considered during execution.

11.1.3 The tenderers should not change the units as specified in the tender. If any unit is changed the tenders would be evaluated as per the original unit and the Contractor/ Vendor would be paid accordingly.

The tenderer should not change or modify or delete the description of the item. If any discrepancy is observed he should immediately bring to the knowledge of the Architect/Bank. SBI.

11.1.4 Each page of the BOQ shall be signed by the authorized person and cutting or overwriting shall be duly attested by him.

11.1.5 Each page shall be totaled, and the grand total shall be given.

11.1.6 The rate quoted shall be firm and shall include all costs, allowances, taxes, GST, levies, etc.

11.1.6 The quoted rate should be firm & inclusive of materials, labour, wages, fixtures, transportation, installation, wastages, Octroi, levies, all cess, royalties, all taxes (but excluding GST), machinery, temporary works such as scaffolding, cleaning, overheads, profit, statutory expenses, incidental charges and all related expenses to complete the work during the currency of contract including authorized extension, if any, but excluding GST, which shall be mentioned in the bills/invoices separately, as applicable. GST shall be as applicable on

actuals.

11.1.7 The SBI reserve their rights to accept any tenders, either in whole or in part or may entrust the work in phases or may drop the part scope of work at any stage of the project within its sole discretion without assigning any reason(s) for doing so and no claim / correspondence shall be entertained in this regard.

11.1.8 In case, it is decided by the SBI to drop one or more Items from the scope of work at any stage of the project, the Contractor/ Vendor shall not be entitled to raise any claim / compensation for such deleted scope of work. Also, the SBI may consider issuing work order for various branches/offices in phases but within a reasonable time interval and the Contractor/ Vendor shall be bound to execute the same within the stipulated time period and as per rates quoted by them in this tender without any claim for price escalation.

13.0 Pre-bid conference shall be held at 15:00 Hrs. on 03.12.2024 Offline at the office of The Assistant General Manager (Premises & Estate), STATE BANK OF INDIA, Premises & Estate Dept., Local Head Office, GIFT City Gandhinagar, Gujarat-382355. Bidders should send all queries by email agmpe.lhoahm@sbi.co.in before pre-bid conference, latest by 01/12/2024 Because of pre-bid conference, certain modifications may be issued to all eligible bidders by the APMCF /SBI by e-mail, if felt necessary by them. If further pre-bid conferences are required for complete and effective interactions, the date and time of same will be communicated at the end of 1st pre-bid meeting or later. All modifications/addendums/corrigendum issued regarding this bidding process, shall be uploaded on website only and shall not be published in any Newspaper.

14.0 The bid submitted shall become invalid if:

- i. The bidder does not deposit EMD and Pre contract integrity pact with SBI office on given address
- ii. The bidder does not upload all the documents as listed in "List of Documents to be scanned & uploaded with duly signed & stamp within the period of bid submission".

15.1 Bidders may please note:

1. The Bidder should quote for the entire package on a single responsibility basis for the services required under this TENDER.
2. Care should be taken that the Technical Bid shall not contain any price information. Such proposal, if received, will be rejected.
3. The Bid document shall be complete in accordance with various clauses of the TENDER document or any addenda/corrigendum or clarifications issued in connection thereto, duly signed by the authorized representative of the Bidder. Board resolution authorizing representative to Bid and make commitments on behalf of the Bidder is to be attached.
4. It is mandatory for all the Bidders to have class-III Digital Signature Certificate (DSC) (in the name of person who will sign the Bid) from any of the licensed certifying agency to participate in this TENDER. DSC should be in the name of the authorized signatory. It should be in corporate capacity (that is in Bidder capacity).

5. Bids are liable to be rejected if only one Bid (i.e. either Technical Bid or Indicative Price Bid) is received.
6. If deemed necessary, the Bank may seek clarifications on any aspect from the Bidder. However, that would not entitle the Bidder to change or cause any change in the substances of the Bid already submitted or the price quoted.
7. The Bidder may also be asked to give presentation at no extra cost to the Bank for the purpose of clarification of the Bid.
8. The Bidder must provide specific and factual replies to the points raised in the TENDER.
9. The Bid shall be typed or written and shall be digitally signed by the Bidder or a person or persons duly authorized to bind the Bidder to the Contract.
10. All the enclosures (Bid submission) shall be serially numbered.
11. Bidder(s) should prepare and submit their online Bids well in advance before the prescribed date and time to avoid any delay or problem during the bid submission process. The Bank shall not be held responsible for any sort of delay or the difficulties faced by the Bidder(s) during the submission of online Bids.
12. Bidder(s) should ensure that the Bid documents submitted should be free from virus and if the documents could not be opened, due to virus or otherwise, during Bid opening, the Bid is liable to be rejected.
13. The Bank reserves the right to reject Bids not conforming to above.

15.2 Evaluation of Technical Bids :

14. At First evaluation will be done. Upon evaluation based on scrutiny of submitted documents, document verification, Site visit, Bidders will get short listed and these bidders shall be treated as technically qualified bidders. The Financial/Price Bid of the Bidders shall be opened, who qualifies through TENDER Bid evaluation.

15. The bidders who submit TENDER Bid and above documents without any conditions shall be considered only for evaluation and Fuhrer Price Bid Opening process.

16.0 Award criteria and Award of contract :

The indicative price bids of technically qualified Bidders will be opened. Thereafter, e-reverse auction will be conducted. The L1 bidder based on e-reverse auction will be finalized.

(B) BUSINESS RULE DOCUMENT

BUSINESS RULE DOCUMENT OF ONLINE REVERSE AUCTION FOR THE PROPOSED COMPOSITE CONSTRUCTION OF A MULTI-STOREY AO BUILDING (LOWER BASEMENT + UPPER BASEMENT +GROUND FLOOR TO SIXTH FLOOR) INCLUDING CIVIL, PLUMBING, ELECTRICAL AND OTHER SERVICES (GREEN BUILDING WITH GOLD RATING IN LEED /GRIHA) FOR STATE BANK OF INDIA AT FINAL PLOT NO.116, T.P. SCHEME NO. 3, BHAYALI, VASNA-BHAYALI ROAD VADODARA (GUJARAT)”

BUYER NAME	The Assistant General Manager (Premises & Estate), STATE BANK OF INDIA Premises & Estate Dept., Local Head Office, 2nd FLOOR, PLOT NO-53A, SBI TOWER,GIFT CITY, GANDHINAGAR		
AUCTION TO BE CONDUCTED BY	M/S. Antares System Ltd, Bengluru 137/3, 'Honganasu' Kengari, Bangalore - 560060.		
DATE & TIME OF AUCTION	ONLINE REVERSE AUCTION FOR AUCTION FOR THE PROPOSED COMPOSITE Construction Of A Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)		
	Online Auction Date: --As per NIT		
	Auction Time: As per NIT (Unlimited Extension of 5 Minutes Each) Auction Website : https://etender.sbi		
DOCUMENTS ATTACHED	<ol style="list-style-type: none"> 1. Business rules for Reverse Auction 2. Terms & conditions of Reverse Auction 3. Annexure - I 4. Process Compliance Statement (Annexure II) 5. Price Confirmation Letter (Annexure III) 6. Price break up (Annexure IV) 7. Contact Information 		
SPECIAL INSTRUCTIONS	Bidding in the last minutes and seconds should be avoided in the bidder's own interest Neither the Service Provider nor SBI will be responsible for any lapses /failure on the part of the vendor, in such cases.		

Important Note: As per the new Inter-operability guidelines released by Controller of Certifying Authorities (CCA), the Secured Socket Layer (SSL) certificate for an e-Procurement application is generated on a new algorithm, SHA2. Also, the Digital Signature Certificates that will be applicable for these platforms have to be SHA2 algorithm compliant. For the same, the users have to ensure M/S. Antares System Limited| Confidential that they have Windows XP (SP3) / Windows Vista / Windows 7 installed in their respective PC / Laptop. In case of Windows XP service pack -3, if you get any issue you can install the SSL patch, which is available at our download section of our e-Tender/e-Auction Portal and also at our corporate website <https://www.tenderwizard.com/SBIETENDER> just below the label of “Download”.

(A) Business rules for Reverse Auction:

Against this Inquiry for the subject item/system with detailed scope of supply as per our specification, SBI may resort to “REVERSE AUCTION PROCEDURE” i.e. ON-LINE BIDDING on INTERNET.

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.
2. SBI will engage the services of a service provider who will provide all necessary training and assistance before commencement of on-line bidding on Internet.
3. SBI will inform the vendor in writing in case reverse auction, the details of service provider to enable them to contact and get trained.
4. Business rules like event date, time, start price, bid decrement, extensions, etc. also will be communicated through service provider for compliance.
5. Vendors have to send the mail the compliance form in the prescribed format (provided by service provider) before start of Reverse auction. Without this the vendor will not be eligible to participate in the event.
6. Reverse auction will be conducted on schedule date & time.
7. At the end of reverse auction event, the lowest bidder value will be known on the network.
8. The lowest bidder has to mail the duly signed filled-in prescribed format as provided on case-to-case basis to SBI through service provider within 24 hours of auction without fail.
9. In case SBI decides not to go for Reverse auction procedure for this tender enquiry, the price bids and price impacts, if any already submitted and available with SBI shall be opened as per SBI standard practice.
10. The reverse auction will be treated as closed only when the bidding process gets closed in all respects for the item listed in the tender.

(B) Terms & conditions of Reverse Auction:

SBI shall finalize the procurement of the item against this Tender through reverse auction mode. SBI has made arrangement with M/S. Antares System Limited, Bengaluru, who shall be SBI’s authorized service provider for the same. Please go through the guidelines given below and submit your acceptance to the same along with your Commercial Bid.

1. Computerized Reverse auction shall be conducted by M/S. Antares System Limited on behalf of SBI, on prespecified date, while the vendors shall be quoting from their own offices/ place of their choice. Internet connectivity and other paraphernalia requirements shall have to be ensured by vendors themselves. In the event of failure of their Internet connectivity, (due to any reason whatsoever it may be) it is the bidders’

responsibility. In order to ward-off such contingent situation bidders are requested to make all the necessary arrangements/ alternatives such as back -up power supply whatever required so that they are able to circumvent such situation and still be able to participate in the reverse auction successfully. Failure of power at the premises of vendors during the Reverse auction cannot be the cause for not participating in the reverse auction. On account of this, the time for the auction cannot be extended and SBI and M/S. Antares System Limited is not responsible for such eventualities.

2. M/S. Antares System Limited shall arrange to train your nominated person(s), without any cost to you. They shall also explain you all the Rules related to the Reverse Auction. You are required to give your compliance on it before start of bid process.
3. **BIDDING CURRENCY AND UNIT OF MEASUREMENT:** Bidding will be conducted in Indian currency & Unit of Measurement will be displayed in Online Auction.
4. **BID PRICE:** The Bidder has to quote the rate as per the Tender Document provided by State Bank of India.
5. **VALIDITY OF BIDS:** The Bid price shall be firm for a period specified in the tender document and shall not be subjected to any change whatsoever.
6. At the end of the reverse auction, bidder has to provide the price confirmation letter & a detail break up for his lowest offer within 24 hours of closing of auction as per the Annexure III & IV respectively.
7. Procedure of Reverse Auction:

Online English Reverse (no ties) Auction {Reverse Auction}:

1. **OPENING PRICE & BID DECREMENT AMOUNT:** SBI will declare its Opening Price (OP), which shall be visible to all vendors during the start of the reverse Auction. You will be required to start bidding after announcement of Opening Price and decrement amount. Also, please note that the start price of an item in online reverse auction is open to all the participating bidders. Any bidder can start bidding, in the online reverse auction, from the start price itself. Also, please note that the first online bid that comes in the system during the online reverse auction can be equal to the auction's start price, or lesser than the auction's start price by one decrement, or lesser than the auction's start price by multiples of decrement. The second online bid and onwards will have to be lesser than the L1 rate by one decrement value, or lesser than the L1 rate by **multiples of the decrement value.**
2. The bid start price and decrement amount shall be specified by SBI
3. **DURATION OF AUCTION: English Reverse (no ties) shall be for a period of ONE HOUR.** If a bidder places a Bid in the last 5 minutes of Closing of the Auction, the auction shall get extended automatically for another 5 minutes. In case, there is no Bid in the last 5 minutes of closing of Auction, the Auction shall get closed automatically without any extension. Please note that if there are more than one item in a single auction, the auto-extension will be applicable to the entire event i.e. whenever a bidder places an acceptable bid in the last 5 minutes of the closing of the auction, the auction shall get extended automatically for another 5 minutes from the time of this bid for all the items

in the auction. **There are Unlimited Extensions of 5 Min. each.** Vendors are advised not to wait till the last minute or last few seconds to enter their bid during the auto-extension period to avoid complications related with internet connectivity, network problems, system crash down, power failure, etc.

1. Successful vendor shall be required to submit the final prices, quoted during the English Reverse (no ties) exactly in the format issued by SBI/Service provider after the completion of Auction to SBI, duly signed and stamped as token of acceptance without any new condition other than those already agreed to before start of auction.
2. During English Reverse (no ties), if no bid is received within the specified time, SBI, at its discretion, may decide to revise Opening price / scrap the reverse auction process / proceed with conventional mode of tendering.
3. Bids once made by you, cannot be cancelled / withdrawn and you shall be bound to supply as mentioned above at your final bid price. Should you back out and not supply as per the rates quoted, SBI shall take action as appropriate.
4. **LOG IN NAME & PASSWORD:** Each Bidder is assigned a Unique Username & Password by M/S. Antares System Limited. The Bidders are requested to change the Password after the receipt of initial Password from M/S. Antares System Limited. All bids made from the Login ID given to the bidder will be deemed to have been made by the bidder.
5. **VISIBILITY TO BIDDER:** The Bidder shall be able to view the following on his screen along with the necessary fields during English Reverse - No ties Auction:
 - a Leading Bid in the Auction
 - b Bid Placed by you
 - c Auction Opening Price & bid decrement amount
 - d Your rank in the auction
6. **BIDS PLACED BY BIDDER:** The bid of the bidder will be taken to be an offer to execute the work. Bids once made by the bidder cannot be cancelled. The bidder is bound to execute the work as mentioned above at the price that they bid. Should any bidder back out and not make the supplies as per the rates quoted, SBI and / or M/S. Antares System Ltd shall take action as appropriate.
7. **LOWEST BID OF A BIDDER:** In case the bidder submits more than one bid, the lowest bid will be considered as the bidder's final offer to execute the work.
8. At the end of the Reverse Auction, SBI will decide upon the winner. SBI's decision on award of Contract shall be final and binding on all the Bidders.
9. SBI shall be at liberty to cancel the reverse auction process / tender at any time, before ordering, without assigning any reason.
10. SBI/ M/S. Antares System Limited shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause.
11. Other terms and conditions shall be as per your techno-commercial offers and other

correspondences till date.

12. You are required to submit your acceptance to the terms / conditions / modality given above before participating in the reverse auction.

13. AUCTION TYPE: 1) English Reverse No Ties Auction

14. OTHER TERMS & CONDITIONS:

1. The Bidder shall not involve himself or any of his representatives in Price manipulation of any kind directly or indirectly by communicating with other suppliers / bidders.
2. The Bidder shall not divulge either his Bids or any other exclusive details of SBI to any other party.
3. SBI's decision on award of Contract shall be final and binding on all the Bidders.
4. SBI along with M/S. Antares System Ltd can decide to extend, reschedule or cancel any Auction. Any changes made by SBI and / or M/S. Antares System Ltd, after the first posting will have to be accepted if the Bidder continues to access the site after that time.
5. M/S. Antares System Ltd shall not have any liability to Bidders for any interruption or delay in access to the site irrespective of the cause.
6. M/S. Antares System Ltd is not responsible for any damages, including damages that result from, but are not limited to negligence. M/S. Antares System Ltd will not be held responsible for consequential damages, including but not limited to systems problems, inability to use the system, loss of electronic information etc.

N.B.

7. All the Bidders are required to submit the Process Compliance Statement (Annexure II) duly signed to M/S. Antares System Ltd, Bengaluru.
8. All the bidders are requested to ensure that they have a valid digital signature certificate well in advance to participate in the online event.

(C) ANNEXURE- I - The List of Items to be procured along with the Quantities and the Auction Start Time & Close Time is as follows:

ITEM DESCRIPTION: FOR ESTABLISHMENT OF PROPOSED “Construction Of A Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)”

Item	Quantity	Opening Prices in ₹ excluding GST	Bid Decrement in Rs	Opening Time	Closing Time
PROPOSED COMPOSITE Construction Of A Multi-Storey Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)”	1	Will be displayed On Auction screen	Will be displayed On Auction screen	As above	As above

10.Process Compliance Statement (Annexure II)

(The bidders are required to print this on their company's letter head and sign, stamp before emailing)

To,
M/S. Antares System Limited.,
24 Sudha Complex, 3rd Stage,
4th Block, Basaveshwar Nagar,
Bengaluru - 560079

SUB: AGREEMENT TO THE PROCESS RELATED TERMS AND CONDITIONS FOR ONLINE REVERSE AUCTION PROPOSED COMPOSITE Construction Of A Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)”

Dear Sir,

This has reference to the Terms & Conditions for the Reverse Auction mentioned in the Tender document.

This letter is to confirm that:

1. The undersigned is authorized representative of the company.
2. We have read examined and understood the TENDER/Technical Bid / e-Auction documents pertaining to this event and have no reservations to the same.
3. We have studied all the terms & condition, commercial terms, the Business Rules governing the e-auction as mentioned in TENDER (if any) and understood the TENDER/Technical / e-Auction Business Rules documents (if any) pertaining to this event and confirm our agreement to them.
4. We confirm that before participating in e-Auction event, we will arrange and check a Minimum System Pre-requisite to e-Auctioning well in advance before starting of the e-Auction. E.g., Operating System, Installation a Valid Digital Signature Certificate (DSC if applicable), Internet Explorer Browser Active-X Control settings to access the e-Auction portal smoothly as per Minimum System requirement which will be available on homepage of the e-Procurement website.
5. We agree that we shall change the password on receipt by us and keep it confidential. We agree that I shall not hold M/S. Antares System Ltd responsible in any way for any losses that may be suffered by us because of disclosure of the password to any other person.
6. We also confirm that we have taken the training on the e-auction tool and have understood the entire functionality of the same thoroughly including all scenarios & available features for bidding pertaining to e-auction event.
7. We confirm that Dept. / Tendering Authority and M/S. Antares System Ltd (Service Provider) shall not be liable & responsible in any manner whatsoever for my/our failure to access & bid on the e-auction platform due to loss of internet connectivity, electricity failure, virus attack, problems with the PC, any other unforeseen circumstances etc. before or during the e-auction event.
8. In case of Digital Signature Certificate (DSC) based login to the e-Auction/e-Tender/event, we

also confirm that we have a valid DSC issued by a valid Certifying Authority (approved by Controller of Certifying Authorities) in INDIA.

9. We take a note as advised by you related not to wait till last minute or last few seconds to submit valid bid to avoid any complication related to loss of internet connectivity, electricity failure, virus attack, network problems, system crash down, problems with the PC, any other unforeseen circumstances etc...Neither Department / Tendering Authority nor Service Provider (M/S. Antares System Ltd) are responsible for any unforeseen circumstance.
10. We also confirm that we will e-mail the price confirmation & break up of our quoted price to the Dept. / M/S. Antares System Ltd as per Annexures (if applicable) within 24 hours of the completion of the e-auction and the format as requested by Dept. / M/S. Antares System Ltd.
11. We, hereby confirm that we will honour the Bids placed by us during the auction process. Bid cannot be cancelled / withdrawn and you shall be bound to collecting / supply at your final bid price. If you back out and or collecting / supply as per the rates quoted, Dept. / Tendering Authority shall take action as appropriate.
12. We confirm that we have not changed or deleted any clauses in this Process Compliance Form (PCF) and submitting the same to the service provider / Dept. as it is duly stamped and signed. In addition, if any changes found in submitted PCF or in this Business Rules Document (if any) before or after completion of the Sealed Bid (if any) or e-Auction then Dept. / Service provider may take an appropriate action against us.

With regards,

Date:

Signature with company seal Name:

Company / Organization:

Designation within Company / Organization:

Address of Company / Organization:

Scan it and send to this Document on M/S. Antares System Ltd.'s web portal ,

11. Price Confirmation Letter (Annexure III)

(The bidders are required to print this on their company's letter head and sign, stamp before emailing)

To,
M/s Antares Systems Ltd
'Honganasu' Kengari, Bangalore -
560060.

SUB: FINAL PRICE QUOTED DURING REVERSE AUCTION FOR ESTABLISHMENT OF PROPOSED COMPOSITE Construction Of A Multi-Storey Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in Leed /Griha) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)"

Reverse Auction Date:

Dear Sir,

We confirm that we have quoted.

Thanking you and looking forward to the valuable order from SBI.

Yours sincerely,

For _____

Name:

Company:

Date:

Seal:

Scan it and send to this Document on, M/S. Antares System Ltd.'s web portal.

(F) Price break up (Annexure IV)**Price Break up**

As Per TENDER document

Bidding Example:

The final rates of the items may be calculated in ratio of total amount quoted by the lowest bidder through reverse auction process and the amount quoted in indicative price bid, wherever specified in tender.

Example:**Indicative Price Bid submitted by vender:**

Item	Rate (R)	Qty.	Amount
A	100	2	200/-
B	200	3	600/-
C	300	4	1200/-
Total amount in indicative Price bid			2000/-

The total amount mentioned in indicative price bid is Rs. 2,000/- but the final L-1 amount quoted by the vender through E-reverse auction is Rs.1600/- then the K factor for L-1 vender will be calculated as under:

Ratio K = (Total amount quoted but the lowest bidder through reverse auction process) / (The amount quoted in indicative price bid)

$$K = 1600/2000 = 0.8$$

The item wise final price to be confirmed by the vender shall be as under:

Item	Final Rate = K*(R)	Qty.	Amount
A	100X0.8	2	160/-
B	200X0.8	3	480/-
C	300X0.8	4	960/-
Total amount work out after e-reverse Auction			1600/-

The lowest bidder after the e-reverse auction process will have to e-mail the duly signed filled-in prescribed format to SBI through service provider within 24 hours of auction without fail.

1. Contact Information

M/S. Antares System Limited	State Bank of India	APMCF
Contact Person: Mr. Kushal Bose Mobile No: 96747-58719 E mail: helpdesk857@etenderwizard.com	Assistant General Manager (Premises & Estate) State Bank of India Gift City, Gandhinagar. Contact No 079-29090149,	Proprietor/Principal Architect Mamta Shah & Associates Name: Mamta N Shah e: mamta@msain.com Contact No - 0265-2710-67, Mo: 9824016788

12.LETTER OF TRANSMITTAL AND UNDERTAKING (Annexure-V)

(The bidders are required to print this on their company's letter head and sign, stamp before emailing)

To,
The Assistant General Manager (Premises & Estate),
Premises & Estate Dept.,
Local Head Office, 2nd FLOOR, PLOT NO-53A, SBI TOWER,GIFT CITY, GANDHINAGAR

Dear Sir,

Having examined the drawings, specification, design and schedule of quantities relating to the works specified in the memorandum hereinafter set out and having visited and examined the site of the works specified in the said memorandum and having acquired the requisite information relating thereto as affecting the tender, I/We hereby offer to execute the works specified in the said memorandum at the rates mentioned in the attached Schedule of Quantities and in accordance in all respects with the specifications, design, drawings and instructions in writing referred to in conditions of tender, the Articles of Agreement, Special Conditions, Schedule of Quantities and Conditions of Contract and with such materials as are provided for by, and in all other respects in accordance with such conditions so far as they may be applicable.

MEMORANDUM

(a)	Description of work	Construction Of A Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in Leed /Griha) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)”
(b)	Earnest Money	₹. 24,34,800/- (Rupees Twenty Four Lakhs Thirty Four Thousand Eight Hundred Only) by means of demand Draft / Pay Order from any scheduled Nationalized Bank drawn in favour of State Bank of India, Payable at Gandhinagar.
(c)	Time allowed for completion of the Works from fifteenth day after the date of written Order or date of handing over of the site (Whichever is later) to commence the work	As per Clause No 27 of GCC.

1) Should this tender be accepted, I/we hereby agree to abide by and fulfill the terms and provisions of the said conditions of contract annexed hereto so far as may be applicable or in

default thereof to forfeit and pay to SBI, the amount mentioned in the said contract.

2) I / We have deposited a sum of ₹. 24,34,800/-(Rupees Twenty Four Lakhs Thirty Four Thousand Eight Hundred Only) of the total tender amount as Earnest Money with the SBI which amount is not to bear any interest. Should I / We fail to execute the Contract when called upon to do so I / We do hereby agree that this sum shall be forfeited by me/us to State Bank of India.

3) I/ We understand that as per terms of this tender, the SBI may consider accepting our tender in part or whole or may entrust the various work proposed in phases. We, therefore, undertake that we shall not raise any claim/ compensation in the eventuality of Bank deciding to drop any of the work from the scope of work of this tender at any stage during the contract period. Further, we also undertake to execute the work entrusted to us in phases on our approved rates and within stipulated time limit without any extra claim for price escalation unless otherwise separately mentioned as also provided for in the clauses of this tender.

4) I/ We, hereby, also undertake that, we will not raise any claim for any escalation in the prices of any of the material except any provision of clause in the tender during the contract/execution/completion period including authorized extended contract period, if any.

5) Our Bankers are:

i)

ii)

The names of partners of our firm are:

i)

ii)

Name of the partner of the firm Authorized to sign

Or

(Name of person having Power of Attorney to sign the Contract.

(Certified true copy of the Power of Attorney should be attached)

Yours faithfully,

Signature of Contractors.

Signature and addresses of Witnesses

i)

ii)

13. GENERAL CONDITIONS OF CONTRACT (GCC)

“Contract” means the documents forming the tender and the acceptance thereof and the formal agreement executed between State Bank of India (Client) and the contractor, together with the documents referred therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the APMCF/Bank and all these documents taken together shall be deemed to form one contract and shall be complementary to one another.

1.1 In the contract the following expressions shall, unless the context otherwise requires, have the meaning hereby respectively assigned to them.

1.1.1 ‘SBI’ shall mean State Bank of India (client) a body Corporate created under State Bank of India Act 1955, having its Corporate Centre at State Bank Bhavan, Madame Cama Road, Mumbai 400 021 and a LHO at GIFT CITY Gandhinagar Gujarat-382355 and includes the client’s representatives, successors and assigns. ‘APMCF’ shall mean M/s. Mamta Shah & Associates

1.1.2 ‘Site Engineer’ shall mean an Engineer appointed by the Bank as their representative to give instructions to the contractors.

1.1.3 ‘The Contractor’ shall mean the individual or firm or company whether incorporated or not, undertaking the works and shall include legal personal representative of such individual or the composing the firm or company and the permitted assignees of such individual or firms of company

The expression ‘works’ or ‘work’ shall mean the permanent or temporary work described in the ‘Scope of Work’ and/or to be executed in accordance with the contract and includes materials, apparatus, equipment, temporary supports, fittings and things of all kinds to be provided, the obligations of the contractor hereunder and work to be done by the contractor under the contract.

1.1.4 ‘Engineer’ shall mean the representative of the APMCF

1.1.5 ‘Drawings’ shall mean the drawings prepared by the Architects and issued by the Engineer and referred to in the specifications and any modifications of such drawings as may be issued by the Engineer from time to time ‘Contract value shall mean the value of the entire work as stipulated in the letter of acceptance of tender subject to such additions thereto or deductions there from as may be made under the provision herein after contained.

1.1.6 ‘Specifications’ shall mean the specifications referred to in the tender and any modifications thereof as may time to time be furnished or approved by the APMCF.

1.1.6a “Month” means calendar month.

1.1.7 “Week” means seven consecutive days.

1.1.8 “Day” means a calendar day beginning and ending at 00 Hrs and 24 hrs respectively

1.1.9 The following shall constitute the Joint Project Committee (herein under referred to as JPC) for assessing and reviewing the progress of the work on the project and to issue instructions or directions from time to time for being observed and followed by the APMCF’s Site Engineer /APMCF and other consultants / contractors engaged in the execution of the project.

1. Assistant General Manager (Premises & Estate),
2. Assistant General Manager (Civil),
3. SBI Engineer (Civil, Electrical, Fire & Security) in-charge of the Project, as may be nominated by the Premises & Estate Department, State Bank of India, Gift City, Gandhinagar.

4. Proprietor of the Architects or Their Project Architect
5. Resident Civil Engineer- in Charge of PMC.

1.1.10 "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.

1.1.11 "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 tenderer/ contractor and or at the mail id mentioned by the contractor in the "form of tender" of these tender document and shall be deemed to have been received when in the ordinary course of post it would have been delivered. M.

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

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

1.1.14 "SUBCONTRACTOR" 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.

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

1.1.16 "APMCF" shall means M/s Mamta Shah & Associates , Vadodara who are the Project Architect and Project Management Consultants, hereinafter abbreviated as APMCF and their personnel's like Architects, Engineers, Associates, Site Engineers, Project Engineers, Consulting Engineers, PMC Personnels etc. appointed by the SBI at site as their representative for day-to-day supervision of work and to give instructions to the contractors.

1.1.17 "Complete Project Closure Report" by SBI and APMCF means following conditions are satisfied and all works related to it are complete & reports closed after due repairs, replacements, trials, test, etc.

The project shall be considered complete & closed only when:

- a. **Defect Liability Period (DLP)** for all items of work is over : DLP is for one year (Other than Specifically Mentioned in TENDER and BOQ) from the date of virtual completion (as mentioned in GCC) of work and
- b. Acceptance & closure of all queries & works after due rectification/replacements/ tests as referred by Chief Technical Examiner, CVC and
- c. Acceptance and closure of all arbitration, court cases, etc. as decided by the Bank whichever is later.

2.0 Total Security Deposit

Total Security deposit comprise of

- a) Earnest Money Deposit
- b) Initial Security Deposit
- c) Retention Money
- d) Additional Security Deposit

a) Earnest Money Deposit -

The tenderer shall furnish EMD ₹. 24,34,800/- (Rupees Twenty Four Lakhs Thirty Four Thousand Eight Hundred Only) in the form of Demand Draft or Banker's Cheque drawn in favor of State Bank of India Payable at Gandhinagar or any scheduled Bank. No tender shall be considered unless the EMD is so deposited in the required form. No interest shall be paid on this EMD. The EMD of the unsuccessful tenderer shall be refunded within 15 days soon after the decision to award the contract is taken without interest. 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 acceptance by the SBI or after it is accepted by the SBI the contractor fails to enter into a formal agreement or fails to pay the initial security deposit as stipulated. Or fails to commence the work within the stipulated time.

b) Initial Security Deposit (ISD)

The amount of ISD shall be 2% of accepted value of tender including the EMD. Balance of ISD (i.e. excluding EMD) is to be submitted in the form of D/D drawn on any scheduled Bank and shall be deposited within 15 days from the date of letter of acceptance of tender.

c) Retention Money: -

Besides the ISD as deposited by the contractor in the above said manner the retention money shall be deducted from the running account bill at the rate of 10% of the gross value of work done by the contractor and claimed in each bill provided the total security deposit i.e. the ISD plus Retention Money shall both together not exceed 5% of the contract value. 50% of the total security deposit shall be refunded to the contractor without any interest on issue of Virtual Completion certificate by the APMCF. The balance 50% of the total security deposit shall be refunded to the contractors without interest within fifteen days after the end of defects liability period provided the contractor has satisfactorily attended to all defects in accordance with the conditions of contract including site clearance.

d) Additional Security Deposit: -

Additional Security deposit (ASD)/Additional performance Guarantee (APG) shall be applicable if the bid price is below 7.5 % of the estimated cost put to tender. The amount of such ASD/ APG shall be the difference between 92.5 % of estimated cost put to tender and the quoted price.

Additional security deposit Will be refunded or FDR / Bank Guarantee to be released to the contractor without any interest within 15 days after issue of Virtual Completion certificate by the APMCF.

3.0 Language Errors, Omissions and Discrepancies

In case of errors, omissions and/or disagreement between written and scaled dimensions on the drawings or between the drawings and specifications etc, the following order shall apply.

- i) Between scaled and written dimension (or description) on a drawing, the latter shall be adopted.
- ii) Between the written or shown description or dimensions in the drawings and the corresponding one in the specification the former shall be taken as correct.
- iii) Between written description of the item in the specifications and descriptions in bills of quantities of the same item, the latter shall be adopted.
- iv) In case of difference between rates written in figures and words, the rate in words shall prevail.
- v) Between the duplicate/subsequent copies of the tender, the original tender shall be taken as correct.

4.0 Scope of Work:

The contractor shall carryout complete and maintain the said work in every respect strictly in accordance with this contract and with the directions of and to the satisfaction of the Bank to be communicated through the APMCF. The APMCF at the directions of the SBI from time-to-time issue further drawings and / or written instructions, details directions and explanations which are here after collectively referred to as APMCF 's/SBI's instructions in regard to the variation or modification of the design, quality or quantity of any work or the addition or omission or substitution of any work. Any discrepancy in the drawings or between BOQ and / or drawings and / or specifications. The removal from the site of any material brought thereon by the Contractor and any substitution of any other materials therefore, the demolition, removal and / or re-execution of any work executed by him. The dismissal from the work of any person employed/engaged thereupon.

5.0 i) Letter of Acceptance:

Within the validity period of the tender the SBI shall issue a letter of acceptance directly or through the APMCF by registered post or otherwise depositing at the address of the contractor as given in the tender to enter into a Contract for the execution of the work as per the terms of the tender. The letter of acceptance shall constitute a binding contract between the SBI and the contractor.

ii) Contract Agreement:

On receipt of intimation of the acceptance of tender from the SBI/APMCF the successful tenderer shall be bound to implement the contract and within fifteen days thereof he shall sign an agreement in a non-judicial stamp paper of appropriate value.

6.0 Ownership of drawings:

All drawings, specifications and copies thereof furnished by the SBI through its APMCF are the properties of the SBI. They are not to be used on other work.

7.0 Detailed drawings and instructions:

The SBI through its architects/consultants shall furnish with reasonable promptness additional instructions by means of drawings or otherwise necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the contract documents, true developments thereof and reasonably inferable there from.

The work shall be executed in conformity therewith and the contractor prepare a detailed programme schedule indicating therein the date of start and completion of various activities on receipt of the work order and submit the same to the SBI through the APMCF

3 Sets of hard Copies of working drawings will be issued to Contractor by the APMCF, Contractor shall make necessary laminations, waterproof paper covering & filing so that these drawings will be available in good condition at site throughout the period of works.

7.0 Details drawings and instructions

The SBI through its architects/consultants shall furnish with reasonable promptness additional instructions by means of drawings or other-wise necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the contract documents, true developments thereof and reasonably infer-able there from.

The work shall be executed in conformity therewith and the contractor shall prepare a detailed programme schedule (i.e. BAR/PERT Chart) indicating therein the date of start and completion of various activities on receipt of the work order and submit the same to the SBI through the Architect/Consultant.

7.1 Copies of agreement

Two copies of agreement/tender document duly signed by both the parties in a non-judicial stamp paper of Rs 600/- with the drawings shall be handed over to the contractors.

8.0 Liquidated damages:

If the contractor fails to maintain the required progress in terms of clause of Tender or to complete the work and clear the site including vacating their office on or before the contracted or extended date or completion without justification in support of the cause of delay, he may be called upon without prejudice to any other right of remedy available under the law to the SBI on account of such breach to pay a liquidated damages at the rate of 0.5% of the contract value per week subject to a maximum of 5% of the contract value as per stages given in GCC Tender .

9.0 Materials, Appliances and Employees

Unless or otherwise specified the contractor shall provide and pay for all materials, labour, water, power, tools, equipment transportation and any other facilities that are required for the satisfactory execution and completion of the work. Unless or otherwise specified all materials shall be new and both workmanship and materials shall be best quality. The contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him. Workman whose work or behavior is found to be unsatisfactory by the SBI/APMCF he shall be removed from the site immediately.

10.0 Permits, Laws and Regulations:

Permits and licenses required for the execution of the work shall be obtained by the contractor at his own expenses.

The contractor shall give notices and comply with the regulations, laws, and ordinances rules, applicable to the contractor. If the contractor observes any discrepancy between the drawings and specifications, he shall promptly notify the SBI in writing under intimation of the APMCF. If the contractor performs any act which is against the law, rules and regulations he shall meet all the costs arising there from and shall indemnify the SBI any legal actions arising there from.

11.0 Setting out Work:

The contractor shall set out the work and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions, and alignment of all parts thereof and get it approved by the APMCF before proceeding with the work. If at any time any error in this respect shall appear during the progress of the works, irrespective of the fact that the layout had been approved by the APMCF the contractor shall be responsible for the same and shall at his own expenses rectify such error, if so, required to satisfaction of the SBI.

12.0 Protection of works and property:

The contractor shall continuously maintain adequate protection, of all his work from damage and shall protect the SBI's properties from injury or loss arising in connection with contract. He shall make good any such damage, injury, loss due to his fault or negligence except which are due to causes beyond his control.

He shall take adequate care and steps for protection of the adjacent properties. The contractor shall take all precautions for safety and protection of his employees on the works and shall comply with all applicable provisions of Government and local bodies' safety laws and building codes to prevent accidents, or injuries to persons or property of about or adjacent to his place of work. The contractor shall take insurance covers as per clause 24.0 at his own cost. The policy may be taken in joint names of the contractors and the SBI and the original policy may be lodged with the SBI.

13.0 Inspection of work:

The SBI / APMCF or their representatives shall at all reasonable time have free access to the work site and/or to the workshop, factories or other places where materials are lying or from where they are obtained and the contractor shall give every facility to the SBI, APMCF and their representatives necessary for inspection and examination and test of the materials and workmanship. No person unless authorized by the SBI/APMCF except the representative of public authorities shall be allowed on the work at any time. The proposed work either during its construction stage or its completion can also be inspected by the Chief Technical Examiner's organization a wing of Central Vigilance Commission.

14.0 Assignment and subletting

The whole of work included in the contract shall be executed by the contractor and he shall not directly entrust and engage or indirectly transfer assign or underlet the contract or any part or share thereof or interest therein without the written consent of the SBI through the

architect and no undertaken shall relieve the contractor from the responsibility of the contractor from active superintendence of the work during its progress.

15.0 Quality of materials, workmanship & Test

1. All materials and workmanship shall be best of the respective kinds described in the contract and in accordance with APMCF instructions and shall be subject from time to time to such tests as the APMCF may direct at the place of manufacture or fabrication or on the site or an approved testing laboratory. The contractor shall provide such assistance, instruments, machinery, labour and materials

(ii) Samples:

All samples of adequate numbers, size, shades & pattern as per specifications shall be supplied by the contractor without any extra charges. 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 to the satisfaction of the Architect/consultant. Before submitting the sample/literature the contractor shall satisfy himself that the material/equipment for which he is submitting the samples/literature meet with the requirement of tender specification. Only when the samples are approved in writing by the APMCF the contractor shall proceed with the procurement and installation of the particular material/equipment. The approved samples shall be signed by the APMCF for identification and shall be kept on record at site office until the completion of the work for inspection/comparison at any time. The APMCF shall take reasonable time to approve the sample. Any delay that might occur in approving the samples for reasons of its not meeting the specifications or other discrepancies inadequacy in furnishing samples of best qualities from various manufacturers and such other aspects causing delay on the approval of the materials / equipment etc shall be to the account of the contractor.

2. Cost of tests

The cost of making any test shall be borne by the contractor if such test is intended by or provided for in the specifications or BOQ.

iv) Costs of tests not provided for

If any test is ordered by the APMCF/SBI which is either :

If so intended by or provided for or (in the cases above mentioned) is not so particularized, or though so intended or provided for but ordered by the APMCF which is either 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 or any Government / approved laboratory, then the cost of such test shall be borne by the contractor.

16. Obtaining information related to execution of work

No claim by the contractor for additional payment shall be entertained which is consequent upon failure on his part to obtain correct information as to any matter affecting the execution of the work nor any misunderstanding or the obtaining incorrect information or the failure to obtain correct information relieve him from any risks or from the entire responsibility for the fulfillment of contract.

17.0 Contractor's Superintendence

The contractor shall give necessary personal superintendence during the execution the works and as long, thereafter, as the APMCF may consider necessary until the expiry of the defect liability period, stated here to.

18.0 Quantities

i) The bill of quantities (BOQ) unless or otherwise stated shall be deemed to have been prepared in accordance with the Indian Standard Method of Measurements.

The rate quoted shall remain valid for variation of quantity against individual item to any extent subject to maximum variation of the contract value by 25%. The entire amount paid under Clause 20 hereof as well as amounts of prime cost and provisional sums, if any, shall be excluded.

ii) Variation exceeding 25%: The items of work executed in relation to variation exceeding 25% shall be paid on the basis of provisions of clause 21(E) hereof.

19.0 Works to be measured

The APMCF may from time to time intimate to the contractor that he required the work to be measured and the contractor shall forthwith attend or send a qualified representative to assist the Architect in taking such measurements and calculation and to furnish all particulars or to give all assistance required by any of them. Such measurements shall be taken in accordance with the Mode of measurements detailed in the specifications. The representative of the APMCF shall take joint measurements with the contractor's representative and the measurements shall be entered in the measurement book. The contractor or his authorized representative shall sign all the pages of the measurement book in which the measurements have been recorded in token of his acceptance. All the corrections shall be duly attested by both representatives. No over writings shall be made in the M book. Should the contractor not attend or neglect or omit to depute his representative to take measurements then the measurements recorded by the representative of the APMCF shall be final. All authorized extra work, omissions and all variations made shall be included in such measurements.

20.0 Variations

No alteration, omission or variation ordered in writing by the APMCF shall vitiates the contract.

In case the SBI / APMCF thinks proper at any during the progress of works to make any alteration in, or additions to or omission from the works or any. alteration in the kind or quality of the materials to be used therein, the APMCF shall give notice thereof in writing to the contractor or shall confirm in writing within seven days of giving such oral instructions the contract shall alter to, add to, or omit from as the case may be in accordance with such but the contractor shall not do any work extra to or make any alterations or additions to or omissions from the works or any deviation from any of the provisions of the contract, stipulations, specifications or contract drawings without previous consent in writing of the APMCF and the value of such extras, alterations, additions or omissions shall in all cases be determined by the APMCF and the same shall be added to or deducted from the contract value, as the case may be.

21.0 Valuation of Variations

No claim for an extra shall be allowed unless it shall have been executed under the authority of the APMCF with the concurrence of the SBI as herein mentioned. Any such extra is herein referred to as authorized extra and shall be made in accordance with the following provisions.

a. The net rates or prices in the contract shall determine the valuation of the extra work where such extra work is of similar character and executed under similar conditions as the work priced herein. Rates for all items, wherever possible should be derived out of the rates given in the priced BOQ.

b. The net prices of the original tender shall determine the value of the items omitted, provided if omissions do not vary the conditions under which any remaining items of works are carried out, otherwise the prices for the same shall be valued under sub clause (c) hereunder.

c. Where the extra works are not of similar character and/or executed under similar conditions as aforesaid or where the omissions vary the conditions under which any remaining items or works are carried out, then the contractor shall within 7 days of the receipt of the letter of acceptance inform the SBI/Architect of the rate which he intends to charge for such items of work, duly supported by analysis of the rate or rates claimed and the SBI/Architect shall fix such rate or prices as in the circumstances in his opinion are reasonable and proper, based on the market rate.

d. Where extra work cannot be properly measured or valued the contractor shall be allowed day work prices at the net rates stated in the tender of the BOQ or, if not, so stated then in accordance with the local day work rates and wages for the district; provided that in either case, vouchers specifying the daily time (and if required by the SBI /SBI/Architect) the workman's name and materials employed be delivered for verifications to the Architect/Consultant at or before the end of the week following that in which the work has been executed.

e. It is further clarified that for all such authorized extra items where rates cannot be derived from the tender, the contractor shall submit rates duly supported by rate analysis worked on the "market rate basis" for material, labour, hire/running charges of equipment and wastages etc. plus 15% towards establishment charges, contractor's overheads and profit. Such items shall not be eligible for escalation.

22.0 Final measurement

The measurement and valuation in respect of the contract shall be completed within Six months of the virtual completion of the work.

23.0 Virtual Completion Certificate (VCC)

On successful completion of entire works covered by the contract to the full satisfaction of the APMCF/SBI, the contractor shall ensure that the following works have been completed to the satisfaction of the SBI:

- a) Clear the site of all scaffolding, wiring, pipes, surplus materials, contractor's labour equipment and machinery.
- b) Demolish, dismantle and remove the contractor's site office, temporary works, structure including labour sheds/camps and constructions and other items and things whatsoever

brought upon or erected at the site or any land allotted to the contractor by the SBI not incorporated in the permanent works.

- c) Remove all rubbish, debris etc. from the site and the land allotted to the contractor by the APMCF/SBI and shall clear, level and dress, compact the site as required by the APMCF/SBI
- d) Shall put the SBI in undisputed custody and possession of the site and all land allot by the SBI.
- e) Shall hand over the work in a peaceful manner to the APMCF/SBI
- f) All defects / imperfections have been attended and rectified as pointed out by the Architects to the full satisfaction of SBI

Upon the satisfactory fulfillment by the contractor as stated above, the contractor shall be entitled to apply to the APMCF for the certificate. If the APMCF is satisfied of the completion of the work, relative to which the completion certificate has been sought, the APMCF shall within fourteen (14) days of the receipt of the application for virtual completion certificate, issue a VCC in respect of the work for which the VCC has been applied.

This issuance of a VCC shall be without prejudice to the SBI's rights and contractor's liabilities under the contract including the contractor's liability for defects liability period nor shall the issuance of VCC in respect of the works or work at any site be construed as a waiver of any right or claim of the SBI against the contractor in respect of works or work at the site and in respect of which the VCC has been issued.

24.0 Work by other agencies

The SBI / APMCF reserves the rights to use premises and any portion the site for execution of any work not included in the scope of this contract which it may desire to have carried out by other persons simultaneously and the contractor shall not only allow but also extend reasonable facilities for the execution of such work. The contractor however shall not be required to provide any plant or material for the execution of such work except by special arrangement with the SBI. Such work shall be carried out in such manner as not to impede the progress of the works included in the contract.

25.0 Insurance of works

25.1 Without limiting his obligations and responsibilities under the contract the contractor shall insure in the joint names of the SBI and the contractor against all loss of damages from whatever cause arising other than the excepted risks, for which he is responsible under the terms of contract and in such a manner that the SBI and contractor are covered for the contract period stipulated including vide clause 28 of GCC and are also covered during the period of maintenance for loss or damage arising from a cause, occurring prior to the commencement of the period of maintenance and for any loss or damage occasioned by the contractor in the course of any operations carried out by him for the purpose of complying with his obligations under clause.

- a) The Works for the time being executed to the estimated current Contract value thereof, or such additional sum as may be specified together with the materials for incorporation in the works at their replacement value.

- b) The constructional plant and other things brought on to the site by the contractor to the replacement value of such constructional plant and other things.
- c) Such insurance shall be affected with an insurer and in terms approved by the SBI which approval shall not be unreasonably withheld and the contractor shall whenever require produce to the APMCF the policy of insurance and the receipts for payment of the current premiums.

25.2 Damage to persons and property

The contractor shall, except if and so far as the contract provides otherwise indemnify the SBI against all losses and claims in respect of injuries or damages to any person or material or physical damage to any property whatsoever which may arise out of or in consequence of the execution and maintenance of the works and against all claims proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto except any compensation of damages for or with respect to:

- a) The permanent use or occupation of land by or any part thereof.
- b) The right of SBI to execute the works or any part thereof on, over, under, in or through any lands.
- c) Injuries or damages to persons or properties which are unavoidable result of the execution or maintenance of the works in accordance with the contract
- d) Injuries or damage to persons or property resulting from any act or neglect of the SBI their agents, employees or other contractors not being employed by the contractor or for or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or where the injury or damage was contributed to by the contractor, his servants or agents such part of the compensation as may be just and equitable having regard to the extent of the responsibility of the SBI, their employees, or agents or other employees, or agents or other contractors for the damage or injury.

25.3 Contractor to indemnify SBI

The contractor shall indemnify the SBI against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the provision sub-clause 25.2 of this clause.

25.4 Contractor's superintendence

The contractor shall fully indemnify and keep indemnified the SBI against any action, claim, or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claim made under or action brought against SBI in respect of such matters as aforesaid the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expenses to settle any dispute or to conduct any litigation that may arise there from, provided that the contractor shall not be liable to indemnify the SBI if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the APMCF in this behalf.

25.5 Third Party Insurance

25.5.1 Before commencing the execution of the work the contractor but without limiting his obligations and responsibilities under clause 24.0 of GCC shall insure against his liability for any material or physical damage, loss, or injury which may occur to any property including that of SBI, or to any person, including any employee of the SBI, by or arising out of the execution of the works or in the carrying out of the contract, otherwise than due to the matters referred to in the provision to clause 24.0 & 25.0 thereof.

25.5.2 Minimum amount of Third-Party Insurance

Such insurance shall be affected with an insurer and in terms approved by the SBI which approval shall not be reasonably withheld and for at least the amount stated below. The contractor shall, whenever required, produce to the. APMCF the policy or policies of insurance cover and receipts for payment of the current premiums.

25.6 The minimum insurance cover for physical property, injury, and death is Rs.5.0 Lacs per occurrence with the number of occurrences limited to four. After each occurrence contractor will pay additional premium necessary to make insurance valid for four occurrences always.

25.7 Accident or Injury to workman:

25.7.1 The SBI shall not be liable for or in respect of any damages or compensation payable at law in respect or in consequence of any accident or injury to any workmen or other person in the employment of the contractor or any sub-contractor, save and except an accident or injury resulting from any act or default of the SBI or their agents, or employees. The contractor shall indemnify and keep indemnified SBI against all such damages and compensation, save and except as aforesaid, and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

25.7.2 Insurance against accidents etc. to workmen

The contractor shall insure against such liability with an insurer approved by the SBI during the whole of the time that any persons are employed by him on the works and shall, when required, produce to the APMCF such policy of insurance and receipt for payment of the current premium. Provided always that, in respect of any persons employed by any sub-contractor the contractor's obligation to insured as aforesaid under this sub-clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that SBI is indemnified under the policy but the contractor shall require such sub-contractor to produce to the Architect /consultant when such policy of insurance and the receipt for the payment of the current premium.

25.7.3 Remedy on contractor's failure to insure

If the contractor fails to effect and keep in force the insurance referred to above or any other insurance which he may be required to effect under the terms of contract, then and in any such case the SBI may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the SBI as aforesaid and also deduct 15% of contract value from any

amount due or which may become due to the contractor, or recover the same as debt from the contractor.

25.7.4 Without prejudice to the other rights of the SBI against contractors. In respect of such default, the employer shall be entitled to deduct from any sums payable to the contractor the amount of any damages costs, charges, and other expenses paid by the SBI and which are payable by the contractors under this clause. The contractor shall upon settlement by the Insurer of any claim made against the insurer pursuant to a policy taken under this clause, proceed with due diligence to rebuild or repair the works destroyed or damaged. In this event all the monies received from the Insurer in respect of such damage shall be paid to the contractor and the Contractor shall not be entitled to any further payment in respect of the expenditure incurred for rebuilding or repairing of the materials or goods destroyed or damaged.

26.0 Commencement of Works:

The date of commencement of the work will be reckoned as the recorded date of handing over site by the SBI or 15 days from the date of issue of Letter of Acceptance of Bank, whichever is later.

27.0 Time for completion:

Time is essence of the contract and shall be strictly observed by the contractor. The entire work shall be completed within a period of **24 (Twenty four Months) including Monsoon & Holidays** from the date of commencement. If required in the contract or as directed by the Architect / SBI, the contractor shall complete certain portions of work before completion of the entire work. However, the completion date shall be reckoned as the date by which the whole work is completed as per the terms of the contract.

28.0 Extension of time

If, in the opinion of the APMCF, the work be delayed for reasons beyond the control of the contractor, the APMCF may submit a recommendation to the SBI to grant a fair and reasonable extension of time for completion of work as per the terms of contract. If the contractor needs an extension of time for the completion of work or if the completion of work is likely to be delayed for any reasons beyond the due date of completion as stipulated in the contract, the contractor shall apply to the SBI through the Architect' Consultant in writing at least 30 Days before the expiry of the scheduled time and while applying for extension of time he shall furnish the reason in detail and his justification if any', for the delays. The APMCF shall submit their recommendations to the SBI in the prescribed format for granting extension of time. While granting extension of time the contractor shall be informed the period extended time which will qualify for levy of liquidated damages. For the balance period in excess of original stipulated period and duly sanctioned extension of time by the SBI by provision of liquidated damages as stated under clause 8.0 shall become applicable. Further the contract shall remain in force even for the period beyond the due date of completion irrespective whether the extension is granted or not.

1. Rate of progress

Whole of the materials, plant and labour to be provided by the contractor and the mode, manner and speed of execution and maintenance of the works are to be of a kind and conducted in a manner to the satisfaction of the APMCF. Should the rate of progress of the work or any part thereof be at any time be in the opinion the APMCF too slow to ensure the

completion of the whole of the work the prescribed time or extended time for completion the APMCF shall thereupon take such steps as considered necessary by the APMCF to expedite progress so as to complete the works by the prescribed time or extended time. Such communications from the APMCF neither shall relieve the contractor from fulfilling obligations under the contract nor will he be entitled to raise any claims arising out of such directions.

30.0 Work during nights and holidays

Subject to any provision to the contrary contained in the contract no permanent work shall save as herein provided be carried on during the night or on holidays without the permission in writing of the SBI/APMCF, save when the work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the work in which case the contractor shall immediately advise the SBI/APMCF. However, the provisions of the clause shall not be applicable in the case of any work which becomes essential to carry by rotary or double shifts in order to achieve the progress and quality of the part of the works being technically required / continued with the prior approval of the APMCF at no extra cost to the SBI.

All work at night after obtaining approval from competent authorities shall be carried out without unreasonable noise and disturbance.

31.0 No compensation or restrictions of work

If at any time after acceptance of the tender SBI shall decide to abandon or reduce the scope of work for any reason whatsoever and hence not required, the whole or any part of the work to be carried out. The APMCF/SBI shall give notice in writing that effect to the contractor and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever on account of any profit or advantage which he might have derived from the execution of the Work fully but which he did not derive in consequence of the foreclosure of the whole or part of the work.

Provided that the contractor shall be paid the charges on the cartage only of materials actually and bona-fide brought to the site of the work by the contractor and rendered surplus as a result of the abandonment, curtailment of the work or any portion thereof and then taken back by the contractor, provided however that the APMCF shall have in such cases the option of taking over all or any such materials at their purchase price or a local current rate whichever is less.

“In case of such stores having been issued from SBI stores and returned by the contractor to stores, credit shall be given to him at the rates not exceeding those at which were originally issued to the contractor after taking into consideration and deduction for claims on account of any deterioration or damage while in the custody of the contractor and in this respect the decision of APMCF shall be final.

32.0 Suspension of work

The contractor shall, on receipt of the order in writing of the APMCF/SBI whose decision shall be final and binding on the contractor) suspend the progress of works or any part thereof for such time and in such manner as APMCF may consider necessary so as not to

cause any damage or injury to the work already done or endanger the safety thereof for any of following reasons:

- a) On account any default on the part of the contractor, or
- b) For proper execution of the works or part thereof for reasons other than the default of the contractor, or
- c) For safety of the works or part thereof

The contractor shall, during such suspension, properly protect and secure the works the extent necessary and carry out the instructions given in that behalf by the APMCF.

- i) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above:
The contractor shall be entitled to an extension of time equal to the period of every such suspension. No compensation whatsoever shall be paid on this account.

33.0 Action when the whole security deposit is forfeited

In any case in which under any clause or clauses of this contract, the Contractor shall have rendered himself liable to pay compensation amounting to the whole of his security deposit the APMCF shall have the power to adopt any of the following course as they may deem best suited to the interest of the SBI:

- a) To rescind the contract (of which rescission notice in writing to the contractor by - APMCF shall be conclusive evidence) and in which case the security, deposit of the contractor shall be forfeited and be absolutely at the disposal of SBI
- b) To employ labour paid by the SBI and to supply materials to carry out the work, or part of the work, debiting the contractor with the cost of the labour and materials cost of such labour and materials as worked out by the APMCF shall final and conclusive against the contractor) and crediting him with the value of the work done, in all respects in the same manner and at the same manner and at the same rates as if it had been carried out by the contractor under the terms of this contract certificate of Architect /consultant as to the value of work done shall be final conclusive against the contractor.
- c) To measure up the work of the contractor, and to take such part thereof as shall unexecuted, out of his hands, and to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (The amount of which excess the certificates in writing of the Architects / consultant shall final and conclusive) shall be borne by original contractor and may be deducted f any money due to him by SBI under the contract or otherwise, or from his security deposit or the proceeds of sale thereof, or sufficient part thereof.

In the event of any of above courses being adopted by the SBI the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any material or entered into any engagements or make any advances on account of, or with a view to the execution of the work or the performance of the contract and in case the contract shall be rescind under the provision aforesaid, the contractor shall not be entitled to recover or to be paid any sum or any work thereto for actually performed under this contract, unless, and until the APMCF will have certified in writing the performance of

such work and the value payable in respect thereof, and he shall only be entitled to be paid the value so certified.

34.0 SBI's right to terminate the contract

If the contractor being an individual or a firm commit any 'Act of insolvency' or shall be adjusted an insolvent or being an incorporated company shall have an order for compulsory winding up voluntarily or subject to the supervision of Govt. and of the Official Assignee of the liquidator in such acts of insolvency or winding up shall be unable within seven days after notice to him to do so, to show to the reasonable satisfaction of the APMCF that he is able to carry out and fulfill the contract, and to dye security therefore if so required by the APMCF.

or if the contractor (whether an individual firm or incorporated Company) shall suffer execution to be issued or shall suffer any payment under this contract to be attached by or on behalf of any of the creditors of the contractor.

Or shall assign or sublet this contract without the consent in writing of the SBI through the APMCF or shall charge or encumber this contract or any payment due to which may become due to the contractor there under:

- a) Has abandoned the contract; or
- b) Has failed to commence the works, or has without any lawful excuse under these conditions suspended the progress of the works for 14 days after receiving from the SBI through the APMCF written notice to proceed, or
- c) has failed to proceed with the works with such diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or has failed to remove the materials from the site or to pull down and replace work within seven days after written notice from the SBI through the APMCF that the said materials were condemned and rejected by the APMCF under these conditions; or has neglected or failed persistently to observe and perform all or any of the acts matters or things by this contract to be observed and performed by the contractor for seven days after written notice shall have been given to the contractor to observe or perform the same or has to the detriment of good workmanship or in defiance of the SBI or Architect's / consultant's instructions to the contrary subject any part of the contract. Then and in any of said cases the SBI and or the Architect / consultant, may not withstanding any previous waiver, after giving seven days' notice in writing to the contractor, determine the contract, but without thereby affecting the powers of the SBI or the APMCF or the obligation and liabilities of the contractor the whole of which shall continue in force as fully as if the contract had not been determined and as if the works subsequently had been executed by or on behalf of the contractor. And, further the SBI through the APMCF their agents or employees may enter upon and take possession of the work and all plants, took scaffolding, materials, sheds, machineries lying upon the premises or on the adjoining lands or roads use the same by means of their own employees or workmen in carrying on and completing the work or by engaging any other contractors or persons to the work and the contractor shall not in any was interrupt or do any act, matter or thing to prevent or hinder such other contractor or other persons employed for complement and finishing or using the materials and plant for the works.

When the works shall be completed or as soon thereafter as convenient the SBI or APMCF shall give a notice in writing to the contractor to remove his surplus materials and plants

and should the contractor fail to do so within 14 days after receiving thereof by him the SBI sell the same by publication, and after due publication, and shall, adjust the amount realized by such auction. The contractor shall have no right to question any of the act of the SBI incidental to the sale of the materials etc.

35.0 Certificate of payment

The contractor shall be entitled for the certificates to be issued by the APMCF within 10 working days from the date of submission provided it is with all required documents, test reports, recording in MB etc. to the contractor within 10 working days from the date of certificate to the payment from SBI from time to time. The SBI shall recover the statutory recovering other dues including the retention amount from the certificate of payment.

Only submission of Bills to the SBI/APMCF not relieves the contractor's responsibility. Contractor shall help/assist APMCF/SBI during checking/verification of Bills with all required documents, details and presence of Billing Engineer is necessary while scrutiny of Bills.

Provided always that the issue of any certificate by the APMCF during progress of works or completion shall not have effect as certificate of satisfaction relieve the contractor from his liability under clause.

The APMCF shall have power to withhold the certificate if the work or in part thereof is not carried out to their satisfaction.

The APMCF may by any certificate make any corrections required previous certificate.

The SBI shall modify the certificate of payment as issued by the APMCF from time to time while making the payment

The contractor shall submit interim bills only after taking actual measurements and properly recorded in the Measurement Book (M. B.)

The Contractor shall not submit interim bills when the value of work done by him is less than the limit as prescribed in NIT, and the minimum interval between two such bill shall be one month.

The final bill may be submitted by contractor within a period of one month from the date of virtual completion and APMCF shall issue the certificate of payment within a period of two months. The SBI shall pay the amount within a period of three months from the date of issue of certificate provided there is no dispute in respect of rates and quantities.

The contractor shall submit the interim bills in the prescribed format with all details.

36.0 A. Settlement of Disputes and Arbitration

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, matter 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 hereinafter :

- 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 Assistant General Manager (Premises & Estate) 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 Assistant General Manager (Premises & Estate) 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 Assistant General Manager (Premises & Estate) in writing in the manner and within the time aforesaid.
- II. The Assistant General Manager (Premises & Estate) shall give his decision in writing on the claims notified by the contractor. The contractor may within 30 days of the receipt of the decision of the Assistant General Manager (Premises & Estate) submit his claims to the conciliating authority namely the Circle Development Officer/General Manager (OLCS) for conciliation along with all details and copies of correspondence exchanged between him and the Assistant General Manager (Premises & Estate)
- 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 Chief 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.
 - i) 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.
 - ii) It is also a term of the contract that if any fees are payable to the arbitrator these shall be paid equally by both the parties.
 - iii) 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 and place of the Arbitration shall be Gandhinagar. 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.

X) The courts at Gandhinagar shall have exclusive jurisdiction.

Xi) The Law applicable in Gujarat and India shall apply in this Agreement.

37.0 Power Supply

The contractor shall make his own arrangements for power and supply/distribution system for driving plant or machinery for the work and for lighting purpose at his own cost. The cost of running and maintenance of the plants are to be included in his tender prices. He shall pay all fees and charges required for the power supply and include the same in his tendered rates and hold the owner free from all such costs. He has to obtain necessary approval from the appropriate authorities, if required.

38.0 Water Supply

The contractor shall make his own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following condition.

i) That the water used by the contractor shall be fit for construction purposes to the satisfaction of the Architect / consultant's.

ii) The contractor shall make alternative arrangements for the supply of water if the arrangement made by the contractor for procurement of water in the opinion of the APMCF is unsatisfactory.

38.1 The contractor shall construct temporary well / tube well in SBI land for taking water for construction purposes only after obtaining permission in writing from the SBI. The contractor has to make his own arrangements for drawing and distributing the water at his own cost. He has to make necessary arrangements and comply with Environmental Clearance guidelines/NOC. To avoid any accidents or damages caused due to construction and subsequent maintenance of the wells. He has to obtain necessary approvals from local authorities, if required, at his own cost. He shall restore the ground to its original condition after wells are dismantled on completion of work or hand over the well to the SBI without any compensation as directed by the Architect / consultant.

39.0 Treasure Trove etc.

Any treasure trove, coin or object antique which may be found on the site shall be the property of SBI and shall be handed over to the bank immediately.

40.0 Method of Measurement

Unless otherwise mentioned in the schedule of quantities or in mode of measurement, the measurement will be on the net quantities or work produced in accordance with up-to-date rules laid down by the Bureau of Indian Standards. In the event any dispute / disagreement the decision of the APMCF/SBI shall be final and binding on the contractor.

Precedence to be followed for measurements is mentioned below.

- a) As mentioned in Price Bid
- b) As mentioned in Technical Bid
- c) As Per IS 1200 updated till date
- d) As per SP 27 updated till date
- e) As per sound Engineering Practices or any other relevant standards available.

41.0 Maintenance of Registers

The contractor shall maintain the following registers as per the enclosed formats at site of work and should produce the same for inspection of SBI /APMCF whenever desired by them. The contractor shall also maintain the records / registers as required by the local authorities / Govt. from time to time.

- i) Register for secured advance
- ii) Register for hindrance to work
- iii) Register for running account bill
- iv) Register for labour

42.0 PRICE VARIATION ADJUSTMENT (PVA) FOR ALL MATERIALS (INCLUDING CEMENT & STEEL) & LABOUR

(Applicable only for completion period beyond 12 months)

In partial modification of the provisions made elsewhere in this contract regarding rate quoted being not subject to any variations, price adjustments to the value of work payable to the Contractor at tendered rates shall be made towards variations in the prices of materials and labour in the manner specified hereunder: -

If, after written order to commence the work and during the operative period of this contract including any authorized extensions of the original stipulated completion period: -

1. There be any variation in the Consumer Price Index- General Index- for industrial workers (Base 1982=100) (source - data published from time-to-time Indian Labour Journal by the Labour Bureau, Government of India),

OR

- (b) There be any variation in the All-India Wholesale Price Index for all commodities (Base 1993- 94=100) (as published from time to time in the RBI Bulletin based on the date issued by the Office of the Economic Advisor to the Government of India).

Price Variation Adjustment (PVA) towards (1) Labour Component and (2) Material Component shall be calculated in accordance with the formula A and B respectively, given below, subject to stipulations herein under mentioned: -

FORMULA (A) FOR LABOUR:

$$VL = 0.85P \times \frac{K1 \times (C1 - C0)}{100 \quad C0}$$

FORMULA (B) FOR MATERIALS:

$$VM = 0.85X \frac{(P-Y) \times K2 \times (I1 - I0)}{100 \quad I0}$$

Where: -

VL = Amount of Price Variation Adjustment
Increase or decrease in rupees due to labour component

VM = Amount of Price Variation Adjustment
Increase or decrease in rupees on account of materials component

NOTE: Bill period (noted hereunder) signifies the period of actual execution and not date of measurement or preparation of bill.

P = Cost of work done during the period under consideration (bill period) excluding advances
on materials and/or adjustments thereof

Y = Cost of any other materials supplied/ arranged by the Bank at fixed price during the period
under consideration (bill period)

K1 = Percentage of labour component calculated as indicated in Note (1) below

K2 = Percentage of materials component as indicated in Note (2) below.

C0 = Consumer Price Index - General Index Number for industrial workers (Base 1982 = 100) referred to at (a) above, ruling on the last due date of receipt of tenders, and as applicable to the center, nearest to the place of work, for which the index is published)

C1 = Average of above-mentioned Consumer Price Index number during the period under
consideration (bill period)

I0 = All India Wholesale Price Index number for all commodities referred to at (b) above, ruling
on the last date for receipt of tenders and as applicable to the Centre, nearest to the
place of work for which the index is published.

I1 = Average of above mentioned monthly all India Wholesale Price Index numbers during the
period under consideration (bill period)

NOTE (1) : K1 shall be taken as under:-

<u>Component of work</u>	<u>K 1</u>
a) Civil work including ancillary works and external work and RCC / tanks, septic tanks, etc. if any of sanitary and plumbing work	30
b) Sanitary and plumbing works including fittings and fixtures (internal work only)	20
c) Electrical installations work including fittings and fixtures (external and internal works)	20

NOTE (2) : K2 shall be taken as under:-

<u>Component of work</u>	<u>K2</u>
a) Civil work including ancillary works as detailed under Note (1) (a) above	70
b) Sanitary and plumbing works including fittings and fixtures as detailed under Note (1) (b) above	80
Electrical installations work including fittings and fixtures as detailed under Note (1) (c) above	80

Stipulations:

(i) PVA Clause is operative either way i.e. if the variations in above referred price indices are on the plus side. PVA shall be payable to the contractor and if they are on the negative side PVA shall be recoverable from the contractor for the respective bill period of occurrence of fluctuations.

(ii) The rates quoted by the Contractor shall be treated as firm for the value of work required to be done in the first 12 months of the contract period from the date of written order to commence work and no PVA is admissible on the same on any grounds whatsoever. The value of work required to be done during the first 12 months of the contract period shall be taken as 80% of the value of work to be done on pro-rata basis in 12 months as compared to the total stipulated completion period. No PVA is admissible on the value of work required to be done in first 12 months as worked out above, even if this value of work is actually done in a period longer than 12 months. However, in case of any delay in the first 12 months due to genuine reasons which are not attributable to the contractor and which are beyond his control, such period of delay will be deducted from 12 months, and the value of work to be done will be 80% of the pro-rata value of work to be done in such reduced period on pro-rata basis.

(iii) (a) For works where the original stipulated period of completion is not more than 12 months, no PVA whatsoever is permissible under this clause. However, if the period of completion is delayed beyond 12 months on account of genuine reasons which are not attributable to the contractor and which are beyond his control, PVA will be admissible on the value of work done only in excess of value of work required to be done on a pro-rata basis in the first 12 months minus the period of such genuine delay.

(b) For purpose of admissibility of PVA all the cumulative period of extensions granted for reasons which are solely attributable to the contractor is excluded from the total extended period of the contracts and PVA shall not be admissible on the value of work done during such period of extensions, which are granted for keeping the contract current, but only due to reasons for which the contractor was solely responsible. Periods of extensions granted on account of genuine reasons which are not attributable to the contractor and which are beyond his control will, however, be included in the period for which PVA is admissible.

(c) Notwithstanding anything to the contrary mentioned in any other clause/ clauses of the contract, extensions of the contract period shall be granted by the Architect only with prior approval of the Bank. Extensions granted by the Architect without Bank's prior approval shall not bind the Bank for payment of PVA for work done in the concerned period of extensions.

(iv) (a) Where the total cost of work done beyond the value of work required to be done in the first 12 months (vide note (ii) and (iii) above does not exceed Rs.50 lacs the total amount of PVA worked out on the basis of provisions of foregoing stipulations will be limited to an upper ceiling of 10% of such value of work done in excess of value of work required to be done in the first 12 months, minus the cost of any materials issued/arranged by the Bank at fixed prices i.e. P - Y (these terms being as per definitions given formulae A and B above).

(b) Where the total value of work done beyond the value of work required to be done in the first 12 months exceeds Rs.50 lacs, the PVA on the first Rs.50 lacs will be calculated as provided for in the foregoing para and for the balance value of work done for which PVA is admissible subject to foregoing conditions, the PVA will have the upper ceiling of 10% but it will be worked out at a lower rate i.e. 80% of the amount worked out as per the formulae A and B referred to earlier.

(v) In working out the amount of PVA as per all the foregoing stipulations, value of such extra items or such portions of extra items the rates of which are derived from the prevailing market rates of materials and labour will not be included in the value of work done. Value of only such extra items or such portions of extra items, rates of which are derived entirely from tendered rates will be included in the value of work on which PVA is calculated.

(vi) For claiming the payment for PVA the contractor shall keep such books of accounts and other documents, vouchers receipts etc. as may be required by the Bank/Architect, for verification of the increased claims or reduction to be made as the case may be and he shall also allow Engineers and/or other duly authorized representatives of the Bank/Architects and furnish such information as may be required or called for to enable verification of the claim within a week of such request.

(vii) The contractor is required to submit to the Bank, through the Architect, his claims for PVA separately for each running Bill for the individual bill periods for the work paid to him

by the Bank. He will also be required to submit detailed calculations in support of the claims.

(viii) No claim will be entertained from the contractor for interest or any other grounds for nonpayment or for any delay in payment of PVA due to late publication or non-availability of the necessary price indices or due to delay in preparation of the Running or Final Bills.

(ix) In view of adjustments for variations in process of materials and labor which have been covered in this clause no other adjustments for any reason whatsoever like statutory measures, taxes, levies, etc. will be allowed.

42.a Materials Having Basic Price

If the basic rate of any material used for the work is more or less than the basic rate given in schedule of quantities, in that case differential rate will be 1.15 times of actual rate without GST minus Basic rate in the tender. The actual rate without GST shall be taken from the GST invoice produced by the contractor subject to be found in order as per the then prevailing market rates by the Architect & the Bank. The differential rate shall be applicable for the actual quantity executed & measured for that item of work. The differential amount thus calculated shall be either plus or minus and shall be paid or recovered from the contractor. GST shall be paid on this amount.

It shall be mandatory to obtain approval of quantity / rate for the PMC / Bank before purchase of any material.

In the above case for calculating price variation as per clause 42 of GCC, amount of above material/s shall be deducted as per basic rate from the total work done amount.

43.0 Force Majeure

43.1 Neither contractor nor SBI shall be considered in default in performance of the obligations if such performance is prevented or delayed by events such as but not war, hostilities revolution, riots, civil commotion, strikes, lockout, conflagrations, epidemics, pandemic, accidents, fire, storms, floods, droughts, earthquakes or ordinances or any act of or for any other cause beyond the reasonable control of the party affected or prevents or delayed. However, a notice is required to be given within 30 days from the happening of the event with complete details, to the other party to the contract, if it is not possible to serve a notice, within the shortest possible period without delay.

43.2 As soon as the cause of force majeure has been removed the party whose ability perform its obligations has been affected, shall notify the other of such cessation and the actual delay incurred in such affected activity adducing necessary evidence in support thereof.

43.3 From the date of occurrence of a case of force majeure obligations of the party affected shall be suspended during the continuance of any inability so caused. With the caused itself and inability resulting there from having been removed, the agreed time completion of the respective obligations under this agreement shall stand extended a period equal to the period of delay occasioned by such events.

42.4 Should one or both parties be prevented from fulfilling the contractual obligations by state of force majeure lasting to a period of 6 months or more the two parties, shall each other to decide regarding the future execution of this agreement.

44.0 Local laws, Acts Regulations:

The contractor shall strictly adhere to all prevailing labour laws inclusive at contract labour (regulation and abolition act of 1970) and other safety regulations. The contractors should comply with the provision of all labour legislation including the latest requirements of the Acts, laws, any other regulations that are applicable to the execution of the project.

- i) Minimum wages Act 1948 (Amended)
- ii) Payment of wages Act 1936 (Amended)
- iii) Workmen's compensation Act 1923 (Amended)
- iv) Contract labour regulation and abolition act 1970 and central rules 1971 (Amended)
- v) Apprentice act 1961 (Amended)
- vi) Industrial employment (standing order) Act 1946 (Amended)
- vii) Personal injuries (Compensation insurance) act 1 963 and any other modifications
- viii) Employees' provident fund and miscellaneous provisions Act 1952 and amendment thereof
- ix) Shop and establishment act
- x) Any other act or enactment relating thereto and rules framed there under from time to time.
- xi) Prevailing Indian Electricity rules & act.

45.0 SAFETY CODE:

Safety code to be followed as per para 82 of SCC (Special Conditions of Contract)

46.0 Accidents

The contractor shall immediately on occurrence of any accident at or about the site or in connection with the execution of the work report such accident to the Architect / consultant. The contractor shall also such report immediately to the competent authority whenever such report is required to be lodged by the law and take appropriate actions thereof.

47.0 The contractor's shall be bound to comply the following provision in terms of "Restrictions imposed by the Government of India, Ministry of Finance Department of Expenditure under Rule 144 (XI) of General Financial Rules 2017 vide their order no. F. No 6/18/2019/PPD dated 23rd July 2020" as under.

6 Any bidder from a country which shares a land border with India will be eligible to bid in this tender ONLY if the bidder is registered with the Competent Authority (registration committee constituted by the Department for Promotion of Industry and Internal Trade).

7 Bidder' (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial judicial person not falling in any of the descriptions of

bidders stated hereinbefore, including any agency branch or Office controlled by such person, participating in a procurement process.

8 'Bidder from a country which shares a land border with India (such a country)' for this purpose means:

- a. An entity incorporated, established or registered in such a country; or
- b. A subsidiary of an entity incorporated, established or registered in such a country; or
- c. An entity substantially controlled through entities incorporated, established or registered in such a country; or
- d. An entity whose beneficial owner is situated in such a country; or
- e. An Indian (or other) agent of such an entity; or
- f. A natural person who is a citizen of such a country; or
- g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above IV. The beneficial owner for the purpose of (iii) above will be as under:

1. In case of A Company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more judicial person, has a controlling interest or who exercises control through other means. Explanation

a. "Controlling ownership interest" means ownership of or entitlement to more than twenty five percent of shares or capital or profits of the company.

b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreements.

2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more judicial person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership.

3. In case of an unincorporated association or body of Individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more judicial person, has ownership of or entitlement to more than fifteen percent of the property or the capital or profits of such association or body of individuals.

4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official.

5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

IV. An Agent is a person to do any act for another, or to represent another in dealings with third person.

V. The successful bidder shall not be allowed to sub-contract works to any contractor from country which shares a land border with India unless such contractor is registered with the Competent Authority.

VI. All bidders need to submit a declaration-cum-certificate (along with evidence) in this regard as per "Annexure VI". Failure to submit such valid declaration-cum-Certificate will make the bid liable for rejection."

48.0 Extension of time:

The time allowed for carrying out the work as entered in the agreement shall be strictly observed by the contractor and shall be reckoned from the date of commencement of work. The work shall throughout the stipulated period of contract be proceeded with care and due diligence (time being the essence of the contract) on the part of the contractor. To ensure good progress of the work during the execution, the contractor shall be bound in all cases, by the time schedule submitted by him.

1. If the contractor shall desire an extension of time for completion of work on the grounds that there having been unavoidable hindrances in execution or on any other ground, he shall apply in writing in format enclosed at Annexure VII to the architect within 30 days of the hindrance on account of which he desires such extension.
2. The Site Engineer/APMCF shall consider the application with reference to the reasonableness of the grounds cited therein and the recordings in the Hindrance register maintained at site (Proforma enclosed at Annexure VIII). They shall thereafter forward their comments/recommendations to the architects. The architects shall refer the case to the /Premises & Estate Department of the Bank along with their recommendations.
3. The Premises & Estate Department on being satisfied about the reasonableness of the request of the contractors, in terms of the relevant contract conditions, may recommend a fair and reasonable extension of time as per Bank Guidelines for granting extension of time.
4. Extension of time shall be granted before expiry of the contract period so that the contract is in force at the time of granting extension of time. Even if the contractor fails to apply for extension of time, the Site Engineer/APMCF and architects shall bring the fact to the notice of the Premises & Estate Department.
5. While granting extension of time, it shall be clearly stipulated that the extension of time is being given without prejudice to the Bank's right to recover liquidated damages under relevant contract clause.
6. The letter granting extension of time is to be issued by the architects as per Bank's standard format
7. If the contractors fail to complete the work within the stipulated period, the extended time as above or if the delay in completion of the work is attributable to the contractor in any way whatsoever, liquidated damages shall be recovered from the contractor's dues as stipulated in the contract. The authority to decide as to whether liquidated damages are to be levied or not is as per Bank guidelines.

49.0 Substandard works and materials:

The contractors are required to execute all works satisfactorily and according to the specifications.

1. If any material or work is found to be unsound, imperfect, or inferior, from what is specified in the contract, the contractor shall be advised to rectify or re-execute the work or remove the material as the case may be within a reasonable time depending upon the nature of work. If the contractor fails to do so, the work shall be got redone or rectified or the material replaced through any other agency at the contractor's risk and cost as per the provisions of the contract. The form of letter to be given to the contractor in regard to rectification of defective work and removal of substandard material is to be issued as per Bank's Standard Format.
2. Under certain exceptional circumstances, when the substandard work done cannot be rectified or redone because of structural or other constraints, the matter shall be reported to the architects and Premises & Estate Department and if it is subsequently decided to accept the said work, payment for such work shall be allowed at a reduced rate arrived at keeping in view the nature and extent of deviation from the specifications or drawings.

50.0 DELINQUENCIES

The under noted delinquencies / defaults / misconduct / misdemeanors on the part of tenderer or enlisted contractor will attract disqualification action.

1. Incorrect information about credentials, about his performance, equipment, resources, technical staff etc.
2. Non-submission of the fresh / latest income tax clearance certificate
3. Irregular tendering practice.
4. Submission of tender containing far too many arithmetical errors and freak rates.
5. Revoking a tender without any valid reasons.
6. Tardiness in commencing work
7. Poor organization at site and lack of his personal supervision
8. Ignoring Bank's notices for replacement / rectification of rejected materials, workmanship etc.
9. Violating any of the important conditions of contract i.e. site facilities, insurance, labour laws, ban on subletting etc.
10. Lack of promptitude and co-operation in measurement of work and settlement of final account.
11. Non-submission of vouchers and proof of purchases etc.
12. Tendency towards putting up false and untenable claims.
13. Tendency towards suspension of work for frivolous reasons.
14. Treatment of labour
15. Bad treatment of sub-contractors (piece workers) and unbusiness like dealings with suppliers of material.
16. Lack of co-operation with nominated contractors of Bank
17. Contractors becoming Bankrupt or insolvent.
18. Contractor's conviction by a Court of Law.
19. Failure to satisfactorily rectify defects during Defects Liability Period (DLP) and discovery of latent defects in contractor's work after the expiry of DLP of his contract.

50.1 DISQUALIFICATION ACTION AGAINST (DELINQUENCIES OF) CONTRACTOR

The award of the under noted disciplinary action shall be considered.

- a) Placing embargo on issue of tenders or temporary suspension from the Bank's approved list.
- b) Permanent ban on issue of tenders and removal from the Bank's approved list.

50.2 PROCEDURE

1. Correspondence on this subject shall be initiated (marked confidential) by the concerned Engineer in charge of project who discovered the contractor's misdemeanors / delinquencies etc.
2. The correspondence shall contain facts and proofs and not mere suspicions.
3. No disqualification action shall be taken against a contractor by an officer below rank of Assistant General Manager or the authority who have accorded approval for empanelment of pre-qualification.
4. Record of disqualification action taken against contractors shall be maintained in a separate file as also in the concerned contractor's dossier.

51. Observance of Contract Labour Act 1970 (Manual page no. 116 soft copy)

Various provisions of the Contract labour Act 1970 and the rules made there under cast certain obligations on the Bank in respect of Bank's Projects under construction at various centers. Under the Act, the Assistant General Manager of Premises & Estate Department would be considered as the "Principal Employer", even though the labourers are employed by the building contractor. The Act applies to every establishment in which twenty or more workmen are employed or were employed on any day of the preceding 12 months as contract labour. A workman shall be deemed to be employed as contract labour in connection with the work of an establishment when she/he is hired in connection with such work through a contractor with or without the knowledge of the principal employer.

However, in the cases of package deal agreements, it would not apply until the builder/vendor is deemed to be a contractor after execution of Deed of Conveyance, if so, provided in the agreement. The Act also does not apply to the work of gardening, maintenance of residential colonies and services therein. Such arrangements need not be included in the records to be maintained under the Act and rules made thereunder. During the construction of a project the "Principal Employer" shall comply with certain provisions of the Act in so far as they are applicable to the particular case. These provisions relate to-

(i) Registration of Establishment (Section 7).

The principal employer shall make an application to the registering officer in the prescribed manner for registration of establishment. The application for registration shall be made in triplicate in Form No.1 (Ref. Annexure XII) to the registering officer of the area in which the establishment sought to be registered is located. The application shall be accompanied by the Treasury receipt showing payment of fees for the registration of the establishment. The application shall be either personally delivered to the registering officer or sent to him by registered post. The employer can not employ the contract labour in his establishment unless he registers under Section 7 of the Act.

(ii) Maintenance of registers and other records (Section 29).

The following registers and records are required to be maintained by the Principal Employer:

1. Register of contractors in Form XII of the Contract Labour (Regulation & Abolition) Control Rules 1971 (Refer Annexure-XIII).
2. Notice showing the rates of wages, hours of work, wage period, dates of payment of wages, names and address of the Inspectors having jurisdiction and date of payment of unpaid wages, shall be displayed in English and in Hindi and in local language, in conspicuous places at the work site.
3. Return intimating the actual date of the commencement or completion of each contract work, under each contractor, shall be submitted to the Inspector within 15 days from the commencement or completion of the work as the case may be. The return shall be filed in Form No.VI B (Refer Annexure XIV)
4. The annual return in duplicate in Form No. XXV (Annexure XV) shall be submitted to the Registering Officer concerned so as to reach him not later than the 15th of February following the end of the year to which it relates.

All the registers, records and notices shall be produced on demand before the Inspector or any other authority under the Act.

(iii) Responsibility of payment of wages of workmen (Section 21).

Every principal employer shall nominate a representative duly authorized by him to be present at the time of disbursement of wages by the contractor and it shall be the duty of such representative to certify the amounts paid as wages in the prescribed manner. The authorized representative shall record under his signature, a certificate at the end of the entries in the Register of wages or in the Register of wage and Muster Roll, in the following form.

"Certified that the amount shown in Column No. ____ has been paid to the workmen concerned in my presence on _____ at _____."

The Contractor shall be advised to disburse the wages in the presence of the authorized representative. If the contractor fails to make payment of wages within the prescribed period or makes short payment, the principal employer shall be liable to make payment of wages in full or the unpaid balance due to the contract labour employed by the contractor and recover the amount so paid from amounts payable to the contractors.

(iv) Welfare measures (Sections 16 to 19)

The welfare measures like canteen, rest rooms and other facilities to the contract labour are required to be provided by the contractor himself, but if any of the facilities is not provided by the contractor, then it shall be provided by the employer within 7 days of the commencement of the employment of contract labour. However, all expenses incurred by the Bank in providing the amenity shall be recovered from the Contractor either by deductions from any amount payable to the contractor or as a debt payable by the contractor.

(v) Penalty for contravention (Section 22 to 27).

a) Whoever obstructs an Inspector in the discharge of his duties under the Act or refuses or willfully neglects to afford the Inspector any reasonable facility for making any inspection, examination, enquiry or investigation authorised by or under the Act in relation to an establishment, shall be punishable with imprisonment for a term which may extend to 3 months or with fine which may extend to Rs.500/- or with both.

b)The contravention of any provision of the Act or of the rules made thereunder or contravention of any condition of a license granted under the Act is punishable with

imprisonment which may extend to 3 months or with fine which may extend up to Rs.1000/- or with both.

The Site Engineer/APMCF shall ensure that all the obligations under the relevant provisions of the Act including obtaining licenses by the contractor under Section 12 of the Act are complied with. Before releasing the contractor's final payment, they shall also ensure that the contractors have paid all dues to their contract labour. Note : The contractor has to meticulously comply with para 50 & Annexures (XII to XV) about the Observance of Contract Labour Act 1970 and its updated version/ amendments time to time.

14.ANNEXURE XII: FORM I: FORMAT 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 Principal Employer. (furnish father's name in the case of individuals)	
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 Contractors and Contract Labour:	
(a)	Names and address of the Contractors	
(b)	Nature of work in which contract labour is employed or is to be employed.	
(c)	Maximum number of contract labour to be employed any day through each Contractor.	
(d)	Estimated date of commencement of each contract work under each 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 XIII : FORM XII: FORMAT OF REGISTER OF CONTRACTORS

1 Name and addresses of the Principal Employer _____

2 Name and address of the Establishment _____

Sr. No	Name and address of the contractor	Nature of work on contract	Location of contract work	Period of contract from to	Maximum number of workmen employed by the contractor

ANNEXURE XIV: FORM VI-B: FORMAT OF NOTICE OF COMMENCEMENT/COMPLETION OF CONTRACT WORK

1. Name and Principal 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 Principal Employer

The Inspector,

ANNEXURE XV : FORM XXV: FORMAT OF ANNUAL RETURN OF THE PRINCIPAL EMPLOYER TO BE SENT TO THE REGISTERING OFFICER

Sr. No		Year ending 31st December
1	Full name and address of the Principal employer	
2	Name of the Establishment. (a) District (b) Postal Address (c) Nature of operation/industry/work carried on	
3	Full name of the Manager or person responsible for supervision control of the Establishment.	
4	Number of Contractors who worked in the Establishment during the year (Given details as per proforma below).	
5	Nature of work/operations on which contract labour was employed.	
6	Total number of days during the year on which contract labour was employed.	
7	Total number of man days worked by contract labour during the year.	
8	Maximum number of workmen employed directly on any day during the year.	
9	Total number of days during the year on which direct labour was employed.	
10	Total number of man days worked by directly employed workmen.	
11	Changes, if any, in the management of the establishment, its location or any other particulars furnished to the Registering Officer in the application for Registration indicating also the dates.	

Place _____

Date _____

Principal Employer

Name

52.0 Programme charts and Progress Report:

1. As soon as the contract is awarded, a suitable program of work, preferably in the form of a bar / PERT chart shall be drawn up for completion of the different stages of the work, so as to ensure its completion within the allotted period of time. This program shall be submitted by the contractor in consultation with Architect/APMCF or Site Engineer.
2. The monthly progress chart as given in annexure-X indicating there in the programme and progress achieved both physical and financial with reasons for short fall, if any, shall be sent by the Site Engineer/APMCF to concern Department of the Bank before 10th of the following month.

17 Co-ordination and Monitoring:

1. It is the prime responsibility of the architects/APMCF to ensure that execution of the work progresses smoothly in accordance with the programme and in proper co-ordination among different agencies.
2. The Architects/APMCF shall keep a close watch on the progress of work, the resources position etc. and take suitable timely remedial measures to sort out the bottlenecks in consultation with the concerned Department of the Bank.
3. Site meetings shall be held at periodical intervals at least once in a month or at closer intervals where Architect/APMCF/Site Engineer/Bank's Engineer and the representatives of various agencies who are involved in the project shall attend and review the progress of work and sort out hindrances, if any.
4. Concerned Project Engineers/A.G.M. shall attend site meetings as often as possible in the interest of expeditious progress of the work. Minutes of the site meetings shall be prepared by the Architects/APMCF and furnished to the concerned Department and others concerned immediately after of holding such meeting.
5. In terms of the contract provisions, the contractors for general building work are required to submit progress photographs (in triplicate) at the beginning of each month. The photographs shall be so taken in such a manner so as to give a fair idea of progress of construction and the date of photographs taken shall be written on the reverse.
6. As a faster means of coordination and monitoring, the use of advanced technology may be used.

53.0 Testing of materials and approval:

1. To ensure use of quality materials and to exercise proper quality control on the works, certain tests are to be undertaken regularly by the contractor during the progress of the work as per the provisions of the contract. Some of the important tests that are to be carried out on the construction materials are such as water, steel, bricks, cement, tiles, timber, particle boards, aggregates, pipes, fittings, concrete, wires/cables, M.S. sheets, conduits, earth pits and these shall be conducted as per the relevant BIS specifications/agreement at the Government approved Technical Institutes/Laboratories. Report on these tests shall be forwarded to the Architects/APMCF who shall duly certify the results thereof are in order and the materials may be used in the work. If the results do not conform to the relative BIS, the architects shall take immediate appropriate action as per terms of contract.
2. Results of all concrete cube tests shall be recorded in a Register of Cube Tests as per Annexure XI maintained at site in a register and signature of the contractors and Site Engineer/APMCF be obtained.

3. In case to ascertain quality of executed work on site SBI/APMCF may ask Contractor to carry out specialized third-party tests, then the contractor to carry out those tests without any extra cost to SBI/APMCF.
4. Under the terms of contract, the contractors are required to submit samples of various materials, items, fittings etc. for the approval of the Bank and architect. For this purpose, special site meetings shall be arranged in the initial stage of project execution. [The materials of brand names, if any, given in the contract shall only be selected. In exceptional cases only like outdated of product technology, closure of company etc., equivalent material usage other than mentioned in approved materials list shall be allowed after duly approval from the SBI/APMCF. SBI reserves the right to reject the materials without assigning any reason whatever it may be. As far as possible, the materials of brand names, if any, given in the contract shall only be selected.](#)

54.0 Site order book:

- i) For issuing instructions to contractors in the course of day-to-day supervision of works, site order book shall be maintained by the Site Engineer/APMCF in a prescribed form (Refer Annexure XVI). Instructions should be prepared in triplicate and serially numbered. A copy of these instructions can be given to the contractor and architect for necessary action. While issuing such instructions, the contractor/his authorized representatives' signature shall be obtained on the office copy.
- ii) Instructions in the site order book shall be recorded under the signature of the Site Engineer/APMCF. The Bank's Engineer during his periodical inspection/visit shall peruse and record his instructions, if any, in this book.
- iii) All instructions to the contractors which are at variance with tender provisions as also pointing out lapses on the part of the contractors to adhere to the tender specifications shall be issued in writing through site order book by the Site Engineer/APMCF as well as architect and Bank's officials visiting the site.
- iv) The site order book shall be kept in the custody of the Site Engineer/APMCF at site. This fact shall be made clear to the contractors at the beginning of the work.
- v) The site order book shall be referred to at the time of making final payments to the contractors.
- vi) The site order book shall be preserved for a period of 5 years or up to the time of all disputes/arbitration cases of the work are finally settled, whichever is later, after completion of a work in the same manner as a M.B.

55.0 Hindrance Register:

In order to have a record of hindrance in the progress of work which may result in delays and consequent claims from the contractors for extension of time a Hindrance Register shall be maintained at the construction site. The details of hindrances with time period shall be recorded by the Site Engineer/APMCF therein when these occur and all recordings shall be signed jointly by the Site Engineer/APMCF and the contractor's representative. The extract of the same shall be sent to the Premises & Estate Department. While considering the contractor's request for extension of time for completion of work, this register shall be referred to.

56.0 Site Register:

The following registers are to be maintained at site office:

- i) Daily Progress record

- ii) Site order book
- iii) Cement and steel register (Receipts, consumption, balances).
- iv) Concrete cube test register/slump cone test register.
- v) Register of drawings and working details.
- vi) Logbook of defects.
- vii) Test reports of building materials.
- viii) Sand bulkage register/silt content register.
- ix) Lead register.
- x) Daily labour register.
- xi) Variation order register.
- xii) Hindrance register
- xiii) Electrical wiring system testing register.
- xiv) Equipment test certificate register.

These registers and a set of latest drawings shall be kept in the safe custody of the Site Engineer/APMCF.

Other than above registers, more may be required to be maintained at site as per project requirements.

(14) 57.0 BANK'S BUILDING PROJECTS - MAINTENANCE OF RECORDS TO BE DONE BY CONTRACTOR

A.	Registers at the site office of the Bank's Engineer / APMCF:
1	Measurement Books.
2	Cement Register (Daily Record).
3	Steel Register.
4	Steel Consumption Register - Bill wise.
5	Drawings register
6	Materials at site register.
7	Hindrance Register.
8	Concrete cube Test Register.
9	File and Register for extra / variation items.
10	Materials test Register and File.
11	Site Order Book (in triplicate).
12	Lead caulking Register.
13	Labour Reports and progress Reports Register.
14	Site Visit & Instructions Register.
15	Certified true copies of the contracts.

15.ANNEXURE VI

Declaration-Cum- Certificate on the Letter Head of Bidder Regarding Restrictions on Procurement From Bidders From A Country Or Countries, On Grounds Of Defense In India, Or Matters Directly Related Thereto, Including National Security.

Restrictions under Rule 144 (XI) of General Financial Rules 2017 of Ministry of Finance, India order no. F. No 6/18/2019/PPD dated 23rd July 2020

I/We have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India.

I/We, the bidder (Specify full name -----
-----)

certify that we are NOT from such a country OR, if from such a country, has been registered with Competent Authority.

I/We hereby certify that we fulfil all requirements in this regard and is eligible to be considered.

(Signature of Authorised Signatory along with Seal)

Name of authorised signatory:

Designation of Authorised signatory:

List of Evidence enclosed:

1. Copy of certificate of valid registration with the Competent Authority (Score out if not applicable)
2.
3. ...

16.ARTICLES OF AGREEMENT

This agreement made theday of between Assistant General Manager/ DGM (), State Bank of India, -----(hereinafter called the Bank or SBI) which expression shall include the successors and assigns) of the one part and M/s. company / partnership for registered under the Indian Companies Act / Partnership Act having its office registered ----- (hereinafter called 'the Contractors' which expression shall include the present directors / partners and also the directors / partners from time to time as also their respective heirs, legal representatives, administrators and assigns) of the other part

WHEREAS the employer is desirous of execution of _____(Name of Work)_____ and has caused drawings and specifications describing the works to be done prepared by Project Architects M/s _____ having their offices at _____ (hereinafter called "the Architect")

AND WHEREAS THE SAID Drawings numbered as mentioned in the tender documents hereinafter mentioned and to be issued from time to time, the specifications and the Schedule of items and quantities have been signed by or on behalf of the parties hereto.

AND whereas the contractors have agreed to execute upon and subject to the condition set forth herein and Schedule of items and quantities, General & special Conditions of Contract, specification etc. contained in the tendered documents including all correspondences exchanged by or between the parties from the submission of tender till the award of work, both letters inclusive, (all of which are collectively hereinafter referred to as "the said conditions"). The works shown upon the said drawing and /or described in the said specification and included in the schedule of Items and Quantities at the

respective rates therein set forth amounting to the sum of ____Rs_____ (Rupees _____in words_____) as there in arrived at or such other sum as shall become payable there under (hereinafter referred to as " the said Contract Amount").

NOW IT IS HEREBY AGREED AS FOLLOWS:

1. In consideration of the said Contract amount to be paid at the times and the manner set forth in the said Conditions, the Contractors shall upon and subject to the said conditions execute and complete the work shown upon the said drawings and described in the said specifications and the schedule of items and quantities.
2. The employer shall pay the Contractors the amount or such other sum as shall become payable, at the times and in the manner specified in the said conditions.

3. The term “the Architect” in the said condition shall mean the said “M/s _____” or in the event of their ceasing to be the Architect for the purpose of this contract for whatever reason, such other person or persons 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 Employer provided always that no person or persons subsequently appointed to be Architect under this contract shall be entitled to disregard or over rule any previous decisions or approval or direction given or expressed in writing by the architect for the time being.
4. The said conditions and appendix thereto shall be read and construed as forming part of this agreement, and the parties hereto shall respectively abide by / submit themselves to the said conditions and perform the agreements on their part respectively in the said conditions contained.
5. The plans, agreement and documents mentioned herein shall form the basis of this contract.
6. This contract is neither a fixed Lump sum contract nor a piece work contract but is a contract to carry out the work in respect of the entire project on item rate basis to be paid for according to actual measured quantities at the rates contained in the schedule of quantities and rates or as provided in the said conditions.
7. The Bank / Employer reserves to itself the rights of altering the specifications and nature of work by adding to or omitting any item of work or having portions of the same carried out without prejudice to the contract.
8. Time shall be considered as the essence of this contract and the contractor here by agrees to commence the work soon after the site is handed over to him or from the 14th day after date of issue of formal work order as provided for in the said conditions of contractor whichever is later and to complete the entire work within _____(period of contract) months subject never the less to the provisions for extension of time.
9. All payments by the Employer under this contract will be made only at _____.
10. Any dispute arising under this Agreement shall be referred to arbitration in accordance with the stipulations laid down in the tender.
11. That all the parts of this contract have been read by the contractor and fully understood by the contractor. They further agree to complete the said work to fullest satisfaction of architect / Employer.
12. IN WITNESS WHEREOF the Employer and the contractors have set their respective hands to these presents through their duly authorized official and the said two duplicates hereof to be executed on its behalf of the day and year first herein above written.

**Signed on Behalf of
State Bank of India**

**Signed on Behalf of the
Contractor**

In Presence of

In Presence of

1. Signature _____

1. Signature

Name _____

Name _____

Address _____

Address _____

In Presence of

In Presence of

2. Signature _____

2. Signature _____

Name _____

Name _____

Address _____

Address _____

17.APPENDIX HEREIN BEFORE REFERRED TO

1	Name of the organization Offering Contract:	Assistant General Manager, Premises & Estate Dept., Local Head Office 2nd FLOOR, PLOT NO-53A, SBI TOWER,GIFT CITY, GANDHINAGAR
2	Architect Consultants /APMCF	M/s. Mamta Shah & Associates Vadodara
3	Site Address	<i>Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara</i>
4	Scope of Works	<i>Construction works of Civil, Plumbing, Sanitary, Electrical, Firefighting, LIFTS, External Development and Allied Services, etc. for the Proposed Construction Of A Multi-Storey AO Building (Lower basement + Upper basement +Ground floor to sixth floor : Green Building With Gold Rating in Leed /Griha) For State Bank Of India</i>
5	Name of the Contractor	
6	Address of the Contractor	
7	Period of Completion	As per clause 2 of NIT.
8	Earnest Money Deposit	₹. 24,34,800(Rupees Twenty Four Lakh Thirty Four Thousand Eight Hundred Only) in the form of Demand Draft or Banker's Cheque drawn in favor of State Bank of India Payable at Gandhinagar. (Valid for a period of 90 Days from the last date of submission of the tender) EMD to be deposited on or before the time and last date of submission of the technical bid.
9	Security Deposit (SD) / Retention Money	As per Part B - Point 6 of Information and Instruction to Bidders. A
10	Defects Liability Period	As per Clause No. 1.1.18 (a) of GCC.
11	Insurance to be undertaken by the :	As per Clause 25 of GCC.
12	Liquidated damages:	As per Clause No 8 of GCC.

13	Value of Interim Bill (Min.) :	As per Clause no. 15 of NIT.
14	Date of Commencement	As per Clause 26 of GCC.
15	Period of Final measurement	As per Clause 22 of GCC.
16	Initial Security Deposit:	As per clause no. 1.2 (b) of GCC.
17	Total Security Deposit: As per clause No.	1.2 of GCC
18	Refund of Total Security Deposit Comprising of EMD and ISD	This Retention amount shall be released by the SBI in Two stages ie. 50% of Security Deposit be released after issuing of VCC and remaining 50% shall be released after completion of Defect Liability Period and Completion of Project Closure report from SBI and APMCF (para 1.1.18 of GCC) whichever is later and provided no complaint is received or the defects has been rectified by replacing the same satisfactorily.
19	Period for Honoring Certificate	1. One Month for R.A. Bills 2. The final bill will be submitted by the Contractor within one month of the date fixed for completion work and the Bill shall be Certified as per Clause 22 of GCC provided the bills are submitted with all pre-requisite documents, compliances of Statutory Authorities, test reports, etc. prescribed in the tender.

Signature of Tenderer.

Date:

18.SPECIAL CONDITIONS OF CONTRACT (SCC)**GENERAL**

1) Unless otherwise specified, IS Codes, NBC Guidelines, CPWD Specifications 2019 volume I - II with correction slips up to date shall be followed. Any additional item of work, if taken up subsequently, shall also conform to the relevant IS Code, CPWD specifications mentioned above. Should there be any difference or discrepancy between the description of items as given in the schedule of quantities, particular specifications for individual items of work and I.S. Codes etc., the following order of preference shall be observed.

- i) Minimum specification and standards, Tender Drawings, Schedule of Quantities
- ii) Particular Specifications, Special Conditions
- iii) CPWD Specifications.
- iv) Indian Standard Specifications of BIS
- v) National Building Code 2016 with up-to-date amendments
- vi) Sound engineering practices as per directions of the APMCF/SBI

2) The work shall be carried out in accordance with the Architectural drawings, structural drawings & MEP drawings, relevant codes, specifications etc. before commencement of any item of work, the contractor shall correlate all the relevant architectural and structural drawings issued for the work and satisfy himself that the information available therein is complete, suitable and unambiguous. The discrepancy, if any, shall be brought to the notice of the APMCF/SBI before execution of the work, The contractor shall be solely responsible for any loss or damage occurring by the commencement of work on the basis of any erroneous and or incomplete information. The APMCF /SBI, in no case, shall be held responsible for the accuracy thereof and/or interpretations or conclusions drawn there from by the Contractor and all consequences shall be borne by the Contractor. It is presumed that the Contractor shall satisfy himself for all possible contingencies, incidental charges, wastage, bottlenecks etc. likely during execution of work and acts of coordination which may be required. Nothing extra shall be payable on this account.

3) The work shall be carried out, all in accordance with true intent and meaning of the specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings

and/or described in the specifications, provided that the same can be reasonably inferred. There may be several incidental works, which are not mentioned in the scope of work but will be necessary to complete the item in all respect. All these incidental works/ costs which are not mentioned in specifications / drawings / tender document but are necessary to complete the item shall be deemed to have been included in the rates quoted by the contractor. No adjustment of rates shall be made for any variation in quantum of incidental works due to variation / change in actual working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such items in all respects) on account of the directions of APMCF /SBI. Nothing shall be payable on the account of incidental works.

4) If any further details/elaboration or any miscellaneous clarifications etc. to the attached drawings required to the contractor for execution of work, the same may be asked by the contractor at least one month prior to its requirement so that consultant of the work may provide within a month to him. No hindrance shall be given on this account. Requirement of more Elaboration/detailing/Miscellaneous Drawings as required by contractor and provided by the consultant/department shall not mean change of Scope of Work etc. and for that nothing extra shall be payable to contractor.

5) In the event of any variation/ discrepancy in the drawings, specifications and tender Documents etc. the decision of the APMCF /SBI shall be final binding and conclusive on the contractor and in the case the contractor have any doubt and the same should be got clarified immediately from the APMCF /SBI and no claim of the contractor shall be entertained thereafter. Moreover, the agency is not allowed to take benefit out of any clerical/ grammatical mistake in the standard clauses/Specifications etc. being used in the agreement.

6) Existing drains, pipes, cables, over-head wires, sewer lines, water lines and similar services encountered in the course of the execution of work shall be protected against the damage by the contractor, in case any damages to such existing services take place the same shall be rectified by the contractor at his own expense to the satisfaction of the APMCF /SBI. The contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.

7) Existing Storm water drains around periphery of site shall be maintained by the Contractor free of cost by regular cleaning, repairing, protecting, Debris removing, making smooth path for the flow of storm water.

8) The contractor shall be responsible for the watch and ward / guard of the buildings, safety of all fittings and fixtures including sanitary and water supply fittings and fixtures provided by him against theft/ pilferage and breakage during the period of installations and thereafter till the building is physically handed over to the department.

9) The entire work up to the plinth level, as required for obtaining approval up to the plinth (Further commencement certificate after plinth level) from the local authority, shall be completed by the Contractor simultaneously. Work above plinth shall be allowed to be carried out only after obtaining approval from the local body. No delay shall be allowed on this ground and also no claim whatsoever on account of any delay in approval at plinth level by the local body shall be entertained from the Contractor.

10) The rates quoted by the Contractor are deemed to be inclusive of site clearance, setting out work, profile, establishment of reference benchmark(s), taking spot levels, construction of all safety and protection devices, barriers, preparatory works, working during monsoon, working at all depths, height, lead, lift and location and any other incidental works required to complete this work.

11) For works below ground level the contractor shall keep that area free from water. If dewatering or bailing out of water is required, the same shall be responsibility of contractor. Nothing extra shall be paid on this account.

12) Any legal or financial implications resulting out of disposal of earth shall be carried out by the contractor at his own cost. Nothing extra shall be payable on these accounts

13) The Contractor shall keep himself fully informed of all acts and laws of the Central & State Governments, all orders, decrees of statutory bodies, tribunals having any jurisdiction or authority, which in any manner may affect those engaged or employed and anything related to carrying out the work. All the rules & regulations and byelaws laid down by local body and any other statutory bodies shall be adhered by the contractor, during the execution of work. The Contractor shall also adhere to all traffic restrictions notified by the local authorities.

14) The cost of water for construction and labours (for municipal water connection as well as tanker water) shall be borne by the contractor. Also, if the contractor obtains water connection for the drinking purposes from the municipal authorities or any other statutory body, the consequent charges shall be borne by the contractor. All statutory taxes, levies, charges (including water and sewerage charges, charges for temporary service

connections and / or any other charges) payable to such authorities for carrying out the work, shall be borne by the Contractor.

15) The Contractor shall arrange to give all notices as required by any statutory / regulatory authority for labour licenses, registration with EPFO, ESIC and BOCW Welfare Board etc. and shall pay to such authority all the fees, cess, labour cess, etc. that is required to be paid for the execution of work. He shall protect and indemnify the Department and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts.

16) All payments or fees related to all works shall be payable to Government/ Local Body including statutory payments demanded either in the name of Customs Department Contractor for obtaining the various applicable permissions/ all required and applicable Approvals/licenses like CFO approvals, excavation approval, Certificate and making and getting all permanent civil and E & M service connections, Payments payable to electrical supply company etc. for the scope of this work shall be borne by the Contractor. No extra payment shall be done to Contractor on this account.

17) Royalty at the prevailing rates shall be paid by the Contractor on all materials such as boulders, metals, sand and bajri etc. collected by him for the execution of the work, directly to the revenue authority of the state government concerned.

18) No foreign exchange shall be made available by the Department for importing (purchase) of equipment, plants, machinery, materials of any kind or any other items required to be carried out during execution of the work. No delay and no claim of any kind shall be entertained.

19) The Contractor shall carry out his work so as not to interfere with or hinder the progress of the work being carried out by any other agency. As far as possible, he shall arrange his work and place, so as not to interfere with the operations of other Contractors or shall arrange his work with that of the others, in an acceptable and coordinated manner and shall perform it in proper sequence

20) If the work is carried out in more than one shift or during night, no claim on this account shall be entertained. The agency must take permission from the police authorities etc. if required for work during night hours, no claim / hindrance on this account shall be considered if work is not allowed during nighttime.

21) The Contractor shall assume all liability, financial or otherwise in connection with this contract and shall protect and indemnify the SBI from any and all damages and claims that may arise on any account. The Contractor shall indemnify the SBI against all claims in respect of patent rights, royalties, design, trademarks of name or other protected rights, damages to adjacent buildings, roads or members of public, residents, visitors, other agencies/vendor's workers, & their vehicles in course of execution of work or any other reasons whatsoever, and shall himself defend all actions arising from such claims and shall indemnify the SBI in all respect from such actions, costs and expenses. Nothing extra shall be payable on this account.

22) The Contractor shall make all necessary arrangements for protection from rains, the work already executed and for carrying out the further work, during monsoon including providing and fixing temporary shelters, protections etc.

23) In case of flooding of site on account of rain or any other cause and any consequent damage, whatsoever, no claim financially in the contract agreement. Also, the Contractor shall make good at his own cost, the damages caused, if any.

24) The Contractor shall take all necessary precautions to prevent any nuisance or inconvenience to SBI, tenants or occupants of the adjacent properties and to the public in general. The Contractor shall take all care, as not to damage any other adjacent property or other services running adjacent to the plot. If any damage is done, the same shall be made good by the Contractor at his own cost and to the entire satisfaction of the APMCF /SBI. The Contractor shall use such methodology and equipment for execution of the work, so as to cause minimum environmental pollution of any kind during construction, to have minimum construction time and minimum inconvenience to road users and to the occupants of the buildings on the adjacent plot and public in general, etc. He shall make good at his own cost and to the entire satisfaction of the APMCF /SBI any damage to roads, paths, cross drainage works or public or private property whatsoever caused, due to the execution of the work or by traffic brought thereon, by the Contractor. Further, the Contractor shall take all precautions to prevent any pollution of streams and waterways. All waste or superfluous materials shall be carted away by the Contractor, entirely to the satisfaction of the APMCF /SBI. Utmost care shall be taken to keep the noise level to the barest minimum so that no disturbance as far as possible is caused to the occupants / users of adjoining buildings. No claim whatsoever on account of site constraints mentioned above or any other

site constraints not specifically stated here, shall be entertained from the Contractor. Therefore, the Contractors are advised to visit site and get first-hand information of site constraints. They should quote their rates accordingly.

25) The quoted rates shall also be inclusive of all ancillary/enabling and incidental works required for execution of work like labour camp, stores, fabrication yard, offices, watch and ward, temporary structure for plants and machineries, scaffolds, H frames, Props, Spans, Cup lock system, Safety Platforms, Covering external scaffold with green shade nets, polypropylene sheets to avoid direct fall of any materials from higher side, Safety equipment, watch and ward security, vehicles, labs, water storage tanks, arrangement for temporary connection for electricity, telephone, water etc. including their consumption charges, protection works, barricading, providing testing facilities / laboratory at site of work for various field and laboratory tests or any other activity which is necessary for execution of work and as directed by APMCF /SBI. Before start of the work, the Contractor shall obtain approval of the APMCF /SBI, before locating various temporary structures/ site office, positioning of machinery, material yard, cement and other storage, steel fabrication yard, site laboratory, water tank, etc.

In Addition to the above Contractor to take into considerations of Preamble mentioned in Tender BOQ

26) The Contractor shall display all permissions, licenses, registration certificates, bar charts, other statements etc. under various labour laws and other regulations applicable, at his site office.

27) The Contractor shall cooperate with and provide facilities to the sub-Contractors and other agencies working at site for smooth execution of the work. The Contractor shall

- i) Properly co-ordinate his work with the work of other agencies.
- ii) Provide control lines and benchmarks to his Sub-Contractors and the other Contractors.
- iii) Provide electricity at mutually agreed rates.
- iv) Co-ordinate with other Contractors for leaving inserts, making chases, alignment of services etc. at site.
- v) Adjust his work schedule and site activities in consultation with the APMCF /SBI and other Contractors to suit the overall completion schedule.
- vi) Resolve the disputes with other Contractor amicably and the APMCF

/SBI shall not be made intermediary or arbitrator. The contractor shall indemnify the SBI against any claim(s) arising out of such disputes.

Vii) In case of variation / conflicting provisions is observed in any condition of bid document forming part of contract, the decision of tender accepting authority shall be final and binding on the contractor

28) As Built Drawings

i) For the drawings issued to the contractor by the APMCF . The APMCF will issue two sets of drawings to the Contractor for the items for some changes have been made. From the approved drawings as instructed by the SBI / APMCF. The contractor will make the changes made on these copies and return these copies to the APMCF for their approval. In cases revision is required or the corrections are not properly marked the APMCF will point out the discrepancies to the contractor. The contractor will have to incorporate these corrections and / or attend to discrepancies either on copies as directed by the APMCF and resubmit to him for approval. The APMCF will return one copy duly approved by him.

ii) For the drawings prepared by the contractor

The contractor will modify the drawing prepared by him wherever the changes made by the SBI / APMCF and submit two copies of such modified drawings to the APMCF for approval. The APMCF will return one copy of the approved drawing to the contractor.

29) SUFFICIENCY OF TENDER

The Tenderer shall be entirely responsible for sufficiency of rates quoted by him in his tender.

Sufficiency of tender prices: Subject to any provisions laid down in the tender document, the Contractor shall be deemed to have satisfied himself before submitting his tender as to the correctness and sufficiency of the tender and to have taken account of all that is required for the full and proper execution of the contract and to have included in his rates and prices all costs related to the completion of work.

30) PROGRAM /SCHEDULE

The Contractor shall prepare an integrated programme chart within fifteen days of issue of award letter including Civil as well as E & M activities for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, equipment and machinery required for the fulfillment of the program within the stipulated period and

submit the same for approval of the APMCF /SBI. These shall be submitted by the contractor through electronic media besides forwarding hard copies of the same. The integrated programme chart so submitted should not have any discrepancy with the physical milestones attached in the contract agreement. The programme chart should include the following:

- i) Descriptive note explaining sequence of various activities.
- ii) Construction Programme prepared on PRIMAVERA/MS Project Software, which will indicate resources in financial terms, manpower and specialized equipment for every important stage. One planning engineer should be engaged in project who is familiar in PRIMAVERA/MS Project software. No extra payment shall be made in this regard to the contractor. Hard copy of the construction programme with sign & stamp of Authorized signatory shall be submitted to SBI/APMCF
- iii) Programme for procurement of materials by the contractor.
- iv) Programme for arranging and deployment of manpower both skilled and unskilled so as to achieve targeted progress.
- v) Programme of procurement of machinery/equipment having adequate capacity, commensurate with the quantum of work to be done within the stipulated period, by the contractor.
- vi) Programme for achieving fortnightly micro milestones and periodic milestones.

31) The time allowed for carrying out the work as entered in the tender shall be strictly observed by the Contractor. This shall be reckoned from the date on which the order to commence work is given to the Contractor. Time being deemed to be the essence of this contract on the part of the Contractor, the work shall, during the stipulated period of the contract, proceed with, all due diligence and executed as follows :

TABLE OF MILESTONE(S)

Sr. No.	Financial Progress	Time allowed (From date of start)	Amount to be withheld in case of non- Achievement of Milestone.
1	1/8th (of the whole work)	1/4th (of the whole work)	In the event of not achieving the necessary progress as assessed from the running payment, 1% of require financial progress value at that level of time will be withheld for failure of each milestone
2	3/8th (of the whole work)	½ (of the Whole work)	-do-

3	3/4th (of the whole work)	3/4th (of the whole work)	-do-
4	Full	Full	-do-

i) The agency shall submit measurement of work done with milestone on monthly basis along with RA bill as per milestone claimed. Based on milestone bill will be recommended for the payment.

ii) In case, the contractor does not achieve a particular milestone mentioned in table of milestones, amount shown against the milestone shall be withheld, to be adjusted against the compensation levied at the final.

iii) The amount on failure to achieve a milestone shall be automatic withheld without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s) the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However, no interest, whatsoever, shall be payable on such withheld amount.

32) If at any time, it appears to the APMCF /SBI that the actual progress of work does not conform to the approved programme referred above, the contractor shall produce a revised program within seven days showing the modifications to the approved program by additional inputs to ensure completion of the work within the stipulated time. A recovery of amount/Penalty as specified shall be made in case of delay as per tender clause.

33) The submission for approval by the APMCF / SBI of such programme or the furnishing of such particulars shall not relieve the contractor of any of his duties or responsibilities under the contract. This is without prejudice to the right of APMCF /SBI to take action against the contractor as per terms and conditions of the agreement.

QUALITY ASSURANCE & TESTING OF MATERIALS

34) The contractor shall establish field laboratory at site including all necessary equipment for field tests as given in tender document. All the relevant and applicable standards and specifications shall be made available by the contractor at his cost in the field laboratory.

Quality Assurance Engineer of the contractor shall be responsible for carrying out all mandatory field/ laboratory tests. The contractor shall so provide adequate supporting staff as his cost for carrying out field tests, packaging & forwarding of samples for outside laboratory tests and for maintaining test records. All the registers of tests carried out at site or in outside laboratories shall be maintained by the contractor. The test register shall be prepared and maintained by the Contractor as directed and approved the APMCF /SBI. All the entries in the test register will be made by the designated engineer of the contractor and same shall be regularly reviewed by the APMCF /SBI or his authorized representatives at site.

35) The Contractor shall procure and provide all the materials from the manufacturers / suppliers as per the list attached with the tender documents, as per the conditions and specifications for the work. The equivalent brand for any item shall be permitted to be used in the work, when any of the preferred make is not available. This is, however, subject to documentary evidence produced by the contractor regarding non availability of the preferred brand and also subject to independent verification by the APMCF /SBI. In exceptional cases, where such approval is required, the decision of APMCF /SBI as regards equivalent make of the material shall be final and binding on the Contractor. No claim, whatsoever, of any kind shall be entertained from the Contractor on this account. Also, the sample work/ material shall be procured only after obtaining written approval of the APMCF /SBI.

36) All materials shall be got checked by the APMCF /SBI or his authorized supervisory staff on receipt of the same at site before use.

37) The Contractor or his authorized representative shall associate in collection, preparation, forwarding and testing of such samples. In case he or his authorized representative is not present or does not associate him, the result of such tests and consequences thereon shall be binding on the Contractor. The Contractor or his authorized representative shall remain in contact with the APMCF/SBI or his authorized representative associated for all such operations. No claim of payment or claim of any other kind, whatsoever, shall be entertained from the Contractor.

38) All the hidden/Buried/ Concealed items such as water supply lines, drainage pipes, conduits, sewers etc. are to be properly tested as per the design conditions before covering.

39) Water tanks, taps, sanitary, water supply and drainage pipes, fittings and accessories should conform to Green Building norms, bylaws and municipal body/ corporation where Specifications are not available.

40) BIS marked materials except otherwise specified shall be subjected to quality test at the discretion of the APMCF /SBI besides testing of other materials as per the specifications described for the item/material. Wherever BIS marked materials are brought to the site of work, the agency shall, if required, by the APMCF /SBI, furnish manufacturer's test certificate or test certificate from approved testing laboratory to establish that the material / procured by the agency for incorporation in the work satisfies the provisions of specifications / BIS codes relevant to the material and / or the work done.

41) The contractor shall procure the required materials in advance so that there is sufficient time to testing of the materials and clearance of the same before use in the work.

42) The contractor shall supply free of charge the materials required for testing including packing and transportation to testing laboratory. The testing of materials shall be conducted in Govt. Laboratory/ Govt. colleges/ IITs/NITs or from the laboratory approved by APMCF/SBI. The charges for testing of materials shall be borne by the Contractor.

The tests shall be carried out under the supervision of the Engineer-in-charge. 70% of the total tests to be done is to be carried out on site laboratory if the facilities are available as per tender terms and conditions, remaining 15% tests is to be carried out at govt./ Semi Govt. laboratory and 15% tests is to be carried out at Govt. recognized/NABL accredited laboratory.

43) All expenditure to be incurred for testing of samples e.g., packaging, sealing, transportation, loading, unloading etc. including testing charges shall be borne by the contractor in all cases irrespective of testing results.

44) Contractor shall submit minimum "Quality Assurance" plan within 45 days after award of work which shall be consisting of:

45) Lot size, number of required tests and frequency of testing.

46) While deciding these criteria Tender Specifications & Provisions of BIS Codes and Standard Practices may be referred. Volume of work, Practical Difficulties and Site Conditions etc. may also be kept in view. The lot size, number of tests and frequencies of testing can be increased as per requirement by the APMCF /SBI from the prescribed limits.

47) It should clearly indicate the Machinery and other Tool & Plants required to be deployed at site by the agency. Entire Machinery and T&P may not be required at the start of work, therefore, a proper time schedule by which each Machinery & T&P is to be brought at site should

also be indicated.

48) The Contractor shall allow access to Third Party Quality Assurance (TPQA) Agency if any appointed by APMCF/SBI or any other Committee related to APMCF/SBI which required to visit the site to have a control on quality and methodology of execution. Samples of materials including Cement Concrete Cubes shall be taken jointly by Contractor and APMCF / APMCF /SBI or his authorized representative. All arrangements for transporting and getting them tested shall be made by the Contractor.

49) All material received at site shall be entered in MAS Register and copy of Supply order, Manufacturer's Test Certificate & Bill-invoice shall be maintained in order.

50) The MAS Registers, Cement Register, Steel Register, Paint and Chemical Register, Bitumen Register, Test Register etc. shall be maintained by a qualified staff of Contractor which may be inspected by APMCF /SBI or his/her representative at any time. The daily report of receipt of material shall be sent to Project Manager / Project Architect of APMCF or his/her representative.

51) The safe custody of all registers shall be the responsibility of Contractor. Submission of copy of all test registers and Material at Site Register along with each alternate Running Account Bill and Final Bill shall be mandatory.

52) As and when any important item is taken up for execution, the Contractor shall submit the specifications and develop a checklist and Pour card. This sample checklist should be got approved from the

APMCF /SBI and should be used at site. This check list should be shown to the APMCF /SBI or his/her representative during inspection. This procedure is to be followed for all hidden items, CC/RCC work, Steel-reinforcement, shuttering, flooring, doors & windows, plumbing, including water supply pipelines, roof treatment, earth filling etc.

53) In addition, the contractor shall submit theoretical consumption statements for the items involving use of cement, steel reinforcement, chemical, paints, ready mix concrete, bitumen etc. as directed by the APMCF /SBI along with every running account bill for record and reconciliation of material issued, consumed and balance.

54) These measurements shall then be 100% checked & verified by the authorized representatives of the APMCF. Subsequently measurements shall be checked by SBI engineer as per SBI guidelines along with APMCF. The contractor shall incorporate all such changes or corrections, as may

be done during these checks, to his draft computerized measurements and submit the corrected computerized measurement Books with its pages machine numbered to the APMCF /SBI.

55) The Computerized Measurement Book shall be allotted a serial number as per the Register of Computerized Measurement Books and processed for payment.

56) PREPARATION OF SAMPLE

The contractor shall prepare mock up sample comprising of all finishes and fittings included in the scope of this contract for approval of committee consisting of members from each discipline, of APMCF and SBI. However, any sample not approved will not form part of the main work and the contractor shall have to dismantle and remove the same from the site of work as his cost and shall prepare new sample for approval as per direction of the APMCF /SBI. Nothing extra shall be paid on account of this.

Contractor can prepare 4 to 5 /suitable nos. of mockups of tiles, Toilets, CP Sanitary fittings and all other materials separately and get the samples approved well in before.

57) FACILITIES AT SITE FOR SBI & APMCF (Separately)

I) The Contractor shall construct site office (Permanent/semi-permanent structure for SBI & APMCF staff, equipped with all necessary equipment required for functioning of the office. The area of the office shall accommodate pantry, conference room, office rooms, toilets and other requisite facilities. In case of shifting CLIENT/APMCF site office should be carried out without any cost as per site requirement.

ii) The Contractor shall provide 2 number of computers (with minimum specification i5, 8GB RAM, 1 TB hard disc, 256 SSD, integrated graphic card), 1 laptops (with minimum specification i5, 8GB RAM, 1 TB hard disc, 256 ssd, 2GB dedicated graphic card) and 1 Tablets of Samsung or equivalent (with minimum specification 4G, VoLTE, Wi-Fi, Snapdragon 750G or equivalent, 2.2 GHz Processor, 6 GB RAM, 128 GB inbuilt, 10000 mAh Battery with Fast Charging, Memory Card Supported, up to 1 TB) along with two multi-function colour laser printers and two black and white laser printers etc. all new and in working condition with necessary peripherals. One colour printer (inkjet) for A3 size shall also be provided. It's O&M too is to be arranged by contractor by own cost.

iv) The Contractor shall provide one land line with broadband connection.

V) The Contractor shall provide brand new, BEE certified Air Conditioners of necessary tonnage capacity as per space, lighting and fixtures i/c fans, RO

purified drinking water etc. during the whole agreement period. AMC charges, Electricity bill, water supply bills, RO/drinking water bills, telephone charges, internet charges etc. shall be borne by the contractor.

vi) The contractor shall provide the minimum required file/ Document storages and required infrastructure for a site office

vii) Security and watch and ward

viii) The contractor shall be responsible for security and watch and ward of the office, records, furniture and fixtures.

ix) The contractor shall maintain the site office and its surroundings in a neat and clean condition for the entire duration of the construction. The toilet effluent shall be discharged into sewer line or soak pits without causing unsanitary conditions in the surroundings. After completion of the work, site office shall be dismantled by the contractor and all the dismantled materials furniture fixtures shall be taken away at his cost.

X) Nothing extra shall be paid on account of this. The quoted rate by the contractor is inclusive of these facilities.

57.0 WATER / ELECTRICITY / TELEPHONE CONNECTION

i) The contractor shall make his own arrangement for water, electricity & telephone etc. for his use at his cost. The Contractor shall abide by the rules/ bye laws applicable in this regard and he shall be solely responsible for any penalty on account of violation of any of the rules /bye laws in this regard. The Contractor shall indemnify the Department against any claim arising out of pilferage, theft, damage, penalty, non-settlement of bills etc. whatsoever on this account.

ii) The Department shall in no way be responsible for any delay in getting electric and water and telephone connections for execution of the work or not getting connections at all. No claim of any kind, whatsoever, on this account shall be entertained from the Contractor. The Contractor shall arrange electricity and water etc. at his own cost required for testing of the various electrical installations, testing of water supply, sanitary and drainage lines, water proofing of underground and overhead tanks.

58.0 WATERPROOFING WORKS

The Contractor has to submit 10 Years Guarantee bond for all Water proofing works executed on site and in addition to Security Deposit additional 2.5% security deducted for completed work of the respective waterproofing work based on the cost of work executed. This security Deposit shall be released after satisfactory compliance of this 10 Years Period. BG shall not be entertained for it.

Note : Interest shall not be paid on any security deposit, retention amount, etc., whatsoever be the duration of it.

59.0 CLEANLINESS OF SITE

The Contractor shall not stack building material / malba / muck on the land or road of the local development authority or on the land owned by the others. The site of work shall be always kept clean. The Contractor shall take all care to prevent any water- logging at site. The wastewater, slush etc. shall not be allowed to be collected at site. It may be directly pumped out to public drainage system with the prior approval of the concerned authorities at his cost. The work shall be carried out in such a way that the entire area is kept clean and tidy.

60.0 SECURITY & TRAFFIC ARRANGEMENTS

i) In event of any restriction being imposed by the Department, traffic or any other statutory authority having control over the project, on the working or movement of Labour, materials, etc., the Contractor shall strictly follow all such restrictions or instructions issued regarding the same and nothing extra shall be payable to the Contractor on account of such restrictions or instructions. No delay or claims of any kind shall be entertained from the Contractor on this account.

ii) The Contractor shall be wholly responsible for security of site and works. The Contractor shall not permit entry of any unauthorized persons in the Site; and entry shall be limited to the Employees of the Contractor, Sub Contractor or persons authorized by the APMCF/SBI

iv) Lighting: The contractor shall provide sufficient lighting at project site, during periods of insufficient natural light, if required.

61.0 PHOTOGRAPHY & VIDEOGRAPHY DOCUMENTATION (TO BE DONE PROFESSIONAL AGENCY ONLY):

The Contractor shall undertake and carry out documenting the total sequences of this project by way of photography, slides, video recording (including drone recording after due approval from Local Authorities if required) etc. at his cost. The original photographs & videos shall be the property of the SBI. No copy shall be prepared by the contractor without prior approval of the APMCF/SBI. The RCC & RMC works for sub-structure & super- structure has to be photographed & video graphed for every slab level as well as foundation work, for each important activities like Concreting, Reinforcement laying, Cube Casting etc. In other cases, the photography shall be taken at minimum of 2 weeks interval and videography at a minimum of 4 weeks interval. The said soft copies shall be shared by pen drive and also be stored in Hard disc of requisite capacity at site. The positive of

photographs in 4" x 6" size should be sequentially documented in album. All should be kept securely at site/ SBI office.

62.0 CONDITIONS WHERE REINFORCEMENT STEEL TO BE PROCURED BY CONTRACTOR

i) The agency shall procure steel reinforcement as per the approved list of makes given in this document and directions given by SBI from time to time.

ii) The contractor shall have to obtain and furnish test certificates to the APMCF /SBI in respect of all supplies of steel brought by him to the site of work.

iv) Samples shall also be taken and got tested by the APMCF /SBI as per the provisions in this regard in relevant BIS codes. In case the test results indicate that the steel arranged by the contractor does not conform to the specifications, the same shall stand rejected, and it shall be removed from the site of work by the contractor at his cost within a week time or written orders from the Engineer- in-Charge/SBI to do so.

v) The steel reinforcement bars shall be brought to the site in bulk supply of 10 tons or more, or as decided by the APMCF /SBI.

vi) The steel reinforcement brought on site shall be of straight bars only and no bent bars are allowed on site and nothing extra shall be paid to Contractor on account of this .

Vii) The steel reinforcement bars shall be stored by the contractor at site of work in such a way as to prevent their distortion and corrosion, and nothing extra shall be paid on this account. Bars of different sizes and lengths shall be stored separately to facilitate easy counting and checking.

Viii) For checking nominal mass, tensile strength, bend test & re-bend test etc. specimen of sufficient length shall be cut from each size of the bar at random at frequency not less than the specified below:

Size of bar	For consignment below 100Tones	For consignment above 100 tons
Under 10 mm diabars	One sample for each 25 tons or part thereof	One sample for each 40 tons or part thereof
10 mm to 16 mm diabars	One sample for each 35 tons or part thereof	One sample for each 45tonnes or part thereof

Over 16 mm dia bars	One sample for each 45 tons or part thereof	One sample for each 50 tons or part thereof
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ix) The contractor shall supply free of charge the required steel bars for including its transportation to testing laboratories. **The cost of tests shall be borne by the contractor.**

x) The actual issue and consumption of steel on work shall be regulated. The theoretical consumption of steel shall be worked out as per procedure prescribed in Tender document, General Conditions of the contract shall be governed by conditions laid therein. In case the consumption is less than theoretical consumption including permissible variations leading to under designing of the structure, the work shall be summarily rejected, otherwise recovery at rate so prescribed shall be made after ensuring structural soundness and stability. In case of excess consumption, no adjustment needs to be made.

xi) Steel brought to site and remaining unused shall not be removed from site without the written permission of APMCF /SBI.

Xii) The standard sectional weights referred to shall be as given in Table 5.4 in para 5.3.4 in CPWD Specification 2019 Vol.-I and will be considered for conversion of length of various sizes of TMT Bars into standard weight. Record of actual sectional weights shall also be kept dia And lot wise. The average sectional weight for each diameter shall be arrived at from samples from each lot of steel received at site. The decision of the APMCF /SBI shall be final for the procedure to be followed for determining the average sectional weight of each lot. Quantity of each diameter of steel received at site of work each day will constitute one single lot for the purpose. The weight of steel by conversion of length of various sizes of bars based on the actual weighted average sectional weight shall be terms as Derived Actual Weight.

Xiii) If the derived weight is less than the standard weight, then the Derived Actual Weight shall be accepted if it is within the following tolerances specified in IS:1786-2008, otherwise whole lot will be rejected. However, deductions shall be made for the difference in derived actual weight and standard weight at the rate mentioned in clause 10CA for TMT reinforcement bars.

TOLERANCES ON NOMINAL MASS

Nominal Size in mm		Tolerance on Batch	Nominal Mass per Individual sample*	Individual sample for coil**
a)	Up to and including 10	± 7	-8	± 8
b)	Over 10 up to and i/c16	± 5	-6	± 6
c)	Over 16	± 3	-4	± 4

* For individual sample plus tolerance is not specified.

**For coils batch tolerance is not specified.

Xiv) If the derived actual weight is found more than the standard weight, then nothing shall be paid extra for the difference in derived actual weight and standard weight.

xv) The contractor shall submit original vouchers from the manufacturer for the total quantity of steel supplied under each consignment to be used in the work. All consignment received at the work site shall be inspected by the Site staff along with the relevant documents before acceptance. The contractor shall obtain Original Vouchers and Test Certificates and furnish the same to the Engineer- in-Charge of APMCF /SBI in respect of all the lots of steel brought by him from approved supplier to the site of work. The original vouchers and test certificates shall be checked/countersigned by the Site staff appointed by APMCF/SBI and kept on record in the site office.

63. CONDITIONS WHERE CEMENT IS TO BE PROCURED BY THE CONTRACTOR

- i) Cement required for the work shall be procured by the contractor.
- ii) The contractor shall procure PPC conforming to IS: 1489(Part-I) / OPC (grade 43/53) conforming to IS:8112 as per list of Preferred Makes for Civil Works. All concrete work shall be carried out as per approved design mix by SBI /APMCF. For Plastering and Waterproofing works Contractor can use PPC cement as given approved list of makes.
- iii) The Supply of cement shall be taken in 50 kg bags/Bulkers bearing manufacturer's name, or his registered trademarks if any and grade and type of cement as well as ISI marking. The packing of the cement bags shall be as per CPWD Specifications 2019 with correction slips up to last date of submission of bid. Samples of cement arranged by the contractor shall be taken by the APMCF /SBI and got tested in accordance with provisions of relevant BIS codes. In case the test results indicate that the cement arranged by the contractor does not conform to the relevant BIS codes, the

same shall stand rejected, and it shall be removed from the site by the contractor at his own cost within a week's time of written order from the APMCF /SBI to do so.

iv) The cement shall be brought at site in bulk supply of approximately 20 tons or more as decided by the APMCF /SBI.

v) At least 1 no. cement godown of the capacity to store a minimum of 500 bags of cement shall be constructed by the contractor at site for which no extra payment shall be made

vi) The contractor shall be responsible for the watch and ward and safety of the cement godown. The contractor shall facilitate the inspection of the cement godown by the APMCF /SBI at any time.

Vii) The cement shall be got tested by the Contractor and shall be used on the work only after satisfactory test results have been received. The contractor shall supply free of cost the cement required for testing including its transportation cost to testing laboratories. The cost of tests shall be borne by the contractor.

Viii) The actual issue and consumption of cement on work shall be regulated and proper accounts maintained. The theoretical consumption of cement shall be worked out as per standard consumption mentioned in Tender /CPWD manual and shall be governed by conditions laid there in. In case the cement consumption is less than theoretical consumption including permissible variation, work shall be liable to be rejected. In case of excess consumption, no adjustment needs to be made.

ix) The cement brought to the site and the cement remaining unused after completion of the work shall not be removed from site without the written permission of the APMCF /SBI.

x) The damaged cement shall be removed from the site immediately by the contractor on receipt of a notice in writing from the Engineer-in-Charge of APMCF. If he does not do so within 3 days of receipt of such notice, the Engineer-in-Charge of APMCF shall get it removed at the cost of the contractor.

66.0 CONDITIONS SPECIFIC TO GREEN BUILDING PRACTICE/ENVIRONMENTAL CLEARANCE

It is envisaged to fulfill Environmental Clearance conditions of for various buildings to be constructed under this contract. The contractor shall strictly adhere to the following conditions as part of his contractual obligation.

l) The Contractor should follow the construction plan as proposed by the

Architect /APMCF /SBI to minimize the site disturbance such as soil pollution due to spilling. Use staging and spill prevention and control plan to restrict the spilling of the contaminating materials at site. Protect topsoil from erosion by collection storage and reapplication of top soil, constructing sediment basin, contour trenching, mulching etc.

ii) No excavated earth shall be removed from the campus unless suggested otherwise by APMCF /SBI. All subsoil shall be reused in backfilling/landscape, etc. as per the instructions of the APMCF /SBI. The surplus excavated earth shall be disposed of by the contractor for reuse. A certificate of reuse as required by the APMCF /SBI shall be submitted by the contractor.

lii) The contractor shall not change the natural gradient of the ground unless specifically instructed by the APMCF /SBI. This shall cover all-natural features like water bodies, drainage gullies, slopes, mounds, depressions, etc. Existing drainage patterns through or into any preservation area shall not be modified unless specifically directed by the APMCF /SBI.

iv) The contractor shall not carry out any work which results in the blockage of natural drainage.

v) The contractor shall ensure that existing grades of soil shall be maintained around existing vegetation and lowering or raising the levels around the vegetation is not allowed unless specifically directed by the APMCF /SBI.

vi) Contractor shall reduce pollution and land development impacts from automobiles used during construction.

Vii) Overloading of trucks is unlawful and creates the erosion and sedimentation problems, especially when loose materials like stone dust, excavated earth, sand etc. are moved. Proper covering must take place. No overloading shall be permitted.

Viii) Preserve and Protect Landscape during Construction

ix) The contractor shall ensure that no trees, existing or otherwise, shall be harmed and damage to roots should be prevented during trenching, placing backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the tree, or, from a safe distance from the tree/plant by means of barricading. Trees will not be used for support; their trunks shall not be damaged by cutting and carving or by nailing posters, advertisements or other material. Lighting of fires or carrying out heat or gas emitting construction activity within the ground,

covered by canopy of the tree is not to be permitted.

x) The contractor shall take steps to protect trees or saplings identified for preservation within the construction.

xi) Contractor should limit all construction activity within the specified area as per the Construction Management Plan (CMP) approved by APMCF /SBI.

Xii) The contractor shall avoid cut and fill in the root zones, through delineating and fencing the drip line (the spread limit of a canopy projected on the ground) of all the trees or group of trees. Separate the zones of movement of heavy equipment, parking, or excessive foot traffic from the fenced plant protection zones.

Xiii) The contractor shall ensure that maintenance activities during construction period shall be performed as needed to ensure that the vegetation remains healthy.

Xiv) The permission for cutting of trees and / or Transplanting of the trees shall be obtained by the Contractor from statutory Authority/Local Authorities or any other authority of the State Government, and execution of cutting and transplanting the trees or any other action in this regard will be taken by the contractor for which provision is already available in amount quoted by the contractor. No extra payment will be made on this ground.

xv) Contractor shall collect all construction waste generated on site. Segregate these wastes based on their utility and examine means of sending such waste to manufacturing units which use them as raw material or other site which require it for specific purpose. Typical construction debris could be broken bricks, steel bars, broken tiles, spilled concrete and mortar etc.

xvi) The contractor shall provide potable water for all workers.

xvii) The contractor shall provide the minimum level of sanitation and safety facilities for the workers at site. The contractor shall ensure cleanliness of workplace with regard to the disposal of waste and effluent; provide clean drinking water and latrines and urinals as per applicable standard. Adequate toilet facilities shall be provided for the workman within easy access of their place of work. The total no. to be provided shall not be less than 1 per 30 employees in any one shift. Toilet facilities shall be provided from the start of building operations, connection to a sewer shall be made as soon as practicable. Every toilet shall be so constructed that the occupant is sheltered from view and protected from the weather and

falling objects. Toilet facilities shall be maintained in a sanitary condition. A sufficient quantity of disinfectant shall be provided. Natural or artificial illumination shall be provided.

Xviii) The contractor shall ensure that air pollution due to dust/generators is kept to a minimum, preventing any adverse effects on the workers and other people in and around the site. The contractor shall ensure proper screening, covering stockpiles, covering brick and loads of dusty materials, wheel-washing facility, gravel pit, and water spraying. Contractor shall ensure the following activities to prevent air pollution during construction:

xix) Clear vegetation only from areas where work will start right away.

xx) Vegetate / mulch areas where vehicles do not ply.

Xxi) Apply gravel / landscaping rock to the areas where mulching /paving is impractical.

Xxii) Identify roads on-site that would be used for vehicular traffic. Upgrade vehicular roads (if these are unpaved) by increasing the surface strength by improving particle size, shape and mineral types that make up the surface & base. Add surface gravel to reduce source of dust emission. Limit amount of fine particles (smaller than 0.075mm) to 10 - 20%

xxiii) Water spray, through a simple hose for small projects, to keep dust under control. Fine mists should be used to control fine particulate. However, this should be done with care so as not to waste water. Heavy watering can also create mud, which when tracked onto paved public roadways, must be promptly removed. Also, there must be an adequate supply of clean water nearby to ensure that spray nozzles don't get plugged.

Xxiv) Water spraying shall be done on:

Any dusty materials before transferring, loading and unloading

Area where demolition work is being carried out Any un-paved main haul road

xxv) Areas where excavation or earth moving activities are to be carried out The contractor shall ensure that the speed of vehicles within the site is limited to 10 km/hr.

Xxvi) All material storages should be adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust / particulate emissions.

Xxvii) Spills of dirt or dusty materials will be cleaned up promptly so the spilled material does not become a source of fugitive dust and also to

prevent of seepage of pollutant laden water into the ground aquifers. When cleaning up the spill, ensure that the clean-up process does not generate additional dust. Similarly, spilled concrete slurries or liquid wastes should be contained / cleaned up immediately before they can infiltrate into the soil / ground or runoff in nearby areas

xxviii) Provide hoardings of not less than 3m high along the site boundary, next to a road or other public area

xxix) Provide dust screens, sheeting or netting to scaffold along the perimeter of the building

xxx) Cover stockpiles of dusty material with impervious sheeting

xxxii) Cover dusty load on vehicles by impervious sheeting before they leave the site

xxxii) The contractor shall ensure that no construction leachate (e.g., cement slurry etc.), is allowed to percolate into the ground. Adequate precautions are to be taken to safeguard against this including, reduction of wasteful curing processes, collection, basic filtering and reuse. The contractor shall follow requisite measures for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant-laden water directly to the treatment device or facility (municipal sewer line).

Xxxiii) The storage of material shall be as per standard good practices as specified in Storage, Stacking and Handling practices, NBC 2016 shall be to the satisfaction of the APMCF /SBI to ensure minimum wastage and to prevent any misuse, damage, inconvenience or accident. Watch and ward of the Contractor is materials shall be his own responsibility. There should be a proper planning of the layout for stacking and storage of different materials, components and equipment with proper access and proper maneuverability of the vehicles carrying the materials. While planning the layout, the requirements of various materials, components and equipment at different stages of construction shall be considered.

Xxxiv) The contractor shall ensure the following activities for construction workers safety, among other measures:

Guarding all parts of dangerous machinery.

Precautionary signs for working on machinery

Maintaining hoists and lifts, lifting machines, chains, ropes, and other

lifting tackles in good condition.

Durable and reusable form work systems to replace timber form work and ensure that form work where used is properly maintained.

Ensuring that walking surfaces or boards and/or working platforms, etc. at height are of sound construction and are provided with safety rails or belts.

Provide protective equipment, helmets etc. -

Provide measures to prevent fires. Fire extinguishers and buckets of sand to be provided in the fire-prone area and elsewhere.

Provide sufficient and suitable light for working during nighttime

The contractor shall provide for adequate number of garbage bins around the construction site and the workers facilities and will be responsible for the proper utilization of these bins for any solid waste generated during the construction. The contractor shall ensure that the site and the workers facilities are kept litter free. Separate bins should be provided for plastic, glass, metal, biological and paper waste and labeled in both Hindi and English with suitable symbols.

The contractor shall prepare and submit spill prevention and control plans before the start of construction, clearly stating measures to stop the source of the spill, to contain the spill, to dispose the contaminated material and hazardous wastes, and stating designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners, and petroleum products.

Contractor shall collect & submit the relevant material certificates for materials with high recycled (both post-industrial and post-consumer) content, including materials like RMC mix with fly-ash, glass with recycled content, calcium silicate boards etc.

The contractor shall ensure that a flush out of all internal spaces is conducted prior to handover. This shall comprise an opening of all doors and windows for 14 days to vent out any toxic fumes due to paints, varnishes, polishes, etc.

The providing & fixing Safety nets at various levels of Buildings as per instruction from APMCF /SBI. Safety Net shall be of Garware nylon Ropes made of three layers of (100 mm X 100 mm square with 8 mm thick nylon rope.), net with 2.5 mm nylon rope with 25mm x 25 mm square and mono filament net on top having width of 5.0 mts. horizontal to the periphery of the Building with supporting structure of 50 mm dia MS

hollow (40 nb) pipe duly anchored on slab/beam with 10 mm thick base plate and anchor fastener (hilti) 4 Nos. at all corners, and free end of pipe to be tied up with upper floor column with the help of nylon rope 16 mm dia. same supporting system is to be followed for every 4.5 Mtr. in such a way to have a proper slope during Construction and removing and re fixing part of the same as and when required/ necessary for smooth progress of the work.

Contractor shall collect the relevant material certificates for rapidly renewable materials such as bamboo, wool, cotton insulation, agri fiber, linoleum, wheat board, strawboard and cork etc.

Contractor shall adopt an IAQ (Indoor Air Quality) management plan to protect the HVAC system during construction, control pollutant sources, and interrupt pathways for contamination. He shall sequence installation of materials to avoid contamination of absorptive materials such as insulation, carpeting, ceiling tile, and gypsum wallboard. He shall also protect stored on-site or installed absorptive materials from moisture damage.

The contractor shall ensure that a flush out of all internal spaces is conducted prior to handover. This shall comprise an opening of all doors and windows for 14 days to vent out any toxic fumes due to paints, varnishes, polishes, etc.

Contractor shall make efforts to reduce the quantity of indoor air contaminants that are odorous or potentially irritating harmful to the comfort and well-being of installer and building occupants. Contractor shall ensure that the VOC (Volatile Organic Compounds) content of paints, coatings and primers used must not exceed the VOC content limits mentioned below: Paints: Non-flat - 150 g/L Flat (Mat) - 50 g/L Anti-corrosive/ anti rust - 250 g/L Coatings / Clear wood finishes: Varnish - 350 g/L Lacquer - 550 g/L Floor coatings - 100 g/L Stains - 250 g/L Sealers: Waterproofing sealer - 250 g/L Sanding sealer - 275 g/L Other sealers - 200 g/L The VOC (Volatile Organic Compounds) content of adhesives and sealants used

must be less than VOC content limits mentioned : Architectural Applications VOC Limit (g/l less water) Indoor Carpet adhesives - 50 g/L Carpet Pad Adhesives - 50 g/L Wood Flooring Adhesive - 100 g/L Rubber Floor Adhesives - 60 g/L Sub Floor Adhesives - 50 g/L Ceramic Tile Adhesives - 65 g/L VCT and Asphalt Tile adhesives - 50 g/L Dry Wall and Panel Adhesives - 50 g/L Structural Glazing Adhesives - 100 g/L Multipurpose Construction Adhesives - 70 g/L Substrate Specific Application VOC Limit (g/l less water) Metal to Metal - 30 g/L Plastic Foams

- 50 g/L Porous material (except wood) - 50 g/L Wood - 30 g/L Fiber Glass - 80 g/L

Wherever required, Contractor shall meet and carry out documentation of all activities on site, supplementation of information, and submittals in accordance with IGBC LEED India New Construction v3.0 (or latest amendment) or GRIHA program standards and guidelines. Towards meeting the aforementioned building environmental rating standard(s) expert assistance shall be provided to him up on request

No extra payment shall be done against all such safety measures.

64.0) WATER USE DURING CONSTRUCTION

I) Contractor should spray curing water on concrete structure and shall not allow free flow of water. Concrete structures should be kept covered with thick cloth/gunny bags and water should be sprayed on them. Contractor shall do water poundings on all sunken slabs using cement and sand mortar.

65.0) RESOURCES CONSUMED DURING CONSTRUCTION

I) The contractor shall ensure that the water and electricity is not wasted during construction. The APMCF /SBI can bring to the attention any such wastage and the contractor will have to ensure that such bad practices are corrected.

ii) The contractor shall install necessary meters and measuring devices to record the consumption of water, electricity and diesel on a monthly basis for the entire tenure of the project.

iii) The contractor shall ensure that all run-off water from the site, during construction is collected and reused to the maximum.

iv) The contractor shall use treated recycled water of appropriate quality standards for construction, if available.

v) The contractor shall minimize the use of electricity.

66.0) CONSTRUCTION AND DEMOLITION WASTE

I) Contractor shall minimize the generation of construction waste as per the requirement for Environmental Clearance Perspective.

ii) All construction debris generated during construction shall be carefully segregated and stored in a demarcated waste yard. Clear, identifiable areas shall be provided for each waste type. Employ measures to segregate the waste on site into inert, chemical, or hazardous wastes.

iii) No construction debris shall be taken away from the site, without the prior approval of the APMCF /SBI.

iv) The contractor shall recycle the unused chemical/hazardous wastes such as oil, paint, batteries, and asbestos.

v) If and when construction debris is taken out of the site, after prior permissions from the APMCF /SBI, then the contractor shall ensure the safe disposal of all wastes and will only dispose of any such construction waste in approved dumping sites.

67) DOCUMENTATION

I) The contractor shall, during the entire period of the construction, submit the following records to the APMCF /SBI on a monthly basis:

ii) Water consumption in liters

iii) Electricity consumption in 'kwh' units

iv) Diesel consumption in liters

v) Quantum of waste (volumetric/weight basis) generated at site and the segregated waste. types divided into inert, chemical and hazardous wastes

vi) Digital photo documentation to demonstrate compliance of safety guidelines as specified in the tender The contractor shall, during the entire tenure of the construction phase, submit the following records to the APMCF /SBI on a fortnightly basis:

vii) Quantities of material brought into the site, including the material issued to the contractor by the APMCF /SBI.

viii) Quantities of construction debris (if at all) taken out of the site

ix) Digital photographs of the works at site, the workers facilities, the waste and other material storage yards, pre-fabrication and block making works, etc. as guided by the APMCF /SBI

x) The contractor shall submit a document after construction of the buildings, a brief description along with photographic records to show that other areas have not been disturbed during construction. The document should also include brief explanation and photographic records to show erosion and sedimentation control measures adopted. (Document CAD drawing showing site plan details of existing vegetation, existing buildings, existing slopes and site drainage pattern, staging and spill prevention measures, erosion and sedimentation control measures and measures adopted for topsoil preservation during construction.

xi) The contractor shall submit to the APMCF /SBI after construction of the buildings, a detailed as built quantification of the following:

1) Materials used,

- 2) Total topsoil stacked and total reused
- 3) Total earth excavated
- 4) Total waste generated,
- 5) Total waste reused,
- 6) Total water used,
- 7) Total electricity, and
- 8) Total diesel consumed.

Xii) The contractor shall submit to the APMCF /SBI, before the start of construction, a site plan along with a narrative to demarcate areas on site from which topsoil has to be gathered, designate area where it will be stored, measures adopted for topsoil preservation and indicate areas where it will be reapplied after construction is complete.

Xiii) The contractor shall submit to the APMCF /SBI, a detailed narrative (not more than 250 words) on provision for safe drinking water and sanitation facility for construction workers and site personnel.

Xiv) Provide supporting document from the manufacturer of the Batch mix/ Ready Mix concrete specifying the use of Fly Ash.

xv) Provide supporting document from the manufacturer of the pre-cast building blocks specifying the fly ash content of the blocks used in an infill wall system.

Xvi) Provide total support to APMCF /SBII and Environmental Consultants appointed by the APMCF /SBI in completing all Environmental clearance related formalities, including signing of forms, providing signed letters in the contractor's letterhead whenever required.

68.0 Warning / Caution Boards/Signage

i) All temporary warning / caution boards / glow signage display such as "Construction Work in Progress", "Keep Away", "No Parking", Diversions etc. shall be provided and displayed by the Contractor, wherever required and as directed by the APMCF /SBI. All signage shall be suitably illuminated during night also. The Contractor shall be solely responsible for damage and accident caused, if any, due to negligence on his part. Also, he shall ensure that no hindrance, as far as possible, is caused to general traffic during execution of the work.

ii) In addition, the Contractor shall also provide a sign board of approved size, design & pattern at an approved location giving the details of the project, client / SBI, architects, structural consultants, Department etc. besides

providing space for names of Contractor/Sub- Contractors.

lii) All signage shall be dismantled & taken away by the Contractor after completion of the work with the approval of the Engineer - in - Charge of APMCF.

72.0 CONDITIONS OF NATIONAL GREEN TRIBUNAL

i) The contractor shall not store/ dump construction material or debris on the metaled road.

ii) The contractor shall get prior approval from APMCF /SBI for the area where the construction material or debris can be stored beyond the metaled road. This area shall not cause any obstruction to the free flow of traffic /inconvenience to the pedestrians/public in general. It should be ensured by the contractor that no accidents occur because of such permissible storage.

lii) The contractor shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot/area to ensure that no construction material dust fly outside the plot area.

iv) The contractor shall ensure that all the trucks or vehicles of any kind which are used for construction purposes/or are carrying construction material like cement, sand, earth and other allied material are fully covered. The contractor shall take every necessary precaution that the vehicles are properly cleaned and dust free to ensure that enroute their destination, the dust, sand or any other particles are not released in air/contaminate air.

v) The contractor shall provide mask to every worker on the construction site and involved in loading, unloading and carriage of construction material and construction debris to prevent inhalation of dust particles.

vi) The contractor shall provide all medical help, investigation and treatment to the workers involved in the construction of building and carry off construction material and debris relating to dust emission.

Vii) The contractor shall ensure that C&D waste is transported to the C&D waste site only and due records shall be maintained by the contractor

viii) The contractor shall compulsorily use wet jet in grinding and stone cutting.

ix) The contractor shall comply with all the preventive and protective environmental steps as stated in the MoEF guidelines, 2010.

x) The contractor shall carry out on-Road-Inspection for black smoke generating machinery. The contractor shall use cleaner fuel.

xi) The contractor shall ensure that all DG set comply emission norms notified by MoEF/Respective Department.

Xii) The contractor shall use vehicles having pollution under control certificate. The emissions can be reduced by a large extent by reducing the speed of a vehicle to 20 Kmph. Speed bumps shall be used to ensure speed reduction. In case where speed reductions cannot effectively reduce fugitive dust, the contractor shall divert traffic to nearby paved areas.

Xii) The contractor shall ensure that the construction material is covered by tarpaulin. The contractor shall take all other precaution to ensure that no dust particles are permitted to pollute air quality because of such storage.

Xiii) The paving of the path for plying of vehicles carrying construction material is more permanent solution to dust control and suitable for longer duration projects.

Xiv) Any violation of orders of MoEF including guidelines of State Government, SPCB or any officer of any department shall lead to stoppage of work for which Contractor shall be responsible and no hindrance shall be accounted in this regard.

xv) The contractor shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot/area using CGI sheets or plastic and/or other similar material to ensure that no construction material dust fly outside plot area.

73.0 Make in India Policy

i) The main contractor as well as associate contractor of each discipline shall comply to Government of India Public Procurement (Preference to Make in India), Order-2017 amended up to last date of submission of bid.

69.0 Training and Awareness:

1) Training:

The training shall be in two phases - first induction training and then periodic training / refresher workshop.

Induction Training: All the workers shall have to undergo a training program of 16 hrs (8 hrs for 2 days) and to be declared satisfactorily trained by the Safety Manager before they are allowed to work on site.

ii) Orientation Program:

An orientation program shall be arranged for all people (other than workers) who normally work at or visit the site.

lii) Workshops:

Refresher workshops shall be arranged in every three months for all the workers on site.

iv) Advance Training:

For workers involved in high-risk activities (to be identified by the APMCF) an intensive training shall be kept once in a month. The training modules shall be designed by the Safety Manager and approved by the APMCF
 Methodology: The training methodology shall include both classroom and practical demonstration with audio visual techniques. For greater impact, demonstration with dummies will be done to highlight hazards of not following safe practices.

The training shall be imparted in vernacular language and may include means such as songs, theatre, puppetry etc. for better appreciation and assimilation by workers.

v) Implementation:

The basic responsibility of implementation of safe practices shall be that of the safety manager and safety supervisors of the contractor at the first level and project team APMCF on second level. The basic approach of implementation should be towards voluntary acceptability of safe practices by all stakeholders.

The safety arrangement made by the contractor shall be open to inspection by the safety officer or any other representative appointed by the APMCF and the observation made by him shall be complied with by the contractor.

All workmen are checked for their suitability before development by the respective Safety Manager and each Safety Supervisor. Workers physical fitness knowledge about the activity and his previous experience are checked before deployed. Workmen involved in physical activity (such as driver, operators, Height workers, Food handlers at Canteen and Pantries, welders) shall be subjected to pre-employment medical check-up, those who do not clear the medical examination shall not be employed.

Adequate number of safety equipment and personals protective equipment (PPE) as per Indian Standards will be planned and procured.

Recommendations as per following table/Matrix should be followed:

ACTIVITY	WORKMEN CATEGORY	PPE- RECOMMENDED
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General - Entry into work premises	All Employees	Safety Helmet, Safety Shoes & Reflective Jacket
Signaling	Security/marshal	Reflective Jacket
Working at Height - Morethan1.8 meters	All	Full body harness Double lanyard
Involved with cement & Concrete Handling	All	Gum Boots & Rubber Hand Gloves
Breaking of ceramics & Agglomerate Materials	Chippers	Eye protection-Clear Goggles
Welding & Gas Cutting	Welders & Cutters	Leather gloves, Safety shoe, Welding Shield with proper number
Working with slush	Unskilled & Excavation gang	Gumboots
Forming and Making shuttering materials	Carpenters and Woodworkers	Face shield & Nose Mask
Rebar's handling & Working	Bar benders	Cotton hand Gloves
Scaffolding	Scaffolders	Cotton hand gloves
Painting	Painters	Clear, Goggles, Nose mask
DG Operators & Other Noise prone areas	Operators	Ear Muff, Rubber Hand Gloves (Electrical Grade)
Electrical Maintenance & Repairs	Electricians	HV Rubber hand gloves
Concrete Batching Plant	Operators & Loaders	Nose Mask

vi) Color Coding of Helmets:

Grey	All Staff of Contractor/other Respective Person
Green	Safety Inspectors

Red	Electricians & Signal men
Blue	Supervisors
Yellow	Workmen
Orange	New Workmen (for one month)
Purple	Visitor
White	SBI/client

Vii) Enforcement:

The safety team of the contractor and project team of APMCF are entrusted with enforcement of safe practices. If safety program is not followed (as assessed by either APMCF) then recovery as below shall be made:

If the contractor does not employ and / or submit the names of Safety Manager and Safety Supervisors of specified numbers with appropriate qualification and or experience then a recovery of Rs. 2000 per day and Rs. 1000 per day shall be affected for Safety Manager and Safety Supervisor respectively.

Contractor will ensure that no person shall be allowed to enter the demarcated area without adequate safety gadgets (as per occupation / purpose of visit).

Inside the work area it is the responsibility of the contractor to make sure all person will follow the safety instructions as per agreement.

In case of default from workers their employer (hiring agency) will have to pay a penalty of Rs 100 per offense.

These fines will be collected into workers welfare fund. Money thus collected will be utilized for supporting welfare programmes for workers and their families.

A display board shall be kept at site which would list the names of workers / teams and agencies following safety program in the best manner. This would be updated weekly.

During training and workshops, the names of persons / teams / agencies that are best following safety program shall be announced and they shall be felicitated.

On completion of the work, shields for best person / team / agencies following safety program in different categories shall be awarded.

A biometric system/record of attendance will be put in place by the Contractor as per the direction of Engineer- in-Charge of APMCF and the SafetyManager and all the Safety Supervisors will record their presence in the system. Recovery as suggested will be made for failure to recordsuch presence / non availability of safety personals.

In case of an accident resulting in death / permanent disability of a worker,

a recovery of Rs. 10 Lakh per death / permanent disability will be made for the contract values more than Rs. 20 crores. The recovery for the contracts less than Rs. 20 crores shall be @ 0.5% of the contract amount per death / permanent disability. The money so recovered will be kept in the "Workers Welfare Fund" and will be at the sole discretion of the APMCF/SBI for utilizing to support the welfare programs of the workers.

This recovery shall be in addition to recovery (recoveries) or compensation under any other Statute / Act / Provision of Contract. However, the total recovery on this account shall not exceed 2% of the contract value.

70.0 Standard Operating Procedures (SOPs) and Guidelines for Construction Sites for COVID-19 Outbreak/Similar Such Situations

i) The agency shall follow all the COVID 19/Any Epidemic protocols enforced by state / central Government/ statutory Authority etc. from time to time and the guidelines issued by SBI from time to time as per directions of the APMCF /SBI and nothing extra payable on this account.

ii) The Agency/contractor shall install inspection lifts of minimum 8-10-person capacity for inspection of officers. Each tower should have independent inspection lift. Agency shall ensure they are in safe working conditions throughout the execution period and safety of the persons.

71.0 PRODUCT DELIVERY, STORAGE AND HANDLING OF CHEMICALS

i) The contractor shall construct storage space for Chemicals materials to ensure that the storage conditions are as recommended by the manufactures.

ii) All the materials shall be procured and delivered in sealed containers with labels legible and intact.

lii) All the chemicals (polymers, epoxy, water proofing compound, plasticizer, Polysulphide, SBR based elastomeric, APP (Atactic iv) Polypropylene Polymer), all exterior and interior paints, polish etc.) shall be procured in convenient packs say 20 liters/kg} capacity packing only or as approved by the APMCF /SBI, and not in bigger capacity containers, say 200-liter (kg) drums unless otherwise specifically permitted by the APMCF /SBI. One sample from each lot of the chemical procured by the contractor shall be tested in a laboratory as approved by the APMCF /SBI.

v) All material required for the execution of the work shall be got approved, procured and deposited with the Departmental supervisory staff. The materials shall be kept in joint custody of the contractor and the Department. The watch and ward of such material shall, however, remain to be the responsibility of the contractor and no claim, whatsoever, on this account shall be entertained. Different containers of each chemical shall be serially numbered on packing and also consumed in that order. Day-to-day account of receipt, issue and balance shall be regulated by the Department and proper account shall be maintained at site of work in the prescribed form as per the standard practice.

vi) All the chemicals shall be procured by the contractor directly from the

manufacturer. In exceptional circumstances, the contractor may be allowed to procure the materials from the authorized dealers of the manufacturers, if specifically permitted by the APMCF /SBI.

Vii) The original copies of challan /cash memos towards the quantity of various chemicals procured shall be made available by the contractor at the request from the APMCF /SBI and a copy of the same shall be kept in record.

Viii) The Name of manufacturers, manufacturer's product identification, manufacturer's mixing instructions, warning for handling and toxicity and date of manufacturing and shelf life shall be clearly and legibly mentioned on the labels of each container.

ix) The contractor shall submit for the chemicals procured, manufacturer's and / or authorized dealer's certificate regarding supplying and verifying conformance to the material specifications, as specified.

x) All filled containers shall be handled in safe manner and in a way to avoid breaking container seals.

xi) Empty containers of the chemicals should not be removed from site till the completion of work and shall be removed only with the written approval of the APMCF /SBI.

Xii) All arrangements for measuring, dosing and mixing of material / chemicals at site have to be made by the contractor.

Xiii) Contractor shall suitably advise his site Engineer and all the workers as regards safe handling of chemicals. Necessary protective and safety equipment in form of hand gloves, goggles etc. shall be provided by the contractor and be also used at site.

Xiv) All incidental charges of any kind including cartage, storage and wastage and safe custody of material etc. shall be borne by the contractor and no claim, whatsoever, shall be entertained on this account.

xv) The chemicals shall be tested in an independent laboratory as approved by the APMCF /SBI at the frequency as specified. If required, more samples may have to be tested as per the directions of the Engineer-in-Charge of APMCF. Nothing extra shall be payable on this account.

72.0 ESCALATION

The rate quoted shall be firm throughout the tenure of the contract (inclusive of extension of time if any granted) and will not be subject to any fluctuation due to increase in cost of materials, labour, taxes, octroi, transportation on work contract unless specifically provided in these documents

73.0 LABOUR CAMP/LABOUR MOVEMENTS

i) The said work is to be carried out within the allotted Plot and very rare place is available for Labour Camp. Contractor shall take a note of this while quoting the rates.

ii) Contractor needs to allot space to labour camp outside allotted plot at no extra cost to SBI. Daily to and fro movement of the labour shall be carried out at no extra cost to SBI. Required Approval from local governing Authority for labour camp shall be taken by the Contractor of such labour camp.

lii) In & Out timing of as per shifts to be fixed for Labourers and within that time labour movement to be carried out. In other time no movement of labours shall be permitted except the special permission from the APMCF /SBI.

iv) As this project comes under premises of Authority, utmost care shall be taken to avoid nuisance to occupants from labourers, material/machinery movement. If it is found that some labours are creating nuisance then those labourers shall be removed off the site immediately.

v) Movement of labourers shall be carried out as per norms by the Authority.

74.0 SITE STAFF to be deployed at Site by the Contractor :

Requirement of Technical Representative(s) :				
Sr. No.	Qualification	Requirement of Technical Staff		
			Minimum Experience (Years)	Designation of Technical Staff
1	Graduate Engineer	1	15 (and having experience of one similar nature of work)	Project Manager with degree in Civil Of Engineering
2	Graduate Engineer/Diploma	1	10year for degree or 15 year for diploma (and having experience of one similar nature of work)	Asst. Project in charge in Civil Engineering
3	Graduate Engineer/Diploma	1	5year for degree or 10 year for diploma in civil engineering	SiteEngineer
4	Graduate Engineer	2	5	QA/QC Engineer

6	Graduate Engineer/diploma	1	5year for degree or 10 year for diploma	Billing Engineer
7	Graduate / Diploma Engineer	1	3year for degree or 5 year for diploma	Safety Engineer/ Manager
8	Graduate / Diploma Engineer	1	3 or 5 respectively and Certificate	PHE Services
9	Graduate / Diploma Engineer	2	3 or 5 respectively and Certificate	1 Electrical and 1 Fire Fighting Services

Note:-

1. Above mentioned staff shall be deployed at site during the currency of Contract. However, Project cum Planning Engineer, QA/QC Engineer and Safety Manager/Engineer has to be compulsorily at site throughout the duration of work.
2. The above designated persons should perform their duties and responsibilities with respect to their functional areas as per sound Engineering Practices and with highest professional standards as defined and practiced in Building Construction Industry.

75.0 Provision of Independent External Monitors (IEM) :

- The Particulars of IEMs appointed by CVC are given below

1	Mr. K. Chandrahas (IRS - Retired)	kchandrahas@yahoo.com
2	Dr. Parvez Hayat(IPS- Retired)	phayatips@gmail.com

76.00 Provision of Special Safety Features during execution

l) The providing & fixing Safety nets at various levels of Buildings as per instruction from APMCF /SBI. Safety Net shall be of Garware nylon Ropes made of three layers of (100 mm X 100 mm square with 8 mm thick nylon rope.), net with 2.5 mm nylon rope with 25mm x 25 mm square and mono filament net on top having width of 5.0 mts. horizontal to the periphery of the Building with supporting structure of 50 mm dia MS hollow (40 nb)pipe duly anchored on slab/beam with 10 mm thick base plate and anchor fastener (hilt) 4 Nos. at all corners, and free end of pipe to be tied up with upper floor column with the help

of nylon rope 16 mm dia. same supporting system is to be followed for every 4.5 Mtr. in such a way to have a proper slope during Construction and removing and re fixing part of the same as and when required/ necessary for smooth progress of the work. This total provision shall be provided at every third floor of all the 3 Towers.

ii) MS/Doka Safety Platforms/Or its equivalent:- MS/Doka Safety Platforms/Or its equivalent with side railing shall be erected throughout the periphery of Proposed Buildings while doing exterior works at heights. Platform shall be per per manufacturer's specifications and suitable for Conventional method of construction (RCC+Brickwork) with necessary brackets, Supporting system, fasteners, ms Plates etc. The stability and load-bearing capacity of all components and units must be checked and design to be done accordingly during all phases of the construction work. Strict attention to and compliance with the functional instructions, safety instructions and load specifications are required to be followed by the contractor while installation and during Usage. Non-compliance can cause accidents and severe injury (risk of fatality) and considerable damage to property. Contractor must give due consideration to any and all effects of the weather on the equipment and regards both its use and storage (e.g. slippery surfaces, risk of slipping, effects of the wind, etc.) and implement appropriate precautionary measures to secure the equipment and surrounding areas and to protect workers. All connections must be checked at regular intervals to ensure that they are secure and in full working order. In particular threaded connections and wedged connections have to be checked and retightened as necessary in accordance with activity on the job site and especially after out-of-the-ordinary occurrences (e.g. after a storm). Suitable skilled and experienced Safety Manager/Engineer shall ensure installation and usage throughout the duration of Project.

lii) No extra payment shall be done against these works and contractor shall take a note of this while quoting the rates.

77.0 SAFETY CODE

ANNEXURE-IX

SAFETY MEASURES AT SITE:

1. All personnel at site should be provided with Helmets and Safety Boots with some Identification Mark. Visitors also should be provided with Helmets. It should be ensured that these are used properly.
2. First Aid Box should be kept at site with all requisite materials.
3. No one should be allowed to inspect / work at a height without Safety Belt.
4. Suitable scaffolds should be provided for workmen for all Works that cannot safely be done from the ground, or from solid construction except such short period Work as can be done safely from ladders. When a ladder is used an extra Mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as

well as suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ to 1 ($\frac{1}{4}$ horizontal and 1 vertical).

5. Scaffolding or staging more than 3.5 meters above the ground or floors, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured at least 1 Meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the 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.
6. Working platforms, Gangways, and Stairways should be so constructed that they do not sag unduly or unequally, and if the height of the platform or the Gangway or the Stairway is more than 3-5 Meters above ground level or floor level they should be closely boarded, should have adequate width and should be suitably fenced, as described.
7. Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1 Meter.
8. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 Meters in length while the width between side rails in rung ladder shall in no case be less than 30cms for ladder up to and including Meters in length. For longer ladders this width should be increased at least 6mm for each additional 30 cms. Uniform step spacing shall not exceed 30 cms.
9. Adequate precautions shall be taken to prevent danger from electrical equipment. For electrical online works gloves, rubber mats, and rubber shoes shall be used.
10. All trenches 1.2 Meters or more in depth shall at all times be supplied with at least one ladder for each 30 Meters length or fraction thereof. Ladder shall be extended from bottom of the trench to at least 1 Meter above the surface of the ground. The sides of the trenches, which are 1.5 Meters 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 1.5 Meters of the edge of the trench or half of the depth of the trench whichever is more cuttings shall be done from top to bottom. Under no circumstances undermining or under cutting shall be done.
11. Before any demolition work is commenced and also during the process of the work :-

- 11.1. All roads and open areas adjacent to the Work Site shall either be closed or suitably protected.
- 11.2. No electrical 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.
- 11.3. All practical steps shall be taken to prevent danger to persons employed from risk or fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.
- 11.4. All necessary personal safety equipment as considered adequate by the Site Engineer should be kept available for the use of the persons 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.
- 11.5. Workers employed on mixing Asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
- 11.6. Those engaged in whitewashing and mixing or stacking of cement bags or any materials which is injurious to the eyes shall be provided with protective goggles.
- 11.7. Those engaged in welding works shall be provided with Welder's protective eye-shields.
- 11.8. Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
- 11.9. 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 the manholes and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals and boards to prevent accident to the Public.
12. Use of hoisting machines and tackle including their attachments, anchorage and support shall conform to the following standard or conditions:-
 - 12.1. These shall be of good mechanical construction, sound material and adequate strength and free from patent defect and shall be kept in good repairs and in good working order.
 - 12.2. Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.

- 12.3. Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in-charge of any hoisting machine including any scaffold, winch or give signals to the operator.
- 12.4. In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension the safe working load shall be ascertained by adequate means.
- 12.5. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of hoisting machine having a variable safe working load, each safe working load of the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
- 12.6. Motor, 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 the risk of accidental descent of the load, adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced.
- 12.7. When workers are employed on electrical installation, which are already energized, insulating 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.
13. 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 shall be provided at or near places of work.

78 Provision of BIS codes, CPWD Manuals, CPWD trade specific guidelines, Catalogues, etc. : Contractor has to arrange all the relevant BIS codes, CPWD Manuals, catalogues, technical details from manufactures, etc. as mentioned in the Technical bid & Price Bid and has to be kept at site till closure of the project.

79 Conditions specific to Project:

a) In response to the tenders invited by Bank/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.

b) 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.

c) It has been understood by the parties hereto that the Bank/Architect will have right to make reasonable changes in the drawings and designs during the progress of the construction works without prejudice to the CONTRACT. Notwithstanding anything to the contrary contained in any of the Annexure hereto the CONTRACTORS shall commence the work and shall complete the same as per stipulated date of Completion

d) The Contractors do hereby agree that the amount of liquidated damages specified in conditions of contract/ special conditions of contract represents a genuine and fair estimate of the loss likely to be suffered by the Bank in the event of the works not being completed in time.

e) It is specifically and distinctly understood and agreed between the Bank and the CONTRACTORS that the CONTRACTORS shall have no right, title or interest in the site made available by the Bank for the execution of the works 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 Bank 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.

f) The CONTRACTORS 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 at any time without assigning any reason.

g) The Contractor shall afford every reasonable facility for the carrying out of all works relating to civil works, installation of lifts, Telephone, electrical installations, fittings and other ancillary works in the manner laid down in the said Conditions, and shall make good any damages done to walls, floors, etc. after the completion of his work.

h) The APMCF/SBI reserves to itself the right of altering the drawings and nature of the

work by adding to or omitting any items of work or having portions of the same carried out without prejudice to this Contract.

80. SAFETY CODE

SAFETY MEASURES AT SITE:

1. All personnel at site should be provided with Helmets and Safety Boots with some Identification Mark. Visitors also should be provided with Helmets. It should be ensured that these are used properly.
2. First Aid Box should be kept at site with all requisite materials.
3. No one should be allowed to inspect / work at a height without Safety Belt.
4. Suitable scaffolds should be provided for workmen for all Works that cannot safely be done from the ground, or from solid construction except such short period Work as can be done safely from ladders. When a ladder is used an extra Mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well as suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ to 1 ($\frac{1}{4}$ horizontal and 1 vertical).
5. Scaffolding or staging more than 3.5 meters above the ground or floors, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured at least 1 Meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the 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.
6. Working platforms, Gangways, and Stairways should be so constructed that they do not sag unduly or unequally, and if the height of the platform or the Gangway or the Stairway is more than 3-5 Meters above ground level or floor level they should be closely boarded, should have adequate width and should be suitably fenced, as described.
7. Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1 Meter.
8. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 Meters in length while the width between side rails in rung ladder shall in no case be less than 30cms for ladder up to and including Meters in length. For longer ladders

this width should be increased at least 6mm for each additional 30 cms. Uniform step spacing shall not exceed 30 cms.

9. Adequate precautions shall be taken to prevent danger from electrical equipments. For electrical on line works gloves, rubber mats, and rubber shoes shall be used.

10. All trenches 1.2 Meters or more in depth shall at all times be supplied with at least one ladder for each 30 Meters length or fraction thereof. Ladder shall be extended from bottom of the trench to at least 1 Meter above the surface of the ground. The sides of the trenches, which are 1.5 Meters 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 1.5 Meters of the edge of the trench or half of the depth of the trench whichever is more cuttings shall be done from top to bottom. Under no circumstances undermining or under cutting shall be done.

11. 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 electrical 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 risk or fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.
 - d) All necessary personal safety equipment as considered adequate by the Site Engineer should be kept available for the use of the persons 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.
 - e) Workers employed on mixing Asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.
 - f) Those engaged in white washing and mixing or stacking of cement bags or any materials which is injurious to the eyes shall be provided with protective goggles.
 - g) Those engaged in welding works shall be provided with Welder's protective eye-shields.

- h) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
- i) 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 the manholes and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals and boards to prevent accident to the Public.

12. Use of hoisting machines and tackle including their attachments, anchorage and support shall conform to the following standard or conditions:-

- a) These shall be of good mechanical construction, sound material and adequate strength and free from patent defect and shall be kept in good repairs and in good working order.
- b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.
- c) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in-charge of any hoisting machine including any scaffold, winch or give signals to the operator.
- d) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension the safe working load shall be ascertained by adequate means.
- e) Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of hoisting machine having a variable safe working load, each safe working load of the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
- f) Motor, 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 the risk of accidental descent of the load, adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced.
- g) When workers are employed on electrical installation, which are already energized, insulating 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.

13. 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 shall be provided at or near places of work.

19. TECHNICAL SPECIFICATIONS**SECTION-1 : Brief Scope of work :****1.0 Brief Scope of work is as follows:**

- i. The Contractor may have to execute all required works at his own cost, if left omitted in above scope, for making the building fit for occupation and functional use by the user department. Nothing extra shall be paid on this account.
 - ii. Execution of the works and construction for Projects per approved drawings, design and plans as well as obtaining clearances required for occupation of the building from the local bodies.
 - iii. Scope of work, Schedule of Quantities, General Conditions, Additional and other conditions/specifications for Civil, E&M and Horticultural works have been given in detail in respective chapters & schedules of this bid document and same may be referred.
 - iv. All following works and allied work shall be the part of scope of Contractor.
 - a) Civil Work
 - b) Plumbing & Sanitary Works
 - c) Electrical, Fire Alarm
 - d) Fire Fighting and Fire Protection Work
 - v) Execution of work
- 1.1. The Contractor should visit/revisit and examine the site of work and satisfy himself as to the nature of the existing roads, municipal drains, supply lines and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work. No extra charge made in consequence of any misunderstanding, incorrect information on any of these points or on ground of insufficient description shall be allowed.
 - 1.2. The work shall be carried out in conformity with the drawings & design and within the requirements of architectural, electrical, structural and other specialized services drawings.
 - 1.3. The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule. All supports to the civil structures shall be provided with dash fasteners.
 - d) On award of the work, Contractor shall submit a schedule of construction as

per clause of the agreement for approval of the ~~APMC~~/SBI. All dates and time schedule agreed upon shall be strictly adhered to within the stipulated time of completion/ commissioning along with the specified phasing, if any.

vi) Completion drawings

On completion of work, Contractor shall submit six complete set of "As built drawings" along with Soft copies, Cad Files, PDF, etc. to the APMCF /SBI. These drawings shall have the following information.

- 1) Location of all mechanical equipment with layout and piping connections and mechanical equipment.
 - 2) All shop drawings shall be updated from time to time for the purpose of making completion drawings.
 - 3) No completion certificate & occupancy certificate shall be issued unless the above drawings are submitted. Piping and drainage works shall be tested as specified under the relevant clauses of specifications.
- 4) Contractor or his associate agency engaged to do this work must hold a valid plumbing or any other as required license by the municipal authority or other competent authority under whose jurisdiction the work falls.

vii) ALL NOC's/Permissions/Approvals required before/after completion of any/all Specialized Works like, tree cutting permission/Garden NOC, /Power Supply/Distribution Company's NOC/Approval, Final Fire NOC and Final, Plumbing, Water Supply, Drainage, Water Meter NOC from the local bodies are to be secured by the contractor. Further Contractor has to complete the work as required by the Local Authorities / VUDA/ and assist the APMCF/Architect in related documentation, if required, for getting the completion certificate and occupancy certificate.

In above case SBI Will pay statutory charges only limited to NON scope of Contractor.

viii) Development works

The work is to be carried out complete in all respect including services. The Agency is required to connect all the external services like Water Supply, Sewerage, Drainage, Electric Supply, LAN/WAN, Telephone Lines etc. to the main lines of the authorities/service providers or any other agency and this shall be considered as integral part of Scope of work and deemed to be included in the quoted price of the agency. The Agency shall supply all documents required in obtaining all mandatory approvals and shall also extend full support to getting

all required statutory & Municipal approval “Occupation and Completion” or any other document required to declare all assets eligible for bringing it in use.

b) Roads and Pathways

- Approach and peripheral roads & pathways as per fire guidelines and functional requirements, to the building for Construction as per site requirements.
- The construction of guard rooms, SS gates, wicket gates, dustbins, sign boards, guide maps, location boards, direction boards and numbering etc. All complete as per the approved drawings of local bodies and direction of APMCF/SBI

c) Storm water drains, sewer lines, rainwater harvesting

- Construction of storm water drains, sewer line, rainwater harvesting in the external area around the building. i/c connection to the trunk sewer line/STP etc. as per given schedule of Quantities.
- Execution of the roof top rainwater harvesting system for collection of rainwater including laying of pipelines and construction of substructure / superstructures as per given schedule of Quantities. etc included in the scope of work.

d) Internal water supply

- Execution of the Internal water supply system in all building components.
- Providing and laying of internal water supply grid with external water supply grid network in all building components.

e) External water supply

- Execution of water supply system of the whole campus.
- Providing and laying water supply lines around the building and connection to Concerned Local Authority main water line which is to be connected to underground water tank.

ix) Defects Liability Period: As per Clause No. 1.1.11 (a) of GCC.

x) Facilities for the Site Staff

Facilities for the Site Staff shall be provided as mentioned in special conditions in part . The quoted amount by the contractor shall include these elements also.

xi) Health & Safety Manual provisions

a. The Contractor will comply of the provisions contained safety, Health and

Environment guidelines failing which he / they will be liable for the penalties on each violation subject to compounding of the same to maximum of such default as mentioned in the various unsafe act / unsafe conditions in this manual. This apart from the other fines/ levies / penalties are mentioned in the documents elsewhere. It is incumbent upon the contractor to ensure in undertaking all health and safety compliance for safety of all concern to generate safety conscious and safety regulatory as his primary statutory duties or responsibilities in the contract.

b. General pest control, fogging, fumigation etc. should be carried out regularly and adjoining areas.

xii) SAFETY MEASURES:

The site of construction shall be under surveillance using CCTV cameras and its viewing rights shall be given to SBI officers with backup of data for 30 days. Installation and operation of the same is under the scope of work. Nothing extra shall be payable on this account.

Before starting of works The permission for cutting of trees and / or Transplanting of the trees shall be obtained by the Contractor from statutory Authority/Local Governing Authority or any other authority of the State Government, and execution of cutting and transplanting the trees or any other action in this regard will be taken by the contractor at his own cost. Contractor to take note of this while quoting the rates.

xiii) Specialized Civil, Electrical & Mechanical works:

The tenderer must associate himself with agencies of the appropriate eligibility for each of specialized nature of items/work listed in Tender Document Such works shall be got executed only through associated agencies specialized in these fields. The tenderer whose tender is accepted shall indicate the name(s) of his associated specialized agencies those fulfilling the eligibility criteria laid down in Tender Document after award of work and at least 30 days before commencement of such items / work but within 90 days of award of work with their credentials whichever is earlier for the approval of the APMCF /SBI of that component, whose decision shall be final and binding.

Xvii) The Work shall be carried out as per Minimum Specifications, particular specifications and drawings (Architectural, Structural and MEP). Any deviation, extra items & substitute Items shall be dealt as per Clause of General Conditions of Contract.

Note: All works has to be executed as per specifications provided in the bid document, CPWD Specifications-2019 (with updated correction slips) Vol-I &Vol. II,

and National Building Codes 2016, Relevant BIS Code (in case of difference, if any, stringent / higher specification of the two shall be followed). In absence of Tender Specification, CPWD, IS Codes, MoRTH Specifications, National Building Code 2016, Specifications, or sound engineering practices shall be adopted as per order of precedence defined in the contract. (Refer clause 1 of SCC).

The scope of works & specifications is given in general but they are not exhaustive i.e., does not mention all the incidental works required to be carried out for complete execution of the item of work. The work shall be carried out, all in accordance with true intent and meaning of the specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings and/ or described in the specifications, provided that the same can be reasonably inferred their form. There may be several incidental works, which are not mentioned in the contract document/specifications but will be necessary to complete the item in all respect. All these incidental works/ costs which are not mentioned but are necessary to complete the work shall be deemed to have been included in the overall amount quoted by the contractor for various components of work. No adjustment of rates shall be made for any variation in quantum of incidental works due to variation/change in actual working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such items in all respects) on account of the directions of APMCF /SBI. Nothing extra shall be payable on this account.

In case, some of items are missing in the scope of work or specifications in the bidding documents same shall be taken from the specification mentioned in similar type of items mentioned for similar type of buildings in the scope of work or shall be executed as given in the CPWD Specifications, NBC-2016, IS Codes or according to sound engineering practices so as to make the building including related services fully functional. No claim whatsoever may be entertained at later stage. All cost of providing and making buildings with services, landscape and horticulture works fully complete in all aspect unless specifically mentioned in the contract document and making buildings with services fully functional are included in the cost tendered for this work.

f) Appendix-I: ESTABLISHING SITE LABORATORY AND TESTING OF MATERIALS

Equipment for conducting necessary tests (as per CPWD Specifications 2019 Volume-I&II) shall be provided and installed at site in the well-furnished site laboratory by the agency at his own cost, as and when required. The following laboratory equipment should be in general or as and when required be set up at site laboratory: -

S No	Equipment	Numbers/ As required
1.	100 MT compression testing machine, electrical-cum- manually operated)	1
2.	Slump cone, steel plate, tamping rod, steel scale, scoop	6
3.	Vicat Apparatus with Desk pot	3
4.	Megger & earth resistance tester	3
5.	Pumps and pressure gauges for hydraulic testing of pressure	3
6.	Weighing scale platform type 100 Kg capacity	3
7.	Graduated glass measuring cylinder	As per requirement
8.	Sets of sieves of 450 mm internal dia for coarse aggregate [100mm, 80mm, 40mm; 2mm; 12.5mm, 10mm; 4.75mm complete with lid and pan	3
9.	Sets of sieves of 200mm internal dia for fine aggregate [4.75mm; 2.36mm; 1.18mm; 600 microns; 300microns & 150 microns, with lid and pan]	3
10.	Sieve Brushes and sieve shaker capable of 20mm and 300mm dia sieves, manually operated with timing switch assembly	5
11.	Cube moulds size 70mmx70mmx70mm	30
12.	Cube moulds size 150 mm x 150 mm x 150mm	60
13.	Ultrasonic Test Equipment (For concrete)	3
14.	Hot air oven temp. Range 50°C to 300°C- sensitivity 1degree	3
15.	Electronic balance 600gx0.1g., 10kg and 50 kg	3
16.	Physical balance weight up to 5 kg	3
17.	Digital thermometer up to 150oc	3
18.	Air Content of concrete testing machine	3

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19.	Measuring jars 100ml, 20ml, 500ml	3 No. each
20.	Gauging trowels 100mm & 20mm with wooden handle	12
21.	Spatula 100mm & 20mm with long blade wooden handle	12
22.	Vernier calipers 12" & 6" size	3 each
23.	Digital PH meter least count 0.01mm	3 each
24.	Digital Micrometer least count. 0.01mm	3 each
25.	Digital paint thickness meter for steel 500 microns Range	3
26.	GI tray 600x450x50mm, 450 300x40mm, 300x250x40mm	3 Nos. each
27.	Electric Motor mixer 0.25 cum capacity	3
28.	Rebound hammer test digital rebound hammer	3
29.	Screw gauge 0.1mm-10mm, least count 0.05	3
30.	Water testing kit	3
31.	Motorized sieve shaker	3
32.	Pruning Rods 2 Kg weight length 40 cm and ramming face 25 mm ²	3
33.	Extra Bottom plates for 15 cm cube mould	21
34.	Standard Vibration Table for gauging the cubes	3
35.	Pocket concrete penetrometer 0 to 50kg/ sq.cm	3
36.	Concrete temperature measuring thermometer with Brass protection sheath 0- 100 degree centigrade	3
37.	Mortar Cube Vibrator	3
38.	Dial type spring balance preferable with zero correction knob capacity 100 kgs. reading to ½ kg	2
39.	Counter scale capacity 1 kg and 10 kg	2
40.	Iron Weight of 5 kg, 2 kg, 1 kg, 500 gm, 20 gm, 100 gm	2 each
41.	Brass Weight of 50 gm, 2 gm, 10 gm, 5 gm, 2 gm, 1 gm	2 each
42.	Measuring cylinder TPX or Poly propylene capacity 100 ml, 500 ml, 250 ml, 100 ml	2 each
43.	Pyrex, corning or Borosil beakers with cover capacity 500ml, 20 ml, 50 ml	3 each
44.	Wash Bottles capacity 500 ml	12
45.	Thermometers 1-100 degree centigrade / max. and Min/Dry and wet with table	6
46.	Set of box spanner ratchet	3

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47.	Hammer 1lb& 2lb	3 each
48.	Distance meter (of 100 meter)	2
49.	Hacksaw with 6 blades	4
50.	Measuring tape (5 meter)	10
51.	Depth gauge 2 cm	6
52.	Shovels & Spade	6
53.	Steel plates 5 mm thick 75x75 cm	6
54.	Plastic or G.I. Buckets 15 liter, 10 liters,5 liter	3 each
55.	Wheelbarrow	12
56.	Floor Brushes, hair dusters, scrappers, wire brush, paint brushes, shutter steel plat oil, kerosene with stoveetc.	12 each
57.	Any other equipment for site tests as outlined in BIS codes and as directed by the APMCF /SBI.	As per site requirement

Appendix-II :PLANT AND EQUIPMENT REQUIRED TO BE OWNED / TAKEN ON LEASE BY THE CONTRACTOR

Sl.No.	Equipment	Tentative Numbers
1	Builder's hoist	7/ As Required
2	Centralized concrete batch mix plant of capacity 60 cum per hour (fully automatic with computer control)	1/ As Required
3	Excavator cum loader (JCB 3D model or equivalent)	2/ As Required
4	Compressor machine minimum 20 CFM with rock Breaker	5/ As Required
5	DG set of minimum capacities of 62.5 KVA.	As per requirement
6	Mini batching plant (6 cum./hr.).	2/ As Required
7	Transit mixers.	As per requirement
8	Concrete pump.	3/ As Required
9	Boom lifter	7/ As Required
10	Needle Vibrators.	6/ As Required
11	Screed leveler.	6/ As Required
12	Plate Vibrator.	6/ As Required
13	Automatic Ring making machine (Reinforcement).	2/ As Required
14	Dumper / Tripper.	6/ As Required
15	Reinforcement bending machine.	3/ As Required
16	Reinforcement cutting machine.	6/ As Required
17	Power driven earth rammer (Soil Computer).	2/ As Required
18	Total Station Machine.	2/ As Required
19	Water tanker (Minimum capacity of 5000 liters)	5/ As Required
20	Welding machine 400 Ampere.	5/ As Required
21	Screener for coarse sand and fine sand.	6/ As Required
22	Centrifugal mono block water pump minimum capacity 2HP.	6/ As Required

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23	Road roller 8 to 10 tons.	2/ As Required
24	Vibratory roller.	2/ As Required
25	Drilling machine.	As per requirement
26	Double H Frame MS scaffolding and staging materials.	4000 Sq.mt./ As Required
27	Air compressor.	6 Nos/ As Required
28	Floor grinding / polishing machines.	6 Nos/ As Required
29	Granite cutting machine.	6 Nos/ As Required
30	Ceramic tile cutting machine.	12 Nos/ As Required
31	Granite polishing machine.	6 Nos/ As Required
32	Granite hand polishing machine.	12 Nos/ As Required
33	Mobile tower crane.	2 Nos/ As Required
34	Tower Crane with necessary covering length /Area required for the Construction of Twin Towers	1 Nos/As Required
35	Any other machinery required for completion of the work as per decision of APMCF /SBI.	As per actual requirement
36	Officers inspection Lift	One per tower
37	Pile foundation machinery	As per requirement
38	Shuttering for Residential building	As per requirement

Note: The above list is only indicative and not exhaustive. However, quantity may be optimized commensurate to progress of work with the approval of APMCF /SBI.

LIST OF MATERIALS OF APPROVED BRAND AND THEIR MANUFACTURES

LIST OF MATERIALS FOR CIVIL WORKS

The materials, accessories, fittings, etc. be used in the civil, Electrical, plumbing machinery, and lift installation work, shall be one of the following particular make or equivalent IS Make. The direction of selection of any particular make shall be rest with APMCF/SBI.

No	Item	Approved make
	CIVIL	
1	Cement	Ambuja, Ultratech, JK Laxmi, ACC, Lafarge
2	Sand	Locally available & as approved sample
3	Aggregates	Sevalia, or approved sample
4	Bricks	as per approved sample by Client
5	AAC Block	Iolite, Siporex, Aerocon, Billtech, Ecolite, Ascolite Ultratech, Eco green, Brixo, Magicrete, Litecon, JK Lakmi, Wonder
6	Reinforcement bar	SAIL, TISCON, JSW, RINL.
7	Structural steel	SAIL ,TATA Steel, Jindal, RINL- Vizag, Arcelor Mittal, Essar, JSW, APL Apollo Tubes Ltd, HI Tech Pipes,
8	Anti termite treatment	Pidilite, Bayer-Premise, Ultratech, PCI, Godrej HI-CARE, Pest control India, Rallis India-Termex

9	Waterproofing compound	Pidilite, Sikka, Balendura, Fosroc, Kerakoll, BASF, Sunanda Chemical
10	Weather sealant	Kerakoll, Down corning, Fosroc, Sikka, Dr. Fixit (Pidilite), Bostik, Wacker
11	Tile adhesive	Saint gobain - Weber, Bal Endura , Kerakoll, Pidilite , Roff, Myk Laticrete, Fevimate
12	Epoxy grouting	Myk Laticrete, Dubond, Kerakoll, Bal Endura, Fosroc, Saint Gobain -Weber, Pidilite
13	Paint & Putty	Jotun, Asian, Berger, Nerolac, Indigo, Birla, JK, Dulex
14	Texture Paint	Asian, Luxture, Jotun
15	Italian Marble	As per approved sample
16	Granite	As per approved sample
17	Kotah Stone	As per approved sample
18	Vitrified tiles	Simpolo, Kajaria, Somany, Varmora , Nitco, Sunheart, AGL
19	Ceramic Tiles	Simpolo, Kajaria, Somany, Varmora , Nitco, Sunheart, AGL
20	Gypsum Plaster	Gyproc - Saint Gobain, USG Boral, Birla-white, JK, MYK
21	Thin Profile Glass Door	Sonic, Kubik, Dorma, Saint Gobain, Ozone, Geze

22	Glass door hardware & fittings	Dorma, Geze, Haffle, Enox, Kitch, Hettich, Ebco
23	Glass	Modiguard, Saint-Gobain, Asahi, HNG
24	Flush door	Greenly-door, Century- door, Archidply - door, Euro door, Nippon, Merino
25	Metal Door	Doorwin, Ajni, Shakti Hormann, Ardor, Navair, Aaccess, Gujcon
26	Fire Rated Door	Doorwin, Ajni, Shakti Hormann, Ardor, Navair, Aaccess, Gujcon, JC Fire Door Corporation
27	Ply (BWP - IS 710 & BWR 303)	Green ply, Century ply, Euro ply, Nippon ply, Merino ply,
28	Laminate	Greenlam, Century, Merino, Timex, Euro, Aerolam, Royal touch, Formica, Nippon ply, Neosine
29	Veneer	Greenlam, Century ply, Euro ply, Timex, Natural Deco wood, Nippon ply
30	Alluminium heavy duty section	Jindal, Domal series, Hindalco, Banco, Gujarat Extrusion, vitco
31	Polycarbonate sheet	Makrolon, Lexan, Bayer, Dunpalon, Sabic, Coxwell
32	Anchor fastener and bolts	Hilti, Fischer
33	Modular Glass Partition	Sonic, Kubik, Otic , Ozone
34	Hardware & fittings	Hettich, Haffle, Enox, Ebco, kitch, Dorma, Geze

35	Aluminium profile handles & frames	Olive, Hettich, Haffle, Enox, Ebco, kitch
36	Door hardware & accessories	Geze ,Haffle, Enox, Dorma, Kitch, Ozone, kitch
37	Alluminium profile glass railing	Kitch, Olive , Remson
38	PVC edge beading	Rehau, Dolken
39	Glass wool/ synthwool	Rockwool, Twiga, Aco sonic
40	Artificial stone	Emcer, Kalinga, CMC, AGL, Johnson, Simpolo
41	Aluminium Fins	Metalium, Supersil, Hunter duglass
42	ACP (Aluminium Composite Panel)	Viva, Eurobond, Timex, Aludecor, Alstone, Alucobond, Alstrong,
43	Sanitary vessels	Hindware, Jaquar, Cera, Johnson, Kohler
44	Sanitary accessories	Hindware, Jaquar, Cera, Johnson, Kohler
45	Hand drayer	Euronics , Cera, Jaquar, Hindware
46	Toilet Cubical	Marino, Greenlam, Matalium, T-Line
47	CPVC & UPVC, PVC pipe	Prince, Supreme, Astral, Finolex, Ashirvad flow guard,
48	Paver Block	Vyara , Endura, Spectra, Super

PLUMBING

Sr. No.	Description	Approved Make/ Approved Vendor
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1	CP GRATING (P TRAP)	CHILLY/FUTURA/JAYNA/HIGHTECH
2	BALL VALVE	SANT/ZOOTO/LEADER/NVR VALVES
3	GUN METAL WHEEL VALVE	SANT/ZOOTO/LEADER/NVR VALVES
4	PRESSURE REDUCING VALVE	SANT/ZOOTO/LEADER/NVR VALVES
5	BUTTERFLY VALVE	SANT/ZOOTO/LEADER/NVR VALVES
6	NON RETURN VALVE	SANT/ZOOTO/LEADER/NVR VALVES
7	CAST IRON MANHOLE COVER	KAPILANSH/NECO/KEJRIWAL
8	CAST IRON GRATING	KAPILANSH/NECO/KEJRIWAL
9	UPVC PIPES/FITTINGS	ASTRAL / SUPREME / PRINCE
10	CPVC PIPES/FITTINGS	ASTRAL / SUPREME / PRINCE
11	PVC PIPES/FITTINGS	ASTRAL / SUPREME / FINOLEX / PRINCE
12	DUCTILE IRON/CAST IRON PIPES/FITTINGS	JINDAL / TATA TISCO/ RELIANCE / SAINT GOBAIN
13	MINERALLY REINFORCED POLYPROPYLENE HIGH DENSITY LOW	HULIOT/GEBERIT/ WAVIN/ ASTRAL
13A	NOISE PIPE	HULIOT/GEBERIT/ WAVIN/ ASTRAL
14	WATER METER	ELSTER / ITRON (ACTRIS) / ZENER / SAPPLE SANT / NVR VALVES /CAPSTAN / HONEYWELL / ADM
15	WATER LEVEL INDICATOR	SANT / SIGMA / GELCO / HONEYWELL / ABB / E+H /KROHNE / SEIMENS / YOKOGAWA / VEGA / EMERSON
17	WATER SOFTENER SYSTEM	ION EXCHANGE/H2O ION EXCHANGE/ALDEE/EARTHLINK/THERMAX
21	DOMESTIC RO SYSTEM	ION EXCHANGE/H2O ION EXCHANGE/ALDEE/EARTHLINK/THERMAX

22	WATER COOLER	BLUE STAR/VOLTAS/USHA
23	ELECTRIC GEYSER	JAQUAR/A O SMITH/VENUS/BAJAJ / HAVELLS
24	BALL FLOAT VALVE	PRAYAG / ZOLOTO/NVR VALVES
25	SEWAGE TREATMENT PLANT	ION EXCHANGE/H2O ION EXCHANGE/ALDEE/EARTHLINK/THERMAX
26	DOMESTIC/ RAIN WATER TREATMENT PLANT	ION EXCHANGE/H2O ION EXCHANGE/ALDEE/EARTHLINK/THERMAX
27	DWC PIPE	REX/ SUPREME / NOBLE / ASTRAL /PRINCE
28	MOTOR	ABB/BBL/BHEL/CGL/ KEC / SIEMENS / KEC / CROMPTON /MARATHON / BB/ NGEF / HAVELLS
29	HDPE PIPE	PIL / MANEKYA / DURALINE / IRRIGATION / RIL / SANGHIR /DUTRON / SUPREME / RELIANCE
30	RCC HUME PIPES EXTERNAL MAIN UNDER GROUND PIPE	INDIAN HUME PIPE/PRANALI/ALCOCK/NECO/BENGAL IRON
31	C.I. PIPE & FITTINGS	KESORAM/ELECTROSTEEL/KEJRIWAL/TISCO/UPADHYA NEW JANTA / CORPORATION / KAPILANSH / RJ INDUSTRY
32	FRP MANHOLE COVER	EVERALST/THERMODRAIN/HP/INTERNATIONAL/SINTEX/SUMIP/DAKLE/RANI & CO./ GANDHI & ASSOCIATE / CPE
33	MS/G.I. PIPES	TATA / JINDAL / ASIAN
34	G.I. PIPES FITTINGS WATER SUPPLY	DRP-M/R-BRAND/ZOLOTO / GST / AMBIKA / TATA / SURYA / JINDAL / ASIAN / ASIAN/NVR VALVES
35	GI TO GI JOINTS	CHAMPION/CROWN/DIAMOND / GST / AMBIKA / TATA / SURYA / JINDAL / ASIAN / ASIAN/ NVR VALVES
36	TAR	SHALIBOND/TIKIBOND-BS/SWASTIK
37	NITRILE RUBBER	SUPERLON, THERMAFLEX, ARMAFLEX

38	SOLVENT CEMENT	SUPREME/FINOLEX/ASTRAL / PRINCE
39	STARTER	SIEMENS / Lauritz Knudsen / ABB / AB / SCHINEIDER / YASHKAWA / YOKOGAWA / DENFOSS / HITACHI / VACON / KEB
40	PRESSURE GAUGE	BELLS/H GURU/DENFOSS / BAUMER / H.GURU / BELLS /MANOMETER / GIC
41	WATER TRANSFER PUMP	GRUNDFOSS / XYLEM / KIRLOSKAR
42	METALLIC EXPANSION BELLOWS	BELLOW FLEX/PRCISION/DHRUV/B.D. ENGR.
43	CABLES	CCI / UNIVERSAL / FINOLEX / INCAB / TORRENT / HAVELLS /BHARATCAB / GLOSTER /RR KABEL / POLYCAB
44	UV	BIO UV / ATG UV / TROJAN UV / ULTRAAQUA / XYLEM /ALPHA / EUREKA FORBES / SUKRUT
45	RAINY FILTER	NEERAIN/RAINY/APPROVED EQUIVALENT AS APPROVED BY EIC
46	SLUICE GATE	JASH / IVC / BIC / YASHWANT / IVI / BRAY
47	AIR RELEASE VALVE	KIRLOSKAR / IVC / IVI / FOESS / INTERVALVE / AUDCO / BRAY / GM ENGG./ MACK (ORBIT) / NVR VALVES/ MAGVEN / ZOLOTO/R.B.
48	GULLY TRAP	PERFECT/RK/ANAND
49	SLOT DRAIN	FUJI/ACO/APPROVED EQUIVALENT AS APPROVED BY EIC
50	AIR VENT VALVE	AVK / KIRLOSKAR / FOESS / IVI / JAINSONS INDUSTRIES/(JSI) / SANT / ZOLOTO / NVR VALVES/ VAG / GM ENGG.
51	PIPE SUPPORT, HANGERS	INTELLO TECH/CAMRY/HILTI/FISCHER
52	SS PIPE	TATA / JINDAL / RELIANCE / REMI / RATNAMANI
53	STRAINER	KSB / KITZ / EMERALD / AMIAD / GOPANI / ANSYS / HY-PRECESSION / 3M CUNO

54	ELECTROMAGNETIC FLOW METER	HONEYWELL / E&H / ABB / KHRONE MARSHALL / SEIMENS
55	HEAT PUMP (AIR TO WATER)	SOLAHART/AO SMITH/BENCHMARK/TATA.
56	PERCOLATION WELL	'FURAAT/VARDHMAN/SUJALAAM// M/S. EN-VISION ENVIRONMENTAL SERVICES / M/S.SHESH ENVIRO INFRA PVT. LTD. / M/S.CRYSTAL CLEAR WATER TECHNOLOGY PUNE
57	LOFT TANK (HDPE)	SINTEX/SUPREME/ASTRAL
58	SOLID WASTE COMPOSTER	DCS TECHNO/SMART ENVIRO/ENVICARE/ALFA THERM
59	BINS & CONTAINER	SINTEX/NILKAMAL/SUPREME
60	MEMBRANE	GE / TORRAY / DOW / HYDRANUTIC / DUPONT
61	HOT WATER RECIRCULATION PUMP	GRUNDFOS / XYLEM / KBL / KSB

Electrical		
Sr. No.	Description	Approved Make/ Approved Vendor
1	11 KV VCB	Schneider / ABB/ Lauritz Knudsen
2	11 KV HT Cable	Finolex / Polycab / KEI/Torrent
3	11 KV HT End Termination Kit	Raychem / 3M / RPG
4	Transformer/CSS	Power Lite / Kokila Transformers/Raychem/KV TRANSPower INDUSTRIES
5	DG Set	Alternator: -Kirloskar Green /Crompton /Stamford/LeroySommer.
		Engine: -Cummins / Caterpillar / Volvo Penta / Kirloskar/ Perkins

6	LT Panels/Feeder Pillar -Normal Fabricated	Authorized Panel Builder of Legrand / Schneider /Lauritz Knudsen - Panel Manufacturers : Adishwaram Corp/ AD Enterprise/Hi-Tech Engineers.
7	Distribution Boards	Legrand / Schneider /Panasonic/ Lauritz Knudsen
8	Low Voltage Cable	Havells/Finolex / KEI/ Polycab / RR Kabel /Torrent
9	Cable Tray (Ladder Type / Perforated)	OBO Bettermann / Legrand / Indiana / Profab
10	UPS	Eaton/ APC/ Numeric
11	SPD (Surge Arrester)	OBO / Legrand / Schneider/Lauritz Knudsen
12	LT Switchgear (ACB)	Legrand /Schneider/ Lauritz Knudsen
13	LT Switchgear (MCCB)	Legrand /Schneider/ Lauritz Knudsen
14	LT Switchgear (MCB)	Legrand /Schneider/ Lauritz Knudsen/ Anchor by Panasonic
15	LT Switchgear (Contactor, Relay, MPCB)	Legrand /Schneider/ Lauritz Knudsen/ Anchor by Panasonic
16	Auto Transfer Switch (ATS)	Legrand /Schneider/ Lauritz Knudsen
17	Busbar Trunking	Legrand /Schneider/ Lauritz Knudsen
18	Meters (Analog)	Schneider-Conserve/Trinity/Selec/Nippen
19	Meters/Energy Meters & Load Managers (Digital)	Schneider-Conserve/Trinity/Selec/Nippen
20	Indicating Lamps	Schneider / Lauritz Knudsen / Salzer/ GE/ ABB/ As Per OEM Standard
21	Electric Timer	Siemens / Legrand / Lauritz Knudsen / Legrand / MECO/ Siemens/ BCH / Anchor by Panasonic
22	Rotary Switch	Siemens / Keycee / Salzer / As Per OEM Standard
23	Push Button and Push Button Set	Siemens / Schneider electric / Lauritz Knudsen / Legrand / C&S / ABB/ GE

24	Selector Switch	Keycee / Salzer / MECO/ Siemens/ Lauritz Knudsen/ Schneider/ Abb/ As Per OEM Standard
25	APFC Relay	Enercon / Lauritz Knudsen / Trinity / Beluk/ Siemens/ EPCOS/ Abb/Schneider/Selec
26	LT Capacitors	Lauritz Knudsen / Legrand / Schneider/ Datar
27	Lugs	Dowell's / 3d / hEX Jainson / Comet / HMI/ CCI/
28	Bimetallic Lugs	Dowell's / 3d / hEX Jainson / Comet / HMI/ CCI/
29	Cable Gland	3d / Comet / HMI/ Grippwell/ Dowels/Polycab
30	PVC Conduits and Accessories	Precision / AKG/ Astral / Polycab/ Anchor By Panasonic
31	M.S. Conduit and Accessories	Akg / BEC / Steelcraft/ Anchor By Panasonic/ MK - Blenze Plus / Legrand-Arteor / Schnedier-Zencelo / Norisys /Panasonic- Europa/Cabtree- Athena/L &T- Englaze/ABB-IVIE & model shall be as approved as per architect.
32	Modular Switches, Sockets & Other Accessories	Contractor to provide minimum 3 no sample of different make for approval of end user & architect
33	Metal Clad Socket With MCB	Legrand / Hensel / Schneider/ Hager/ Lauritz Knudsen/ ABB / Anchor by Panasonic
34	PVC Tape	Steel Grip or Equivalent
35	PVC Junction Box	Hensel / Clipsal/ Sintex
36	Wires for Internal Wiring	Finolex/ Polycab / RR Kabel/ Anchor by Panasonic
37	Connectors (Colours as per Phase & Neutral)	WAGO / Phoenix Contact/ Connectwell
38	Control Transformer [PT/ CT]	Ashmor / Kappa / Elmex/ Ae/ Precise/ Pragati/ / ECS/ Kalpa
39	Paint	Nerolac / Asian Paints/Jotun

40	Ceiling Fan / Exhaust Fan	Crompton / Bajaj / Havells/ Usha/Almonard/Anchor by Panasonic
41	Floor Trunking	MK / Legrand / OBO Bettermann/ Schneider
42	Floor Junction box	Legrand / MK / OBO Bettermann/ Schneider
43	Fire Extinguisher	Firex/ Minimex / Safex / Ceasefire
44	Chemical Earthing	OBO Bettermann / JEF / JMV
45	Convectonal LPS	OBO Bettermann / JEF / JMV
46	DC Battery Charger	Chhabi / HBL/Amararaja
47	SMF Battery	Exide / Rocket / Amaron-Amararaja/ Standard/ Prestolite
48	Solar PV Cells	Adani/Tata/Waaree/Bhel/Anchor by Panasonic
49	Grid TIE Inverter	Hitachi / SMA/ABB/EVVO/Waaree/Delta/Fimer
50	External light pole	Wipro/Havells/Philips/Panasonic
51	Light fixture	Wipro/Havells/Philips/Panasonic
52	BOREWELL PUMP	GRUNDFOS / XYLEM/ KBL / KSB
53	BOREWELL COLUMN PIPE	ASHIRVAD/ SUPREME/ ASTRAL
54	FLEXIBLE SUBMERSIBLE COPPER CABLE	FINOLEX/ POLYCAB/ RR KABEL
55	HYDRO PNEUMATIC SYSTEM	FRANKLIN/GRUNDFOS/XYLEM/KSB
56	SUBMERSIBLE PUMPS	GRUNDFOSS / KIRLOSKAR / KSB / XYLEM
57	NON CLOG SUBMERSIBLE DE WATERING PUMP FOR RAIN WATER	GRUNDFOSS / KIRLOSKAR / KSB / XYLEM
58	MUD PUMP FOR DRAINAGE	GRUNDFOSS / KIRLOSKAR / KSB / XYLEM
59	LIFT	OTIS, Schindler, Orbis Elevator, Kone, Mitsubishi,

Fire Fighting

SR. NO.	DESCRIPTION	APPROVED MAKE / APPROVED VENDOR
1	FIRE EXTINGUISHERS	KANEX, MINIMAX, SAFEX
2	FIRE FIGHTING PUMP - ELECTRICAL DRIVEN	KIRLOSKAR/LUBI/WILO
3	FIRE FIGHTING PUMP - DIESEL DRIVEN	KIRLOSKAR/LUBI/WILO
4	DIESEL ENGINE	GROUNDFOSS /KIRLOSKAR
5	BATTERY	EXIDEs / AMCO / AMARON
6	JOCKEY PUMP	KIRLOSKAR/LUBI/WILO
7	LT Panels/Feeder Pillar -Normal Fabricated	Authorized Panel Builder of Legrand / Schneider /Lauritz Knudsen - Panel Manufacturers : Adishwaram Corp/ AD Enterprise/Hi-Tech Engineers.
8	HYDRANT VALVE	SHAH BHOGILAL, NEWAGE, SWATI
9	SHORT BRANCH PIPE	SHAH BHOGILAL, NEWAGE, SWATI
10	FIRST AIDE-HOSEREEL & HOSE CABINET	SHAH BHOGILAL, NEWAGE, SWATI
11	RRL HOSE PIPE	SHAH BHOGILAL, NEWAGE, SWATI
12	FIRE BRIGADE CONNECTION	SHAH BHOGILAL, NEWAGE, SWATI
13	GI PIPES AND ACCESSORIES	JINDAL, ASIAN, SURYA PRAKASH
14	COATING & WRAPPING	IWL / RUSTEK / NEOTAPE
15	PAINTING	ASIAN / NEROLAC / BERGER
16	ANTICORROSIVE TAP	PIPEKOT / IWL / RUSTECH
17	RCC PIPES	INDIAN HUME PIPE / PRANALI / ALCOCK
18	BUTTERFLY VALVES	ZOLOTO, KARTAR, SANT, NVR
19	SLUICE VALVES	ZOLOTO, KARTAR, SANT, NVR
20	NON RETURN VALVE	ZOLOTO, KARTAR, SANT, NVR
21	Y STRAINER	ZOLOTO, KARTAR, SANT, NVR
22	AIR RELEASE VALVE	SANT / ZOLOTO / SHAH BHOGILAL/NVR VALVES
23	SPRINKLER	HD, TYCO, WIKING
24	FLOW SWITCHES	DANFOSS / FORBES / MARSHALL / SWITZER/HONEYWELL

25	ISNTALLATION CONTROL VALVE	HD, TYCO, NEWAGE
26	WATER CURTAIN NOZZLE	HD, SHAH BHOGILAL, NEW AGE
27	SOLENOID VALVE	HD, TYCO, NEW AGE
28	ROSSETE PLATE	HD, TYCO, WIKING
29	SPRINKLER FLEXIBLE PIPE	HD, TYCO, WIKING
30	PRESSURE SWITCH	HD, TYCO, WIKING
31	AUTO GLOW SIGNAGES	AUTOFLOW / GLOWLITE / PROLITE / AUTOGLOW
32	EXIT SIGNAGES	AUTOFLOW / GLOWLITE / PROLITE / AUTOGLOW
33	PUBLIC ADDRESS SYSTEM	Honeywell-X618/Aties-IDA8/Bosch-Prisario
34	FIRE FIGHTER TELEPHONE HANDSET	Honeywell - Notifier, Bosch - UL, Johnson Control, Apollo-Panasonic
35	LT CABLES	Polycab, Avocab, R&M
36	LT TERMINATION	COMET OR EQUIVALENT
37	ADDRESSABLE FIRE ALARM PANEL	Honeywell - Notifier, Bosch - UL, Johnson Control, Apollo-Panasonic
38	HEAT DETECTOR	Honeywell - Notifier, Bosch - UL, Johnson Control, Apollo-Panasonic
39	SMOKE DETECTOR	Honeywell - Notifier, Bosch - UL, Johnson Control, Apollo-Panasonic
40	MULTI CRITERIA DETECTOR	Honeywell - Notifier, Bosch - UL, Johnson Control, Apollo-Panasonic
41	RESPONSE INDICATOR	Honeywell - Notifier, Bosch - UL, Johnson Control, Apollo-Panasonic
42	MANUAL CALL POINT	Honeywell - Notifier, Bosch - UL, Johnson Control, Apollo-Panasonic
43	HOOTER	Honeywell - Notifier, Bosch - UL, Johnson Control, Apollo-Panasonic
44	FIRE ALARM CABLE	Polycab, Avocab, R&M

45	PUMP ON OFF SWITCH	JAIN INSTRUMENTS / N.K.TECHNO FAB / RSS
46	ELCTRIC METERS	SCHNEIDER / NIPPEN / Lauritz Knudsen / SECURE /ELMEASURE
47	STARTER / SWITCHES / MCB / MCCBS / etc.	LEGRAND / Lauritz Knudsen / SCHNEIDER
48	SWITCHGEAR / SFUS	LEGRAND / Lauritz Knudsen / SCHNEIDER
49	LEVEL INDICATOR	TECHNICA / WAAREE/FLOWTECH
50	WELDING ELECTRODES	ADVANI / MARUTI / ESAB
51	CLAMPS / FASTENERS	HILTI / FISCHER / MUPRO
52	TEST DRAIN ASSEMBLY WITH SIGHT GLASS	TYCO / VIKING / GRINNEL
53	PRIMER	ASIAN PAINTS / BERGER / NEROLAC
54	SS EXPANSION BELLOW	FLEXATHERM / FLEXPART/SSFLEXHOSE
55	AIR VESSEL	NEMA, ZENITH, AS PER CPWD SPECIFICATIONS TESTED UP TO 25KG/ SQRMTR
56	ANTI-VIBRATING MOUNTING PADS, EXPANSION JOINTS	DULOP, RESISTOFLEX, EASY FLEX, FLEXIONICS, VIMPA

Notes:-

- 1) Note:- Besides the above makes, Bank/ APMCF has the right to permit use of any equivalent brand / material matching the specified criteria / quality standards.
- 2) The contractor should obtain prior approval from APMCF / SBI before placing order for any specific materials. APMCF / SBI may / delete any of the makes or brands out of the above list.
- 3) All materials should conform to relevant standards and codes of BIS.

4) Materials with I.S.I. mark shall be used duly approved by the SBI/APMCF.

5) If any material is found to be not up to the mark, the contractor will have to produce original bills/certificate from the manufacturer or his authorized Distributor for authenticity and genuineness of the material for consideration and as per make approved by the SBI/APMCF. The same will not be considered for payment.

6) In exceptional case only, equivalent material's makes (Which are not mentioned in above list) shall be permitted that too with dual approval from SBI/APMCF. SBI reserves the right to accept or reject materials without assigning reason.

PROFORMAS/TABLES OF VARIOUS TESTS, MATERIALS, PACT, GUARANTEES

Sr. No	Particulars	Nos
1.	Record of Cement/Received/Used/Balance.	Table I
2.	Proforma of Paint/Lead/CICO Register	Table II
3.	Proforma for Reinforcement Bars Received	Table III
4.	Format of Receipt Of Materials At Site	Table IV
5.	Format of Monthly Progress Report	Table V
6.	Proforma for Bulkage Test of Sand Register	Table VI
7.	Proforma for Silt Test Register	Table VII
8.	Proforma for Sieve Analysis of Fine Aggregate Register	Table VIII
9.	Proforma for Sieve Analysis of Coarse Aggregate Register	Table IX
10.	Proforma for Slump Test Register	Table X
11.	Proforma of Cube Test Register	Table XI
12.	Proforma for Hindrance to Work	Table XII
13.	Proforma for Running A/c. Bill	Table XXI
14.	Account of Secured Advance if Admissible on Materials Held at Site by the Contractors	Table XIV
15.	Format for Memorandum For Payment	Table XV
16.	Format of Measurement Book	Table XVI
17.	Format of Site Order Book	Table XVII
18.	Format For Application By Contractor For Extension Of Time.	Table XVIII

19.	Details of Insurance Policies	Table XIX
20.	Prebid Query Form	Table XX
21.	Pre-Contract Integrity Pact	Annexure XVIII
22.	Guarantee Bonds Of Civil Works Format Of Guarantee To Be Executed By The Firm/ Contractor In Respect Of The Work Of Pre-Construction Anti-Termite Treatment	Annexure XXI
23.	Proforma Of Guarantee Bond For Waterproofing Treatment To Basement (Walls & Bottom Slab), Underground Reservoir, Overhead Reservoir, Terrace, Staircase Tower & Sunken Floor Of Washrooms.	Annexure XXII

Note : i) Contractor has to get the above record maintained in registers at site and to be kept securely at site.

TABLE-I

RECORD OF CEMENT RECEIVED / USED / BALANCE

S. No.	Cement in stock Bags	Cement received (Bags)	Total Cement received (Bags)	Source from which received	Description of work where cement is used	Number of cement bags consumed	Balance in stock	Signature of Contractor & APMCF/ (Bank's Representative (Periodical))
1	2	3	4	5	6	7	8	9

TABLE-II
RECORD OF PAINT / LEAD / CICO REGISTER

Name of work :
Name of the Contractor :
Agreement No. :

Date of Receipt	Source Receipt with Ref. To S.O./Indent	Qty. Received	Progressive Total	Item of work for which issued with approx. qty. work done in case of paint only	Date of issues	Quantity issued	Qty. returned at the end of the day	Total issued	Delay Balance at hand	Contractors initials	Site Engineers initials	Signature of APMCF/ (Bank's Representative (Periodical)
1	2	3	4	5	6	7	8	9	10	11	12	13

Register for bitumen should be maintained. The format will be similar to that for cement.

Signature & Seal of Contractor

TABLE-III

PROFORMA FOR REINFORCEMENT BARS RECEIVED (In KGS.)

Truck No.	Challan No.	Name of Supplier	Binding Wire	6mm dia.	8mm dia.	12m m dia.	16mm dia.	20mm dia.	25mm dia.	Total Received
1	2	3	4	5	6	7	8	9	10	11

Number of diameters given is only illustrative. Open more columns for other diameters wherever needed.

Signature & Seal of Contractor

TABLE-IV

FORMAT OF RECEIPT OF MATERIALS AT SITE

Sr. No.	Description	Opening balance	Receipt during month	Consumption during month	Closing balance	Total Quantity received till date
1	Cement (M.T.)					
2	Mild steel (M.T.)					
3	Tor steel (M.T.)					
4	Coarse aggregate (cu.mt.)					
5	Fine aggregate (cu.mt.)					
6	Teak wood (cu.mt.)					
7	Bricks (Nos.)					
8	Tiles (Nos.)					

Sr. No.	Description of work	Date of Commencement	Due date of completion	Percentage progress achieved
1	General building work			
2	Security equipment work			
3	Pest control treatment work			

Signature & Seal of Contractor

4	Sanitary & Plumbing work			
5	Electrical work			
	Fire Fighting Works			
7	Other work			

TABLE-V
FORMAT OF MONTHLY PROGRESS REPORT (Annexure X)

Name of work :

Progress report for the month :

Report No. :

Sr No.	Description	Approximate quantity executed (Till Previous Month)	Details of work location where work is done	Approximate quantity executed (Current Month)	Total Quantity Executed
A.	GENERAL BUILDING WORK:				
1	Foundation work				
2	Reinforcement fabrication				
3	Shuttering work				
4	Reinforced cement concrete				
5	Masonry work				
6	Wood work				
7	Plastering work				
8	Flooring work				
9	Glazing work				

Signature & Seal of Contractor

10	Roof treatment work				
11	Painting work				
B	Pest control treatment				
C.	Security equipment work				
D.	Sanitary and plumbing work:				
1	Water supply				
2	Drainage work				
3	Fitting and fixtures				
E.	Electrical installation work				
F.	Fire Fighting Works				
G.	OTHER TRADES				

TABLE-VI

PROFORMA FOR BULKAGE TEST OF SAND REGISTER

Sr. No.	Date of Test	Volume of dust sand in Cylinder inundated & stirred	Volume inundated Sand in Cylinder	Percentage of Bulkage	Signature of Site Engineer	Signature of Contractor	Initial of APMCF / Bank's representative (Periodical)
1	2	3	4	5	6	7	8

TABLE-VII

PROFORMA OF SILT TEST REGISTER

Sr. No.	Date of Test	Height of Sand in Cylinder inundated & stirred	Height of Silt	Max percentage of silt as specified	Percentage of silt obtained	Signature of Site Engineer	Signature of Contractor	Initial of APMCF / Bank's Representative (Periodical)
1	2	3	4	5	6	7	8	9

TABLE-VIII

PROFORMA SIEVE ANALYSIS OF FINE AGGREGATE REGISTER

Sr. No	Date of Test	Wt. of Material to be tested	Sieve as per I.S. designation	Wt. of Sand retained in sieve	%a retained in each sieve successively	Cumulative % retained in each sieve	F. M.	Signature of Site Engineer	Signature of Contractor	Signature of APMCF/ Bank's representative (Periodical)

TABLE-IX

PROFORMA OF SIEVE ANALYSIS OF COARSE AGGREGATE REGISTER

S. No.	Date of Testing	Wt. of Material to be tested	Nominal size of Aggregate	I.S. Sieve designation	Standard passing for graded aggregate. of nominal size	Test Result	Obtained passing	Signature of Site Engineer	Signature of Contractor	Signature of APMCF /Bank's representative (Periodical)
1	2	3	4	5	6	7	8	9	10	11

TABLE-X
PROFORMA FOR SLUMP TEST REGISTER

Sr. No.	Date of Testing	Type of work for which slump taken	Specified slump		Slump Obtained		Signature of Site Engineer	Signature of Contractor	Signature of APMCF / Bank's representative (Periodical)
			When Vibrators are used	When Vibrators are not used	When Vibrators are used	When Vibrators are not used			
1	2	3	4	5	6	7	8	9	10

TABLE-XI

ANNEXURE-XI
PROFORMA OF CUBE TEST REGISTER

Date of taking Cube + Lime	Sample No.	No. of Cubes taken	Specific marking of Cubes	Proportion of mixture	Description of work carried out	Signature of Engineer taking sample	Signature of Contractor	7/28 Days Testing				Permissible Compressive strength of Concrete / 28 Days / 7 days	Remarks on Test Report and No.	Remarks of APMCF /Bank's representative Periodical			
								Date of Test	Test Result Kg / Sq. cm	Av. Strength Kg. / Sq. cm .	Standard strength Kg / Sq.				7 Days	28 Days	

Signature & Seal of Contractor

											cm				
1	2	3	4	5	6	7	8	9	10	11	12	13		14	15

TABLE-XII
ANNEXURE-VIII.

PROFORMA FOR HINDRANCE TO WORK

Name of Work : Date of Start of work :
 Name of Contractor : Period of Completion :
 Agreement No. : Dt. of Completion of work :

S.No	Nature of Hindrance	Date of Occurrence of Hindrance	Date of which Hindrance was removed	Period of which Hindrance existed	Signature of Site Engineer	Signature of APMCF / Bank's Representative
1	2	3	4	5	6	7

TABLE XIII
PROFORMA FOR RUNNING A/C BILL

- i. Name of Contractor / Agency :
- ii. Name of Work :
- iii. Sl.No. of this Bill :
- iv. No. & Date of previous Bill :
- v. Reference to Agreement No. :
- vi. Date of Written order to commence :
- vii. Date of Completion as per Agreement :

S.No.	Item Description	Unit	Rate (Rs.)	As per Tender	
				Quantity	Amount (Rs.)
1	2	3	4	5	

Upto Previous R.A. Bill		Up Date (Gross		Present Bill		Remarks
Quantity	Amount (Rs.)	Quantity	Amount (Rs.)	Quantity	Amount (Rs.)	
6		7		8		9

Note: 1. If part rate is allowed for any items, it should be indicated with reasons for allowing such a rate.

 Net Value since previous bill

2. If ad-hoc payment is made, it should be mentioned specifically.

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 Contractor	Signature and date of Architects Representative (Seal)	Signature and date of Site Engineer
-------------------------------------	--	--

The work recorded in the above-mentioned measurements has been done at the site satisfactorily as per tender drawings, conditions and specifications.

-----	-----
Signature & Date of Architect	Signature & Date of Site Engineer
	Signature & Date of Bank's Engineer

TABLE - XIV

ACCOUNT OF SECURED ADVANCE, IF ADMISSIBLE ON MATERIALS HELD AT SITE BY THE CONTRACTOR

S.No.	Item	Quantity	Unit	Amount	Remarks
1	2	3	4	5	6

Total value of materials at Site.

Secured Advance @ ----- of above value - B

CERTIFIED:

- (i) That the materials mentioned above have actually been brought by the Contractor to the site of the work and on 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 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
Preparing the bill

Signature & Seal of Contractor

Rank

Date signature of
Banks Architects.....
(Name of the Architects)

.....
Dated Signature of the Contractor

TABLE - XV

MEMORANDUM FOR PAYMENT

R/A BILL NO.

1.	Total value of work done since previous bill (A)	Rs. -----
2.	Total amount of secured advance due since Previous Bill (B)	Rs. -----
3.	Total amount due since Previous Bill (C) (A+B)	Rs. -----
4.	PVA on account of declaration in price of Steel, Cement and other materials and labour as detailed in separate statements enclosed.	Rs. -----
5.	Total amount due to the Contractor	Rs. -----
<u>OBJECTIONS:</u>		
i)	Secured Advance paid in the previous R/A	Rs. -----

ii)	Retention money on value of works as per accepted tenders up to date amount Rs.	Rs. -----
	Less already recovered	Rs. -----
	Balance to be recovered	Rs. -----
iii)	Mobilization Advance, if any	
(a)	Outstanding amount (principal + interest) as on date	Rs. -----
(b)	To be recovered in this bill	Rs. -----
iii.	Any other Departmental materials cost to be recovered as per contract, if any	Rs. -----
iv.	Any other Departmental service charges to be recovered if any, as per contract (water, power etc.) enclose statement.	Rs. -----
	Total Deduction as per contract (F)	Rs. -----

Adjustments, if any	Rs.
Amount less received by Contractor in R/A Bill (as per statement of Contractor)	
P.V.A.	Rs.
Total amount payable as per contract (E+F+G)	Rs.
(Rupees in words)	

The bill amount to Rs. (both figures and words) has been scrutinized by us after due checking of the measurements of work as required and is recommended for payment.

Date:

.....

Signature of Architect
with Seal

The bill amount to Rs. certified by Consultants has been scrutinized by me after due test checking of measurements of works as required and is recommended for payment for an amount of Rs.....

Signature & Seal of Contractor

Date :

.....

Signature of SBI Engineer

Signature & Seal of Contractor

STATUTORY DEDUCTION:

i)	Total Amount due (E)	Rs. -----
ii)	Less I.T. Payable	Rs. -----
iii)	Less S.T. Payable	Rs. -----
	Net Payable	Rs. -----

These figures given in the Memorandum for payable has been verified and bill passed for payment -----
----- (in words and figures)

Date: -----

Signature of the Premises Officer

Signature & Seal of Contractor

Table XVI

FORMAT OF MEASUREMENT BOOK (ANNEXURE- XX)

1ST Page:

STATE BANK OF INDIA

.....office,

Measurement Book No.

(Pages 1 to.....)

This book is issued to Shri.....

Signature of A.G.M. (Premises & Estate)

Certified that this book contains..... pages

Signature of the official (to whom the book is issued)

MEASUREMENT BOOK PAGES NOS. 1 TO.....

Item No.	Description	Unit	Measurement No.L B D/H	Quantity	Remarks
----------	-------------	------	---------------------------	----------	---------

Signature & Seal of Contractor

--	--	--	--	--	--

Site Engineer
(Head of PMC)

Architect
(Head of Architect Consultant)

Contractor

Checking/Test checking

Bank's Engineer

Date of checking/Test checking

NOTE :

Checking and test checking pertains to items wherever initialed.

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Table XVII

FORMAT OF SITE ORDER BOOK (ANNEXURE- XVI)

Name of the work_____

Date of Commencement_____

Sr. No	Remarks/ Instructions of the site Engineer/ Architect	Dated Initials of site Engineer/ Architect	Initials of the Contractor for having received the instructions	Action taken with date	Dated initials of the site Engineer	Remarks of the Architects APMCF/SBI Officials
1	2	3	4	5	6	7

Format For Application By Contractor For Extension Of Time (Annexure- VII)

1.	Name of the Contractor			
2.	Name of the work as given in the Agreement			
3.	Agreement WO			
4.	Tender amount			
5.	Date of commencement of work			
6.	Period allowed for completion as per agreement			
7.	Date of completion as per agreement			
8.	Period for which extension of time has been given			
		<u>Date</u>	<u>Month</u>	<u>Year</u>
	a)	1st extension vide Bank's Letter No.		
	b)	2nd extension vide Bank's Letter No.		
	c)	3rd extension vide Bank's Letter No.		
9.	Reasons for which extensions have been previously given (copies of the previous applications should be attached)			
10.	Period for which extension is applied for and the reasons thereof including hindrances, time for extra work assigned, if any etc.			

Signature of Contractor

Table XIX

DETAILS OF INSURANCE POLICIES (ANNEXURE XVII)

Type of policies	Name of Insurance	Amount Rs.	Policy No.	Validity
CAR policy including 3rd party liability				
Workmen's Compensation				
Any other Policy				

Remarks :

- 1) This is only an 'on-account' payment and is not to be interpreted either as approval of work, materials brought or affixed at site or for that matter approval of any sort.
- 2) The quantum of work done and materials delivered at site have been certified by.....
- 3) should you wish to audit such work, kindly contact the undersigned and oblige.

APMCF/Architects

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Table XX

Annexure XIX

Prebid Query Form

Vendor name	Sr. No	TENDER Page No	TENDER Clause No	Existing Clause	Query Suggestion

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Annexure XVIII

PRE-CONTRACT integrity pact

State Bank of India hereinafter referred to as "The Principal".
And hereinafter referred to as The Bidder / Contractor"

Preamble

The Principal intends to award, under laid down organizational procedures, contract/s forThe Principal values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relations with its Bidder(s) and /or Contractor(s). In order to achieve these goals, the Principal will appoint an Independent External Monitor (IEM), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal.

1. The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

a. No employee of the principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

b. The principal will during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/additional information through which the Bidder(s) could obtain an advantage in relation to the process or the contract execution.

c. The Principal will exclude from the process all known prejudiced persons.

2. If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act, or if there be a substantive suspicion in this regard, the principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

1. The Bidder(s)/Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

a. The Bidder(s) / contractor(s) will not, directly or through any other persons or firm, offer promise or give to any of the Principal employees involved in the tender process or

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the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage or during the execution of the contract.

The Bidder(s)/Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

c. The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act; further the Bidder(s) /Contractors will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d. The Bidder(s)/Contractor(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly, the bidder(s)/contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any. Further details as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/Contractor(s). Further, as mentioned in the Guidelines all the payments made to the Indian agent/representative have to be in Indian Rupees only.

e. The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2. The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3: Disqualification from tender process and exclusion from future contracts
If the Bidder(s)/Contractor(s), before award or during execution has committed a transgression through a violation of Section 2, above or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or take action as per the procedure mentioned in the "Guidelines on Banning of business dealings.

Section 4 : Compensation for Damages

1. If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/Bid Security.

2. If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the Contract value or the amount equivalent to Performance Bank Guarantee.

Section 5 : Previous Transgression

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1. The Bidder declares that no previous transgressions occurred in the last three years with any other company in any country conforming to the anti-corruption approach or with any other public sector enterprise in India that could justify his exclusion from the tender process
2. If the bidder makes incorrect statement on this subject, he can be disqualified from the tender process for action can be taken as per the procedure mentioned in “Guidelines on Banning of business dealings”.

Section 6: Equal treatment of all Bidders/Contractors/Subcontractors.

1. The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.
2. The Principal will enter into agreements with identical conditions as this one with all bidders, contractors and subcontractors.
3. The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

Section 7: Criminal charges against violation Bidder(s)/Contractor(s)/Subcontractor(s)

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer.

Section 8: Independent External Monitor/Monitors

- (1) The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
- (2) The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the Chairman, SBI.
- (3) The Bidder(s)/Contractor(s) accepts that the Monitor has the right to access without restriction to all project documentation of the principal including that provided by the Contractor. The Contractor 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 is under contractual obligation to treat the information and documents of the Bidder(s)/Contractor(s)/ Subcontractor(s) with confidentiality.
- (4) The principal 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 Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

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(5) As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or to take other relevant action. The monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

(6) The Monitor will submit a written report to the Chairman, State Bank of India within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

(7) Monitor shall be entitled to compensate on the same terms as being extended to / provided to Independent Directors on the SBI Board.

(8) If the Monitor has reported to the Chairman SBI, a substantiated suspicion of an offence under relevant IPC/PC Act, and the Chairman SBI has not, within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioner.

(9) The word Monitor“ would include both singular and plural.

Section 9 - Pact Duration

This pact begins when both parties have legally signed it. It expires for the Contractor 10 months after the last payment under the contract, and for all other Bidders & months ---- the contract has been awarded. If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged / determined by Chairman of SBI.

Section 10 - Other provisions

- This agreement is subject to Indian Law, Place of performance and jurisdiction is the Registered Office of the Principal, i.e. GIFT City, Gandhinagar, Gujarat-382355.
- Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
- Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

For & on behalf of the Principal
Office Seal

For & On behalf of Bidder/ Contractor
(Office Seal)

Place -----

Date -----

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Witness 1: (Name & Address) _____

Witness 2: (Name & Address) _____

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Annexure- XXI

**Guarantee Bonds of Civil Works FORMAT OF GUARANTEE TO BE EXECUTED BY THE FIRM/
CONTRACTOR IN RESPECT OF THE WORK OF PRE-CONSTRUCTION ANTI-TERMITE
TREATMENT**

(On non-judicial Stamp Paper of Rs. 600/- or as per latest Govt. Rules)

The agreement made this Day of _____ Two Thousand _____ between Assistant General Manager, Premises & Estate Department, State Bank of India, Gift City, Gandhinagar of one part and _____ (Name of the Firm/ Contractor (hereinafter called the Guarantor) of the other part.

WHEREAS THIS AGREEMENT is supplementary to the Contract (hereinafter called the Contract dated made between the Employer of the one part and the Guarantor of the part) whereby the Firm/Contractor interlaid undertook to render the building/ structure completely free of any infestation of termites, and whereas the Guarantors agreed to give guarantee to the effect that the said building/ structure shall remain free from infestation for the period of 10 years from the date of Completion of pre-construction anti-termite treatment as per IS Code.

Now the Guarantor hereby agrees to make good all defects and render the building/ structure free from any infestation of termites, during this period of guarantee and to the satisfaction of the employer. The Guarantor also agrees to take up such rectification work at his own cost, and within one week from the date of issue of notice from the Employer, calling upon him to rectify the defects.

The decision of the Employer as to the cost by the Guarantor will be final and binding in the case, the Guarantor fails to commence the work as per the above notice and the work is got done through the other Contractor, that if the Guarantor fails to execute the preconstruction anti-termite treatment or commits breach thereunder then the Guarantor will indemnify the principal and his successors against all loss, damaged caused, expenses otherwise which may be incurred by him by any reason of any default on the part of the Guarantor in performance and observance of this agreement, as to the amount of loss and /or damage and / or cost incurred by the Employer, the decision of the Employer will be final and binding. In witness where of these presents have executed by the obligator and by and for of behalf of the Employer on the day, month and year first above written,

Signed
and delivered by State Bank of India, by
In the presence of

Signed and delivered by the hands of Contractor
In presence of

PROFORMA OF GUARANTEE BOND FOR WATERPROOFING TREATMENT TO BASEMENT (WALLS & BOTTOM SLAB), UNDERGROUND RESERVOIR, OVERHEAD RESERVOIR, TERRACE, STAIRCASE TOWER & SUNKEN FLOOR OF WASHROOMS.

(On non-judicial Stamp Paper of Rs. 600/- or as per latest Govt. Rules)

FORM OF GUARANTEE IN RESPECT OF WATER PROOFING WORKS The Agreement made thisday oftwo thousand and seventeen between (Hereinafter called the Guarantor of the one part) and the Asst. General Manager, Premises & Estate Department, Local Head Office, Premises & Estate Dept., GIFT City, Gandhinagar, Gujarat-382355 (hereinafter called the other part.)

WHEREAS THIS agreement is supplementary to a contract (hereinafter called the Contract), dated and made between the GUARANTOR OF THE ONE part and STATE BANK OF INDIA other part, where by the Contractor, inter alia , undertook to render the buildings and structures in the said contract recited completely water and leak-proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said structures will remain water and leak-proof for 10 years from the date giving of water proofing treatment.

NOW THE GUARANTOR hereby guarantees that water proofing treatment given by him will render the structure completely leak-proof and the minimum life of such water proofing treatment shall be 10 years to be reckoned from the date after the maintenance period prescribed in the contract.

Provided that the guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse of roof or alteration and for such purpose.

(a) Misuse of roof and other water proofed surface shall mean any operation which will damage proofing treatment, like chopping of firewood and things of the same nature which might cause damage to the water proof surface.

(b) Alteration shall mean construction of any additional work by removing the water proofing treatment in parts.

(c) The decision of the SBI/APMCF with regard to cause of leakage shall be final.

During this period of guarantee, the guarantor shall make good all defects and in case of any defect being found render the building water proof to the satisfaction of the Architect/ PMC at him cost and shall commence the work for such rectification within seven days from the date of issue of the notice from the SBI/APMCF calling upon him to rectify the defects failing which the work shall be got done by the owner by some other Contractor at the GUARANTOR's cost and risk. The decision of the SBI/APMCF as to the cost, payable by the Guarantor shall be final and binding.

That if Guarantor fails to execute the water proofing or commits breach there under, then the Guarantor will indemnify the Principal and his successors against al lose, damage, cost expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement As to the amount of loss and/or cost incurred by the Owner the decision of the Architect/PMC will be final and binding on the parties.

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IN WITNESS WHEREOF these presents have been executed by the obligor
and by And for and on behalf of the Asst. General Manager, Premises and
Estate Department, Premises & Estate Dept., Local Head Office, GIFT City
Gandhinagar, Gujarat-382355, on the day, month and year first above written.

SIGNED, SEALED AND delivered by OBLIGOR in the presence of ----

h)

i)

SIGNED FOR AND ON BEHALF OF THE STATE BANK OF INDIA BY In the
presence of ----

1.

2.

**A.CIVIL work
Mode of Measurements**

1.0 EXCAVATION:

1.1.1 Footings: Area of excavation for footing shall be measured equal to area of lowest concrete course as shown on drawing. Depth shall be measured vertically from ground level to bottom of concrete course or dry rubble packing as the case may be.

1.1.2 Plinth beams: Depth of excavation for plinth beam shall be measured from ground level up to bottom of beam and width equal to width of beam.

1.1.3 Where excavation is made, in trenches, measurements for cutting depth shall be taken by means of tape and staff and the width of lowest concrete or rubble packing shall be considered as the width of excavation. When excavation is made for leveling the site, levels shall be taken before start and after completion of work and the total quantity of excavation in cutting computed from these levels.

1.1.4 Where soil including decomposed or soft rock and hard rock are mixed, hard rock after excavation shall be stacked separately. Measurements of the entire excavation shall be taken as indicated above. Excavation of hard rock shall be measured from stacks of excavated hard rock and reduced by 50% to allow for bulgage and voids. The quantity so arrived at, shall be paid under hard rock. The difference between the quantity of entire excavation and quantity payable for hard rock shall be paid as soil. (including decomposed or soft rock)

1.1.5 Width of excavation shall be considered as per BOQ Specific Items and as per preamble.

1.1.6 The unit of measure in all the above cases shall be in cubic meters or as specified in the Bill of Quantities.

1.2. EARTH FILLING:

Measurement for filling when it has been stipulated to be separately paid for, shall be, unless otherwise specified, as follows:-

1.2.1 In open spaces: Filling shall be measured from cross sections of embankments, before start of work and after completion of work by means of level taken at suitable places. When it is not possible to measure filling from cross section, it may be measured in loose stacks or lorry measurements with previous written permission of Clerk-of-Works and 20% deduction shall be made from measured quantity to arrive at payable quantity.

1.2.2 In plinth: Consolidated filling shall be measured without any deduction of voids.

The unit of measure in above cases shall be in cubic meters or as specified in the Bill of Quantities.

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1.3. BRICK MASONRY:

1.3.1 Walls exceeding 150 mm brick/ thick shall be measured in unit of one cubic meter. Deductions for all openings, lintels, recesses shall be made except for the following:

- i) When openings are less than 45 cm in both the directions or less than 45 cm dia on the surfaces.
- ii) When beams & wall plates do not have bearing over entire thickness of wall.
- iii) No extra will be paid for providing such openings, recesses etc..

1.3.2 Half brick walls : Net area over one surface shall be measured. Deductions for all openings, lintels, recesses shall be made as in 1.3.1.

1.4. CEMENT CONCRETE (Plain and Reinforced) :

1.4.1 Cement concrete items shall be measured exclusive of the steel reinforcement and plaster thickness but shall include necessary cost of shuttering, scaffolding, supporting, hacking, centering and curing. Items like R.C.C. precast jalis, R. C. pipes and other such articles which are normally manufactured in factories as well as those items which have been so specifically mentioned in schedule of quantities shall be measured inclusive of reinforcement. No deductions will be made when openings are less than 45 cm in both directions or 45 cm in diameter and no extra will be paid for providing such openings.

1.4.2 Foundation concrete: Will be measured in the unit of one cubic meter and to exact dimensions as shown on drawing or as actually laid as per instructions.

1.4.3 Footings, columns, beams, lintels, sills and bed blocks: Shall be measured in cubic meters. Portions of beams and columns embedded in slab shall be paid at the rate of slab. Only projecting rib of beam shall be paid for at the rate of beam. In case of junctions of columns and beams and/or lintels, columns shall be measured between slabs. In case of junction of columns and footings, the footing will be measured in full and the column above the footing.

1.4.4 Slabs and Chajjas : Shall be measured in cubic meters. Slab shall be measured full throughout. Where slabs of different thickness meet, the highest thickness will be taken into account. For chajja only projected portion shall be measured.

1.4.5 Parapet wall, apron wall and drop wall from chajja having drop exceeding 5 cm. Actual cubic contents for portion projecting over slab or beam shall be measured. If drop from chajja is 5 cm or less, the same shall be measured under chajja item.

1.4.6 Projected bands: Projection of 15 cm or less in breadth and thickness shall only be considered as band. The band shall be measured in cubic meters. Deductions will not be made on account of grooves, patties, bands, molds etc. nor will any extra be paid for forming such grooves or features.

1.4.7 Staircase: Measurements shall be per cubic meter comprising of step and soffit slab. All landings, and landing beams shall be paid separately under slab and beam

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measurements. In the case of soffit slab resting on beams, the portion of beam projecting below landing slab shall be measured and paid as beam. Side parapet walls, railings, finishing of risers and treads and plastering etc. shall be paid separately.

1.4.8 Reinforcement: Shall be measured on standard weight basis for the length and size of bars as shown in drawing. Wastage, rolling margin, spacers, chairs etc. required for construction purpose, and binding wire will not be measured. Lapping of bars shall be provided only as per instructions of the RCC Consultant, and the same shall be paid for. The rate will be inclusive of labour involved in cleaning, cutting, bending & erecting.

The rate will be inclusive of labour involved in cleaning, cutting, bending and erecting in position. The unit of measure shall be in metric tons.

1.5. STRUCTURAL STEEL WORK:

1.5.1 Weight of bolts, nuts, rivets, washers etc. used will not be considered for payment. Only the weight of the main members calculated on length basis at standard weight will be paid to nearest cm. No deduction shall be made for holes, bolts or rivets and wastage involved in cutting, for notching ends of sections or intermediate points for making connections. No additional payment shall be made for welding, riveting and bolting. The units of measure shall be in Kg. or MT as per Schedule of Quantities. Gusset plates shall be actually weighed and paid accordingly.

1.6. DOORS, WINDOWS, ROLLING SHUTTERS AND GATES:

1.6.1 These shall be measured in the unit of Square Meters.

i) Teak wood doors, windows and ventilators: Clear area over one face inclusive of frame shall be measured. Hold fasts and portions embedded in masonry or flooring shall not be measured.

ii) Steel doors, windows and louvers: Clear area over one face inclusive of frame shall be measured. Hold fasts or portions embedded in masonry or flooring shall not be measured.

iii) Steel rolling shutters and rolling grills; Dimensions shall be the clear width between side jambs and clear height between floor and bottom of lintel or beam. Cover will not be measured separately.

1.7. FLOORING, SKIRTING AND DADO:

The net area covered shall be measured in sq. mts.

1.8 PLASTER:

Net area of surface plastered shall be measured in Sq. Mts. No deduction will be made for openings each less than half Sq.Mt. in area. No extras will be payable for any grooves, patties, bands, molds, (including drip molds) which are deemed to be included in the internal and external plastering items.

1.9. PAINTING AND COLOUR OR LIME WASH:

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NOTE : All wood work and steel items given in Schedule of Quantities are generally inclusive of painting, but if these are required to be measured separately, then the following procedure shall be adopted.

1.9.1 Net area of surface painted shall be measured in sq.mts. No deductions shall be made for unpainted surfaces or openings less than half sq.mts. each. The rates shall be inclusive of cleaning glasses and fittings.

a) Walls : Net area of surface painted shall be measured. Extra for moldings, recesses and the like shall not be paid.

b) WOOD WORK:

Description	How measured	Multiplying factor
i) Paneled framed ledged braced and battened	Measured flat (not girthed) including frame; edges; chocks cleats etc shall be deemed to be included in the item	1.30 (for each side)
ii) Flush	Measured flat (not girthed) including frame edges; chocks cleats etc shall be deemed to be included the item.	1.20 (for each side)
iii) Partly paneled & partly glazed / glazed	----- As above -----	1 (for each side)
iv) Fully glazed or partly glazed	----- As above -----	0.80 (for each side)
v) Guard bars balustrades gratings and railings	Measured flat over all, no deduction shall be made for opening. (Supporting members shall not be measured separately)	1 (for painting all over)

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Description	How measured	Multiplying factor
i) Fully glazed or gauzed doors and windows / partitions	Measured flat over) frame. No deduction shall be made for openings. In case of gates supporting members like stays, guide rails, hinges shall not be measured	0.50 (for each side)
ii) Rolling Shutters	Measured flat (size of opening) overall; jamb guides, bottom rails and locking arrangements etc. shall be included in the item (top cover shall be measured separately)	1.10 (for each side)
iii) Collapsible gate	Measured flat (size of opening)	1.50 (for painting overall)
iv) R.C.C jali and Fencing	Measured flat overall No deductions shall be made for openings	1 (for each side)

MATERIALS MINIMUM SPECIFICATIONS/ REQUIREMENTS

- 1) Material shall be of best approved quality obtaining and they shall comply with the respective Indian Standard Specification.
- 2) Samples of all materials shall be got approved before placing order and the approved sample shall be deposited with the Architect.
- 3) In case of non-availability of materials in metric sizes the nearest size in FPS units shall be provided with prior approval of the Architects for which neither extra will be paid nor shall any rebates be recovered.
- 4) If directed, materials shall be tested in any approved Testing Laboratory and the test certificates in original shall be testing including charges for repeated tests, if ordered, shall be borne by the Contractor.
- 5) It shall be obligatory for the Contractor to furnish certificate, if deemed by the Architects, from manufacturer or the material supplier that the work has been carried out by using their material and as per their recommendations.
- 6) All materials supplied by the Employer / any other Specialist Firms shall be properly stored and the Contractor shall be responsible for its safe custody until they are required on the works and till the completion of the work.
- 7) Unless otherwise shown on the Drawings or mentioned in the "Schedule of Quantities" or special specification, the quality of materials, workmanship, dimensions, etc., shall be as specified as hereunder.
- 8) All equipment and facilities for carrying out field tests on materials shall be provided by the Contractor without any extra cost.

a) Cement:

Cement shall comply in every respect with the requirements of the latest publications of IS: 269 and unless otherwise specified ordinary Portland Cement shall be used.

The weight of ordinary Portland Cement shall be taken as 1440 kg. per cu.m. (90 lbs.per c.ft.). Cement shall be measured by weight and in whole bags, and each undisturbed and sealed 50 kg. bag being considered equivalent to 35 liters (1.2 c.ft.) in volume care should be taken to see that each bag contains full quantity of cement. When part bag is required cement shall be taken by weight or measured in measuring boxes.

No other make of cement but that approved by the Architects will be allowed on works and the source of supply will not be changed without approval of Architect in writing. Test certificates to show that cement is fully complying the specifications shall be submitted to the Architects and notwithstanding this, the Architect may at his discretion, order that the cement brought on site and which he may consider damaged or of doubtful quality for any reason whatsoever, shall be re-tested in an approved testing laboratory and fresh certificates of its soundness shall be produced.

Cement ordered for re-testing shall not be used for any work pending results of re-test.

Cement shall be stored in weather-proof shed with raised wooden plank flooring to prevent deterioration by dampness or intrusion of foreign matter. It shall be stored in such a way as to allow the removal and use of cement in chronological order of receipt i.e.,

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first received being used first used. Cement deteriorated and or clotted shall not be used on the work but shall be removed at once from the site. However, allowing use of warehouse set cement shall be determined by the Architect.

b) **Lime:** Lime shall comply in every respect with the requirements of IS: 712 and shall be made from approved lime stone or kankar and properly burnt. It shall be free from excess of unburnt kankars or lime stone ashes or other extraneous materials and shall be stored in weather-proof sheds. Lime which has damaged by rain, moisture, or air slacking shall not be used but shall be removed from the site of work forthwith. Lime shall be slacked with fresh water and screened through appropriate screens and stored and used within 14 days provided it is protected from drying out.

Field tests according to IS: 1624 shall be carried out from time to time to determine the quality of lime.

c) River Sand:

River sand shall confirm to IS: 383 and relevant portion of IS: 515. It shall pass through a I.S. sieve 4.75 mm. (3/16 B.S.) test sieve, leaving a residue not more than 5%. It shall be from natural source i.e. only river or crushed stone screenings, if allowed, chemically clean, sharp, hard durable, well graded and free from dust, pebbles, clay, shale, salt, organic matter, loam, mica or other deleterious matter. The sum percentages of all deleterious substances to acceptable limits. River sand shall not contain any trace of salt and it shall be tested and river sand containing any trace of salt shall be rejected.

The fine aggregate i.e. river sand for concrete shall be graded within limits as specified in IS: 383 and the fineness Modules may range between 2.60 to 3.20.

The fine aggregate shall be stacked carefully on a clean hard dry surface so that it will not get mixed up with deleterious foreign materials. If such a surface is not available a platform of planks or corrugated iron sheets or brick floor or a thin layer of lean concrete shall be prepared.

d) Fine & Coarse Aggregate:

Shall consist of crushed or broken stone 95% of which shall be retained on 4.75 mm. IS tests sieve. It shall be obtained on crushing Granite, Quartzite, Trap, Basalt, or similar approved stones from approved quarry and shall confirm to IS:383 and IS 515. Fine & Coarse aggregate shall be chemically inert when mixed with cement and shall be cubical in shape and be free soft, friable, thin, porous, laminated or flaky pieces. It shall be free from dust and any other foreign matter.

Gravel / Shingle of desired grading may be permitted as a substitute in part or full in plain cement concrete if the Architect is otherwise satisfied about the quality of aggregate. For all the R.C.C. works the size of coarse aggregate shall be 20 to 25 mm. and fine aggregate shall be 10 to 15 mm.

e) Rust Free Reinforcement :

Reinforcement shall be of mild steel tested quality confirming to I.S.: 432-1966 and any other I.S. applicable or deformed bar confirming to IS:1786 and Is:1139 or hard drawn Fe 415 /500/550 (Tor Steel) steel wire fabric confirming to IS:1566;1967.

All finished bars shall be free from cracks, surface flaws, laminations, jagged and imperfect edges.

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f) Bricks:

Bricks shall generally comply with IS:1077 except in size which shall be classified as 1st and 2nd class. 1st class bricks shall be the best quality locally available table moulded, well burnt but not over burnt, have plain rectangular faces with parallel sides and sharp right-angled edges, have a fine compact and uniform texture. The bricks shall be free from cracks, chips, flaws, stones or subsequent to soaking in water. It shall emit a clear ringing sound on being struck and shall not absorb water more than 20% by weight. Common building bricks shall have a compressive strength of 35 kg. / sqm unless otherwise specified for first class bricks.

g) Neeru:

Shall be made of Class "C" Lime (i.e. pre-fat lime) as mentioned in IS: 712. It shall be slaked with fresh water then sifted and reduced to a thick paste by grinding in a mill. Neeru thus prepared shall be kept moist until used and no more than that can be consumed in 15 days shall be prepared at time.

h) Surkhi :

Shall be made by grinding well burnt bricks, brick bats, burnt clay balls, etc., the brick etc., to be used shall be prepared from selected clay. The quality shall conform to IS:1344.

Bricks bats, etc., shall be ground in mechanical disintegrator to a fine powder passing through IS Sieve No. 9 (2.36 mm.) with a residue not exceeding 10% by weight.

Surkhi for lime surkhi plaster shall be ground to fine powder in a mortar mill to pass through IS Sieve 150 micron (No. 100).

Surkhi shall be stored in a weather-proof shed on a brick paved platform.

i) Water:

Water for mixing cement / lime / surkhi mortar or concrete shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil, acid and injurious alkali, salts, organic matter and other deleterious materials which will either weaken the mortar or concrete or cause efflorescence or attack the steel in reinforced cement concrete. Water shall be obtained from sources approved by the Architect. Potable water is generally considered satisfactory for mixing and curing concrete, mortar masonry, etc., where water other than main source is used this shall be tested in an approved testing laboratory to establish its suitability. All charges connected therewith shall be borne by the Contractor.

j) Timber:

Timber shall be well seasoned and of the best quality Indian Teak of specified species viz., Dandeli, Balarshah, Melabar, C.P.

Timber shall be considered as well seasoned, if its moisture content does not exceed the following limits.

- a) Timber for frames 14%
- b) Timber for planking, shutters, etc. 12%

The moisture content of timber shall be determined according to method described in paragraphs 4 of IS:287 for Maximum permissible moisture content of timber used for different purpose in different climatic zones.

In measuring cross-sectional dimensions of the frame pieces tolerance up to 1.5 mm. shall

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be allowed for each planed surface.

k) Superior quality Indian Teak Wood:

Superior quality Indian Teakwood means Dandeli, Balarshah, and Malabar Teak. It shall be of good quality and well-seasoned. It shall have uniform colour, reasonably straight grains, and shall be free from large. Loose, dead knots, cracks, shakes, warp, twists, bends, borer holes, sapwood or defects of any kind. No individual hard and should knot shall be more than 1 cm. in diameter and aggregate areas of all knots shall not exceed ½% of area of the piece. There shall not be less than 6 growth rings per 2.5 cm. width.

l) 1st Class Indian Teakwood:

1st Class Indian Teakwood means C.P. and Bulsar teak of good quality and well-seasoned. It shall have uniform colour, reasonably straight grains and shall be free from large. Loose dead knots, cracks, shakes, warp, twists, bends, sapwood or defects of any kind. No individual hard and should knot shall be more than 2.5 cm. in diameter and aggregate areas of all the knots exceed 1% areas of the piece. There shall not be less than 5 growth rings per 2.5 cm. width.

m) 2nd Class Indian Teakwood:

Shall be similar to first class Indian teak wood except that knot up to 4 cm. diameter and aggregate area of all knots up to 1 ½% of the area of the piece shall be allowed. There shall not be sapwood up to 15% is allowed.

n) Flush Doors:

All flush doors shall be solid core exterior grade unless otherwise specified and it shall generally conform to IS:2202 and shall be fabricated as described under specification.

o) Steel Windows and Doors:

Steel windows and doors shall be fabricated of steel sections conforming to IS:226. They shall conform to IS 1038. Unless otherwise specified the details of construction etc., shall be as described under specification.

p) Floor Tiles:

Designer pre-cast concrete tiles and interlocking paver block, plain cement tiles, chequered tiles, mosaic tiles terrazzo tile shall conform to IS:1237. For neutral shade tiles grey cement shall be used. Tiles shall be compacted by mechanical vibration and hydraulically pressed. It shall be of choice shade and shall have desired pattern of chip distribution. The sizes of chips to cement in terrazzo or mosaic floor shall be as specified in IS:1237. The size and thickness of tiles shall be as approved by the Architect.

q) Ceramic / Vitrified Tiles:

White or coloured glazed tiles shall comply with IS:777 or relevant or latest I.S. code. It shall be from an approved manufacturer and shall be flat and true to shape. They shall be free cracks, crazing, spots, chipped edges and corners. The glazing and colour shall be uniform shade and unless otherwise specified the tiles shall be 6 mm. thick.

r) Marbles:

Marble slabs for flooring, dado veneering etc., shall be of kind specified in the item such as white or pink, Makrana, Chittor black, Bhanslana black, Jaisalmer yellow, Baroda green, Patiala (Pepsu) grey, etc., Marble from which slabs are made shall be selected quality, hard, sound dense and homogenous in texture and free from cracks, weathering, decay and flaws. Before starting the work, the contractor shall get the sample of Marble slabs approved by the Architect. The slabs shall be machine cut and machine polished.

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s) Kotah / Shahbad / Cudappa / Granite:

Shall be of selected quality, hard, sound, dense, and of homogeneous texture, free from cracks decay, weathering and flaws. Stone slabs shall be of uniform colour as approved by the Architect. They shall be machine cut and machine polished where specified and shall confirm to the required size. Thickness shall be specified in the respective items.

t) Glazing:

Glass used for glazing shall be float glass of best quality, free from flaws, specks bubbles and shall be 2.9 mm. thick up to 0.60 x 0.60 mm. size and for larger size it shall be minimum 4 mm. thick unless otherwise specified in the Schedule of Quantities.

The following type of glasses shall be used: -

1) For Office Building Clear glass or as specified in the Schedule of Quantities.

2) Office (toilets) Clear or frosted

3) Partitions Frosted

u) Asbestos Roofing & rain Water Pipes:

All Asbestos pipes and fittings shall comply with IS:459 and shall be free from cracks, chipped edges of corners and other damages.

v) MPI. Sheets:

MPI. Sheets shall be of a gauge specified in the description of the item and shall conform to the IS:277. The sheets shall be free from cracks, spilt edges, twists, surface flaws, etc. They shall be clean bright and smooth. Galvanising shall be uninjured and the perfect condition. The sheet shall show no sign of rust or white powdery deposits on the surface. The corrugations shall be uniform in depth and pitch and parallel.

w) Paints:

Lime for lime wash, dry distemper, oil bound distemper cement primer, oil paint, enamel paint, flat oil paint, plastic emulsion paint, anti-corrosive primer, red lead, water-proof cement paint and exterior grade Acrylic Emulsion paint, cement paint, sand-tex matt shall be from an approved manufacturer and shall conform to the latest Indian Standard for various paints and shall be as per Green Building Norms with low VOC content withing prescribed limits. Ready mixed paints as received from the manufacturer without any admixture shall be used, except for addition of thinner, if recommended by the manufacturer.

x) Mortar:

1) Lime Surkhi Mortar : Lime and surkhi shall confirm to the specifications. It shall be composed of approved lime and surkhi in proportion of 1 lime to 2 surkhi mixed thoroughly. The ingredients shall be accurately gauged by measure and shall be well and evenly mixed together on a platform and water added to make it homogeneous. When large quantities are required, the mortar shall be mixed in a mechanical grinder.

2) Cement Mortar: Cement mortar shall be of proportions specified for each type of work in the schedule. It shall be composed of Portland Cement and sand. The ingredients shall be accurately gauged by measure and shall well and evenly mixed together in a mechanical pan mixer, care being taken not to add more water than is required. No mortar that has begun to set shall be used. River sand shall be used unless otherwise specified.

If hand mixing is allowed, then it shall be done on pucca water-proof platform. The gauged materials shall be put on the platform and mixed dry. Water will then be added and the whole mixed again until it is homogenous and of uniform colour. Not more than

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one bag of cement shall be mixed at one time and which can be consumed within half an hour of its mixing.

3) Composite Lime, Cement, Sand Mortar: The mortar shall be of proportions specified for each type of work in the schedule of quantities. It shall comprise of Portland cement, lime and sand. Lime shall be measured in gauge boxes similar to one used for measuring cement and sand to the proportion specified and sufficient water then added to it to form a thick slurry thus obtained shall then be added to dry cement and sand mixture and thoroughly mixed to make a workable homogenous mortar of uniform colour by adding more water if necessary. Mechanical mixers shall generally be used for mixing such mortars. If hand mixing is allowed it shall be done on pucca platform.

xi) AAC Blocks:

AAC (Autoclaved Aerated Concrete Blocks) 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 the construction. Minor chipping resulting from the customary methods of handling during delivery, shall not be deemed grounds for rejection.

Where units are to be used in exposed wall construction, the face or faces that are to be expelled shall be free of chips, cracks, or other imperfections, except that if not more than 5 percent of a consignment contains slight cracks or small chippings not larger than 25 mm, this shall not be deemed grounds for rejection.

The maximum variation in the length of the units shall not be more than 5 mm and the maximum variation in the height and width of unit, not more than ± 3 mm

The drying shrinkage shall be not more than 0.95 percent for Grade 1 blocks and @ 10 percent for Grade 2 blocks when tested as per table no 9.4 of IS 2185 -3(1984).

xii) Windows

The cross section of the profile must conform to the shape and dimensions of the manufacturer's specification and drawing maximum tolerance on outer surface shall not be more than ± 0.5 mm and glazing and seal grooves shall not deviate more than ± 0.3 mm.

The straightness of the profile as measured on the surface shall not deviate by more than 1.0 mm/meter.

The weight of the profile section per meter shall not be less than 3% of normal value.

XII) RMC GUIDELINES

1.0 GENERAL REQUIREMENTS OF RMC

1.1 Basis of Supply: All concrete shall be supplied and invoiced in terms of cubic meters (full or part) of compacted fresh concrete as discharged from the transportation unit. The RMC shall be supplied in the quantity and having the quality in accordance with the requirements agreed by the producer or supplier and purchaser or user; however, the concrete supplied shall generally comply with the requirements of IS 456/ IS 457 and IS 4926. The volume of fresh concrete in a given batch shall be determined from the total mass of the batch divided by the density of the concrete. The total mass of the batch shall be determined as the mass of the concrete in the batch including the total mixing water. All Batching shall be carried out by mass, except water and admixture, which may be measured by volume.

1.2 Specifying Concrete - Ordering RMC shall be manufactured and supplied on either of

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the following basis.

- a) Performance basis: Specified characteristic strength based on 28 days (or any other specific age) compressive strength in accordance with IS 456/ IS 457.
- b) Prescriptive basis: Specified Mix Proportion. When concrete is supplied on the basis of specified strength, responsibility for proportioning of mix rests with the producer/ seller whereas in case of specified mix proportion, the responsibility for proportioning of mix rests with the purchaser and the purchaser accepts the responsibility for concrete strength and its performance. Thus, it is desirable to place the **supply order on specified strength basis**. This system is based on performance parameters and is best way to order the RMC because RMC producer, who is expert in the field would design an economical mix with desired properties. In all cases the purchaser/user is required to furnish the following information for the guidance of the producer/ seller.
 - a) Type of cement to be used.
 - b) The max. Size and type of aggregates to be used.
 - c) The workability specified by slump or any other requirements.
 - d) Following additional requirements should be specified to satisfy durability requirements:
 - i) Minimum and maximum cement content to be used in production of concrete.
 - ii) Maximum water cement ratio to be kept.
 - iii) Total chloride content in concrete: - Total chloride content should not exceed 0.15% by mass of cement in case of RCC work (IS:456) . For prestressed concrete work, total chloride content should not exceed 0.06% by mass of cement. (IS: 1343)
 - iv) Total sulphate content: - It should not exceed by 4% by mass of cement.
 - v) Permeability test requirements. (if any)
 - vi) Any special requirements such as pumpability or self-compacting concrete (SCC) etc.

1.3 Mixing of Concrete Ready-mix concrete is mixed and delivered to the point/site designated by the purchaser/user by means of one of the following combinations of operations.

- a) Central Mixed or Stationary mixed Concrete: Concrete that is mixed in a stationary mixer at plant that mixes the concrete completely before it is discharge into either in a truck agitator or truck mixer operating at agitating speed or in non-agitating equipment as agreed to by the purchaser/user. Central mix plants are sometimes referred to as wet batch or pre mix plants. When a truck mixer or agitator is used for transporting concrete which has been mixed before leaving the plant, the concrete shall agitated during transit and re-mixed at the site for at least 2 minutes so that the concrete is of the required uniformity.
- b) Shrink Mixed Concrete: Concrete that is first partially mixed in a stationary mixer and then mixed completely in a truck mixer. The time of partial mixing shall be minimum required to intermingle the ingredients. After transfer to the truck the amount of mixing at the designated mixing speed will be that necessary to meet the requirements for uniformity of concrete. Generally, it is two minutes of mixing in truck drum at mixing speed. This is not being practiced.
- c) Truck mixed concrete: Although, truck mixed concrete is also one of the methods of mixing of Ready Mixed Concrete, for the purpose of this chapter, truck mixed concrete shall not be allowed as RMC, as automatic record keeping arrangement such as digital computer slips etc. are not possible in such type of mixing. Regarding mixing whether in a stationary or central mixer it shall be ensured that it complies with performance criteria of mixing efficiency test as per IS 4634:1991. Mixing efficiency test shall be performed at least once in a year.

1.4 Information to be supplied by the purchaser/user of RMC plant The purchaser shall provide the details of the concrete mix or mixes required by him and all pertinent information on the use of the concrete and the specified requirements. Where the purchaser specifies a designed mix to be supplied it is essential that all relevant information is conveyed to the producer. In order to assist in this, the format given in IS 4926 Annex D may be completed and forwarded to the producer at the time of enquiry. The concrete mix shall be specified by its constituent materials and the properties or

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quantities of those constituent to produce a concrete with the required performance. The assessment of the mix proportions shall form an essential part of the compliance requirements. The purchaser shall provide the producer with all pertinent information on the use of the concrete and the specified requirements. In order to assist in this, the format given in IS 4926 Annex D may be followed with suitable modifications as applicable to prescribed mixes. Purchaser responsibilities: The purchaser of Ready-mix concrete has the following responsibilities

- i) When placing procedures can potentially alter the characteristics of fresh concrete, it is the responsibility of the purchaser to inform the producer of changes to the mixture requirements to accommodate these effects. An example is pumping concrete in place.
- ii) When a job uses more than one type of concrete mixture, it is the purchaser's responsibility to verify the mixture delivered and direct it to the correct placement location.
- iii) The purchaser should check and sign the delivery ticket and document any special occurrences on the ticket.
- iv) When strength tests are used for acceptance of concrete, the samples should be obtained at the point of discharge from the transportation unit.
- v) The purchaser or his representative should ensure that proper facilities are available for curing the test specimens at the jobsite and that standard practices are followed for subsequent curing and testing. Certified personnel should conduct the tests.
- vi) Test reports should be forwarded to the producer in a timely manner to ensure that deficiencies are rectified.

1.5 Information to be supplied by the producer/owner of RMC plant Upon the request, the producer shall provide the purchaser with the following information before any concrete is supplied:

- a) Nature and source of each constituent material.
 - b) Source of supply of cement, and
 - c) Proposed proportions or quantity of each constituent/m³ of fresh concrete. d) When requested, the producer shall provide the purchaser the following information of admixtures:
 - i) Generic type(s) of the main active constituent(s) in the admixture.
 - ii) Whether or not the admixture contains chloride and if so, the chloride content of the admixture expressed as a percentage of chloride ion by mass of admixture.
 - iii) Where more than one admixture is used, confirmation of their compatibility.
- Producer's responsibilities: The producer of Ready-mix concrete has the following responsibilities

- i) The concrete producer is responsible for the concrete slump as specified for a period of 30 minutes after the requested time or the time truck arrives at the placement site, whichever is later.
- ii) The concrete producer is required to deliver concrete at the requested slump and air content, within the accepted tolerances, as measured at the point of discharge from the transportation unit. Note: The purchaser shall not alter the quality of concrete by any addition or modification at the job site. These include addition of water, admixture, fiber or special products into the ready-mix concrete supplied by the producer; in case the purchaser does this, then producer is not responsible.

1.6 GENERAL INFORMATION ABOUT RMC FACILITY

1.6.1 Location of RMC Plant

The RMC plant from where the concrete is being procured by the purchaser/user can be a commercial plant owned/operated by a third party or a captive plant owned and operated by the contractor.

In the case of commercial plants, the location is already decided as they are operational plants, and the user of RMC has no control on its location. The nearness to the site and availability of good haul roads can be the deciding factors in such cases.

However, when the RMC plants are captive plants and are erected on their site the

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constructor/user has to see the location of plant is suitable from all the considerations, the factors to be considered while deciding the location of plant can be.

- 1) Availability of land
 - 2) Availability of Raw materials such as sand, aggregates, cements, fly-ash etc. and their leads.
 - 3) Availability of Electric power
 - 4) Availability of water
 - 5) Nearness to site
 - 6) Nearness to village
 - 7) Environmental concerns; waste management, dust and noise control, safety etc.
- Hence, it is necessary that the owner of captive batching plant takes a judicious decision by considering all the above factors with respect to their technical and financial viability.

1.7 Components of RMC plant RMC plant/facility has in general the following components

1.7.1 PROPERTIES OF FRESH CONCRETE

1.7.1.1 Workability of concrete

Workability is a broad term which encompasses a range of properties of fresh concrete such as consistency (fluidity) , mobility (ability of concrete to move around the reinforcement and in restricted areas), compatibility, finishability and pumpability (for pumped concrete). The degree of workability varies depending upon the type of construction and method of placing, compacting and finishing. Workability is measured in terms of slump of concrete using the standard procedure laid down in IS 1199:1959. The IS 456 provides guidance on the range of workability requirements for different placing conditions and applications. Consistency of fresh concrete is considered to be a close indication of its workability and slump test has been the most widely used test for ascertaining consistency and hence workability. For applications requiring very high slumps (higher than 150mm) the IS 9103 recommends use of flow table test. For a majority of concrete supplied by RMC producers, slump test is the most commonly used test. The IS 4926 specifies the following tolerance limits of workability as criteria for acceptance.

- i) Slump: + 25 mm or + 1/3rd of the specified value whichever is less.
- ii) Compacting factor: + 0.03 For specified value > 0.9 + 0.04 For specified value < 0.9 > 0.8 + 0.05 For specified value > 0.8
- iii) Flow Table Test: Acceptance criteria to be established between the producer and the purchaser.

The test for workability needs to be performed upon discharge from producer's delivery vehicle on site or upon discharge into the purchaser's vehicle. On some occasions, lack of preparedness on the part of purchaser at construction site may result in delay of placement. RMC producer will be responsible for maintaining the slump within the permissible range for a period of 30 minutes starting from arrival of transit mixers at job site. However, after 30 minutes, the IS 4926 clearly states that the responsibility for delay passes on the purchaser. Slump of concrete is quite sensitive to a variety of environmental and other factors such as concrete temperature, ambient temperature, surface rate of evaporation, changes in grading, batch mass differences, admixture dosage, presence of mineral admixtures or otherwise, variation in air content, variation in testing, etc.

1.7.12 Density of concrete

The plastic density (unit weight) of conventional normal-weight concrete varies depending upon the variation in the density of different ingredients, the amount of entrapped air and entrained air (if air -entraining agents are used), the maximum size of aggregate and water and cement contents in the mix. Increasing the aggregate volume and reducing the cement paste would increase the density of concrete. Ready Mixed concrete is measured on the basis of volume. The volume of fresh concrete can be determined by dividing the total weight of all batched materials by the unit weight

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or plastic density of concrete determined in accordance with IS 1199. Sometimes there is likelihood a discrepancy in the concrete ordered and that actually supplied. Also, it should be understood that the volume of hardened concrete may be or appear to be less than expected. There could be variety of reasons for this discrepancy. These include wastage and spillage of concrete, over excavation, miscalculation in form volume, deflection or distortions of forms, settlement of wet mixes, loss of entrained air, etc. Such difference can be reconciled if plastic density of concrete is monitored regularly. While carrying out mix Proportioning, the plastic density of designed (Proportioned) mix is measured and tallied with the theoretical density. It would be a good practice to measure the plastic density at regular interval so as that the quantities supplied match orders. The plastic density measurement can be done by filling a container of known volume with fully compacted concrete and taking the mass of concrete in that volume by following procedures detailed in IS 1199. Additionally for concrete of Road and Bridge work the guidelines given in section 1717.7.3 and 1717.7.4 of MORT&H specifications published by IRC (Fifth revision) 2013.

1.7.1.3 Air content of fresh concrete

In most parts of India, tropical weather prevails, necessitating adoption of adequate precautionary measures associated with hot weather concreting practices. Absence of adequate measures may lead to rapid loss of workability, accelerated stiffening of concrete, poor compatibility and finishability, and cracking of concrete owing to plastic and/or thermal shrinkage. To avoid adverse effect of hot weather, both RMC producer and the purchaser need to take adequate precautionary measures. It shall also be noted that generally retarding effect of retarder is smaller at higher temperatures and sometimes few retarders seem to be in-effective at extremely high temperatures. Thus, it is desirable to keep the temperature of concrete as low as possible. Although in the IS 4926:2003 the requirements of temperature of concrete has been deleted it is advisable that the temperature of concrete produced shall not be less than 50 C and shall not exceed 350 C. Additionally for concrete of Road and Bridge work the guidelines given in section 1708.5 and 1715.6 of MORT &H specifications published by IRC (Fifth revision) 2013 shall be referred to.

As far as RMC is concerned, design the concrete mix using a combination of OPC and supplementary cementitious materials or blended cement for reducing the heat of hydration as approved by SBI/APMCF. The aggregate stockpiles in the plant should be covered to avoid direct exposure to sun and water should be sprinkled on the stockpile to bring down the temperature. Some RMC producers use chilled water or ice flakes to bring down the temperature of mixing water during hot summer months. Covering the drum of transit mixer by hazien cloth helps in maintaining the temperature of concrete during transit. The requirements of extreme weather (hot weather conditions) concreting are given in IS 7861(part 1):1975 and shall be referred to.

1.8 PROPERTIES OF HARDENED CONCRETE

1.8.1 Strength of concrete

a. Concrete Cubes: - When strength of concrete is used as a basis for acceptance of concrete, which is generally adopted parameter, the standard specimen shall be made, cured and tested at 28 days in accordance with IS 516. The compliance shall be assessed against the requirements of IS 456. The testing frequencies and sampling shall be as per para 9.0 - sampling and testing of concrete of this guideline. While the strength at 28 days has emerged as a basis for contract specification; in order to get relatively quicker idea of the quality of concrete, compressive strength at 7 days may be carried out; however, it is important to establish a relationship between early age and 28 days strength for a particular concrete. But in all cases 28 days compressive strength shall alone be the criteria for acceptance or rejection of concrete.

b. Concrete Cores: - The most widely accepted method of determining the in-place compressive strength of concrete in existing structures, pavements and linings is the

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testing of core specimens obtained by drilling with a diamond core bit. While core strength tests are more reliable than the less expensive & less tedious non-destructive test methods now in use, the results can be affected by many structure and testing variables which must be controlled or taken into consideration while evaluating the concrete strength. Where possible, a length to diameter ratio L/D of 2 should be used but the diameter of core should be at least three times the nominal maximum size of coarse aggregate (MSA) and in no case shall the diameter of specimen be lower than twice the maximum nominal size of aggregate (MSA). Any specimen intended for strength testing shall not contain embedded reinforcing steel. Testing variables includes considerations such as method of end preparation. Often sawing is necessary to thin cores so that ends are perpendicular to the axis of the core, to eliminate reinforcing steel or honeycombed areas or to eliminate surface irregularities. Usually, cores shall be capped to produce the required plainness for testing and it shall be ensured that good practices of capping are followed as per IS 516. The capping shall be thin with a strong material. The use of thick caps or ones that are not properly bonded to the specimen or are made with a weak material may cause markedly reduced core strengths specially in short cores of L/D less than 2.0. Shorter cores with L/D less than 2.0 give a higher indicated strength which increases as L/d decreases; therefore, these higher strengths must be corrected by a factor (correction factor) given in IS 516 for each ratio which, on the average, will produce a corrected strength on a parity with the standard L/D = 2.0 specimen. The equivalent cube strength of the concrete shall then be determined by multiplying the corrected cylinder strength by 5/4.

A1.8.2 acceptance criteria for concrete a. Cubes the IS 456:2000 provides guidance on the acceptance criteria of concrete based on compressive strength and shall be adhered to. Accordingly, i. The test results of the sample shall be average of the strength of the three specimens. The individual variation should not be more than + 15% of the average. If more, the test results of the sample are invalid. ii. The concrete shall be deemed to comply with the strength requirements when both the following conditions are met the mean strength determined from any group of four consecutive non overlapping test results complies with appropriate limits in column 2 of Table 1. Any individual test result complies with the appropriate limits in column 3 of Table 1.

Table1: Characteristic compressive strength compliance Requirement

Specified Grade	Mean of the group of 4 Non overlapping consecutive test results in N/sq.mm	Individual test results in N/sq. mm
M15	> or equal to $f_{ck} + 0.825 \times$ established standard deviation (rounded off to nearest 0.5 N/sq mm) or $f_{ck} + 3$ N/sq mm whichever is greater.	> or equal to $(f_{ck} - 3)$ N/sq mm
M20 And Above	> or equal to $f_{ck} + 0.825 \times$ established standard deviation (rounded off to nearest 0.5 N/sq mm) or $f_{ck} + 3$ N/sq mm whichever is greater.	> or equal to $(f_{ck} - 3)$ N/sq mm

Additionally for concrete of Road and Bridge work the guidelines given in section 1717.7 of MORT &H specifications published by IRC (Fifth revision) 2013 shall be referred to.

Table 2: Assumed Standard deviation.

Grade of Concrete	Assumed Standard Deviation N/sq.mm
M10	3.5
M15	
M20	
M25	4.0
M30	
M35	
M40	
M45	
M50	5.0

b. Cores The IS 456:2000 gives the acceptance criteria for the core test on concrete. Accordingly, Concrete in the member represented by a core test shall be considered acceptable if the average equivalent cube strength of the cores is equal to at least 85% of the cube strength of the grade of concrete specified for the corresponding age and no individual core has strength less than 75%.

1.9 QUALITY AUDITS & Q.C. TECHNIQUES

1.9.1 General

RMC is both a service and a product. It is essential that the user is assured of quality of concrete received from RMC producer/plant. To maintain the quality & to have the quality assurance the following measures can be taken:

- 1) Quality Audit
- 2) Internal quality audits
- 3) Custom Techniques or its variants.

1.9.2 Quality Audit

The RMC production facility/plant shall be audited by Third party audit on annual basis. In such case the owner and the auditors are involved in an audit called as appraisal - that is someone other than the owner or purchaser is to decide whether the owner/production plant can

be certified as meeting prescribed quality standards/norms. In India, RMCMA having its office in Mumbai which has developed regulatory framework based on RMC quality schemes in developed countries and which have certified /accredited quality auditors used to carry out the third-party audits of RMC and they had audited and certified around 250 RMC plants at 45 locations in India. Recently this scheme was upgraded by RMCMA and scope enlarged by making the scheme truly third-party certification scheme. The scheme is owned jointly by Quality Council of India (QCI) and Building Materials & Technology Promotion Council (BMTPC) and they have developed a document - Criteria for RMC production control -Basic level certification for production control of RMC, the draft of which is under wide circulation and finalization. Hence, QCI-BMTPC can be contacted for third party audit of RMC plants. Additionally, there can be external audit called as second party audit, where in the purchaser of RMC or his representative will decide whether the plant/ RMC production facility is well/ enough organized to be able to meet their requirements as per quality standard

1.9.3 Internal quality audits

Internal quality audit also called as First party audit in which the owner of RMC plant or the same group will help the plant meet and improve on its own quality standards. For this, each RMC plant shall preferably develop its own QA-QC plan and documentation. Each plant Owner/producer can develop its own quality norms over and above the provisions in Indian Standards. The RMC producer shall bear in mind that there is always the scope for continuous improvement in quality and should strive for it. There shall be a system for reporting on quality parameters to the organization; for that there shall be norms and well-defined practices to monitor and control quality of input and output materials. The

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QA-QC plan incorporated as internal quality audit shall consists of information such as source & properties of all ingredients of concrete; Mix design; process control; information on fresh and hardened properties of concrete; statistical analysis of results etc.

1.10 ENVIRONMENTAL CONCERNS AND SITE SAFETY

1.10.1 Site Safety

As in all civil engineering constructions, at the RMC plant safety shall be given a paramount importance and “Safety first” rule shall be followed. Ready Mixed Concrete plants are industrial operations relying on heavy equipment and vehicles with potential for accidents. So, safety of workers should be a critical objective. All guardrails and machinery guards shall be fixed securely in position and walkways kept clean and with clear access. The facility shall provide suitable communication system between batching plant operator, transit mixer and delivery site. The RMC producer shall provide working conditions which have regard to the health and safety of employees. Plant should adopt a written safety program that includes formal safety training and provide incentives for workers who maintain safe practices. The following arrangements shall be ensured from safety point of view.

- i Earthing arrangement: RMC equipment essentially needs to be earthed in view of abundant use of metal. Necessary earthing facility needs to be created by the owner/producer.
- ii Air conditioning: Control unit of the RMC plant needs to be kept air-conditioned for trouble free running of computer systems and to provide good environment to the operators and staff.
- iii Plumbing and drainage work: Water supply network needs to be laid at site for availability of water at different locations. Similarly, site drainage for rainwater or spillages need to be provided to keep it workable.

1.10.2 Environmental Considerations

Due regard shall be given to the environment in any RMC production facility. The technologies used shall be such that to reduce the environmental impact to the lowest realistic level at the same time the technologies shall be proven, economic and reasonable. The RMC facility shall endeavor that plant operations are well landscaped and screened from the surrounding residential or rural community such that the impact is minimal. The producer shall ensure that the traffic routes chosen are such as to avoid congested and sensitive areas wherever practicable and to minimize the fuel consumption. Concrete spillage on the public highway roads and pathways shall not be there. On the rural roads the dust menace shall be reduced by watering the pathways/roads near the rural community/site. As concrete producers in RMC plant the producer shall be aware and know the details of responsibilities regarding the environmental regulations such as Air Quality

Permits; Discharge permits; Storm water management, clean water permits, Solids management, Hazardous waste regulations, Dust control, Recycling, reuse and sustainability.

1.10.3 Air and Noise Pollution and Vibration

Particulate matter emissions to air, also known as dust emissions, are the major air quality concerns at the ready mixed plant site. These very small particles can pose a health and safety risk to persons who may inhale those particles. The dust emissions can be process (point source) emissions and fugitive emissions. Process or point source emissions occur at discrete and definable locations during various activities such as silo filling; material handling and stacking; truck batching etc. Fugitive dust emissions are difficult to pin point and may arise from onsite vehicle movement, loading/transfer activities. The dust emissions can be reduced by plant enclosures and dust suppression wherein water is sprayed at the source of dust to prevent it from becoming airborne. There are many techniques and strategies available and the producer shall utilize appropriate technology to prevent or minimize dust emissions in line with local and national regulations. Noise is defined as “unwanted sound” and is primarily a concern of surrounding community and plant employees. While sound is inherent to RMC facility there are many areas where noise

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can be minimized, and the producer should take steps to ensure that plant and vehicle noise are minimized through plant designs, landscaping, berms and sound walls, and through the use of appropriate technology and strategies.

1.10.4 Fuel, Oil and chemical spillage the risk of leaks and spills can be minimized by proper design of storage facilities. The producer shall take appropriate measures and employ best management strategies to prevent leaks and spills and prevent pollution of surrounding areas and ground water by accidental effluent discharges and fuel, oil and chemical spillage.

1.10.5 Waste management Waste is defined as materials disposed of in an unproductive manner for example being land filled or discarded in a quarry or back lot. Comprehensive waste management and programs will reduce environmental burden of waste disposal. Re use of the waste material alleviates the burden of raw materials extraction. Excess concrete and returned concrete mainly forms the solid waste in RMC industry and forms the major waste concern. The producer shall introduce processes, strategies and practices that minimize the production of waste.

1.10.6 Training It is the responsibility of RMC producer to ensure that the employees/workers are properly trained and educated in safe handling of materials, hazardous chemicals and responsibility towards the environment. The producer shall give high priority to site care and good housekeeping along with participation of local community. It is also essential that emergency response procedures be established and employees be made familiar with the procedures. A formal training plan shall be prepared and implemented. Drivers play a key role in fuel management. Training to drivers can improve fleet efficiency and reduce spillage and leaks

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1.11 LIST OF REFERRED STANDARDS & LITERATURE

INDIAN STANDARDS	Title
IS 383 : 1999	Coarse and fine aggregates from natural sources for concrete— Specification (third revision)
IS 456:2000	Plain and reinforced concrete— Code of practice (fourth revision) (Reaffirmed 2005)
IS 457:1957	Code of practice for Plain and reinforced concrete for Dams & other Massive structures.
IS 516:1959	Method of test for Strength of concrete.
IS 1199: 1959	Methods of sampling and analysis of concrete.
IS 1343:2012	Code of practice for prestressed concrete
IS 1791:1985	General requirements for batch type concrete
IS 2386(Part I):1963	Methods of test for Aggregates for concrete, Part I: particle size and shape, (Reaffirmed 2007)
IS 2386(Part III):1963	Methods for test for Aggregates for concrete, Part III: specific gravity, Density, Voids, Absorption and Bulking (Reaffirmed 2007)
IS 2430:1986	Methods for sampling of Aggregates for concrete(First Revision),(Reaffirmed 2005)
IS 3812(Part 1):2003	Pulverized fuel Ash For use on Pozzolana in Cement, Cement Materials and concrete
IS 3812(Part 2):2003	Pulverized fuel Ash For use on Admixture in Cement, Cement Materials and Concrete
IS 4082:1996	Recommendations on stacking and storage of construction materials and components at site (second revision)
IS 4634:1991	Methods for testing performance of batch-type concrete mixers (first revision)
IS 4925:1968	Specification for concrete batching and Mixing
IS 4926:2003	Ready Mixed Concrete – Code Of Practice
IS 5816:1999	Splitting tensile strength of concrete Method of
IS 5892:2004	Specification for concrete transit mixers and
IS 7861 (Part I):1975	Guidelines for concreting in Extreme weather conditions (Hot weather conditions)
IS 8142: 1976	“Method of test for determining setting time of concrete by penetration resistance.
IS 9103: 1999	Concrete admixtures—Specification (first revision) (Reaffirmed 2004)

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WORKMANSHIP

CLEARING OF SITE, EXCAVATION AND EARTH FILLING

Note: Workmanship for all items related to the construction work should be as per relevant I.S. Code.

General:

Trenches for wall foundations, column footings, raft foundations, pile caps, plinth beams, water tanks, cess pits, etc., shall be excavated to the exact length, width and depth shown in the figure on the drawing or as may be directed by the Architect. If taken out to greater length, width or depth than shown or required, the extra work occasioned thereby shall be done at the Contractors own expenses. Extra depth shall be brought up by plain cement concrete filling 1:4:8 proportion and extra length and width filled in by rammed earth or murum or if the Architect thinks it necessary for the stability of the work by 1:4:8 concrete, as may be directed by the Contractors costs.

Excavated material shall be used for filling in plinth, or each side of the foundation blocks or trenches or it shall be spread elsewhere on or near the site of work including watering, ramming and consolidating or carted away from site free of charge, as may be ordered. The Contractor shall at his own expenses and without any extra charge, make provision for supporting all utility services, lighting the trenches, separating and stacking, serviceable materials neatly, shoring, timbering, stuttering, bailing out of water either sub-soil or rain water including pumping at any stage of the work. Trenches shall be kept free of water while masonry or any concrete works are in progress and until the Architects consider that concrete is sufficiently set.

Excavation excluding in Hard Rock:

Excavation shall be carried out in any type of soil, murum (soft or hard), soft rock, boulders, old foundation, concrete asphalt or stone paved surfaces, old masonry or concrete (plain or reinforced).

Excavation in Hard Rock:

Rock which is in solid beds, which can only remove either by wedging or chiseling shall be treated as hard rock. A boulder or detached rock measuring one cubic meter or more, shall wedging or chiseling.

Where hard rock is met with the blasting operations is considered necessary, the Contractor shall intimate about the same to the Architect.

The Blasting shall not be permitted in any case and contractor have to carry out hard rock excavation in hard rock by means of Wedging and chiseling only.

Excavation shall be done by wedging or chiseling and it shall be restricted to the quantity required to enable the necessary foundation etc. to be put in. In case, the dimension of trenches exceeds those shown in drawings or as directed by the Architect, the excess quantity shall not be paid for, the item also covers bailing out subsoil or rain water including pumping at any stage of work, shoring strutting, etc.

Earth Filling:

General: Filling shall be done with good earth, murum, stone chips, or disintegrated building debris. It shall be free from salts, organic matter, black cotton or slushy earth and combustible material. All clods shall be broken.

a) Filling in Plinth :

Filling shall be done in layers not exceeding 25 cm., amply watered and consolidated by ramming with iron or wooden rammers weighing 7 to 8 kgs. and having base 20 cm. Square or 20 cm. diameter. When the filling reaches the finished level, surface shall be flooded with water for at least 24 hours, allowed to dry and then rammed and

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consolidated, after making good any settlement in order to avoid settlement at a later stage. Special care shall be taken to pack earth under plinth beams and column corners. Finished level of filling shall be kept to a slope intended to be given to the floor.

b) Filling in Outdoor portions and for Site Development:

Shall be done in layer of 30 cm. Each layer shall be adequately watered. When filling reaches the required level the top most layer shall be dressed to proper section, grade and camber and rolled by 8 to 10 ton's power roller and adequately watered to aid compaction.

DRY RUBBLE PACKING & LEVELING COURSE.

Dry Rubble Packing: Ground shall first be leveled up and thoroughly consolidated by means of heavy log hammer or frog rams. Rubbles of specified thickness shall then be laid and set with hand. It shall be consolidated by either hand roller or wooden log hammer; free use of water being made during consolidation. All hollows and interstices after consolidation shall be filled up with quarry spalls, stone chips etc., and the packing blinded with stone grit and watered and consolidated by log hammer.

Rubble packing in Road work shall be thoroughly consolidated by means of power rollers of 8 ton's capacity instead of log hammers and the surface shall be brought to proper grade and camber. After checking the level, grade and camber the surface will again be watered and rolled to receive road structure.

Leveling Course:

It shall be either plain cement concrete of leaner mix or lime concrete which shall be proportioned as stipulated in the relevant item and mixed and placed in position confirming to line and level show on the drawing and compacted by approved means and cured adequately.

Lime concrete shall be prepared by mixing sand and slaked lime in proportion of three parts of sand and one part of lime and ground in a suitable mill and the mortar so prepared shall be added to six parts of the brick bat passing through 50 mm. mesh, mixed well and placed in position and compacted by approved means. The concrete shall be cured adequately.

PLAIN & REINFORCED CEMENT CONCRETE**A) VOLUMETRIC BASIS: -**

General : In any case volumetric batching shall not be allowed.

Proportioning the Mix :

Design Mix shall be carried out and same shall be got approved from APMCF/SBI. If aggregates are moist allowance shall be made for bulking in accordance with IS:2386/-. Allowance shall also be made for surface water present in aggregate when computing water contents. Surface water present shall be determined by one of the field methods described in IS:2386/- (Part III).

Mixing :

All Concrete shall be mixed in an approved mechanical mixer. The mixer and mixing platform shall be suitably protected from wind and rain. Aggregates shall be accurately measured as per design mix and mixed dry along with cement, water shall be then added in measured quantity and mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and in consistency but in no case shall he mixing be done for less than 2 minutes.

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Hand mixing shall not be permitted in any case.

Consistency:

Quantity of water for making reinforced concrete shall be sufficient so as to ensure that concrete shall surround and properly grip all the reinforcement. The best consistency shall be that which will flow sluggishly without flattening out and without separation of coarse aggregates from the mortar. The degree of plasticity shall depend on the nature of work and atmospheric temperature and whether the concrete is vibrated or hand compacted. The slumps shall be determined by standard slump test carried out in accordance with the procedure laid down in IS:119-1959 shall be adopted for different types of work and same shall be validated as per approved Design Mix Reports.

Admixtures:

The usage of admixtures is allowed only if approved by the structural consultant and his decision in this regard shall be final.

Transportation:

Concrete shall be conveyed from the place of mixing to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of any of the ingredients. If segregation does occur during transport, the concrete shall remix before being placed. In

no case, more than 30 minutes shall elapse between mixing the consolidation in its position.

Placing and Compacting:

Concrete shall be placed in layers of suitable thickness or in strips and compacted before initial setting commences and should not be subsequently disturbed. Method of placing shall be such as to preclude segregation and as far as practicable the placing shall be continuous. Special care shall be taken in accordance with IS:456 while laying concrete under extreme weather.

Concrete shall be thoroughly compacted during the operation of placing and thoroughly working around the reinforcement, embedded fixtures and spaded against corners of the form work and by punning, rodding, mechanically vibrating or by any other approved means. In addition, form work shall be tapped lightly by using wooden mallet at the pouring head. The number and type of vibrator to be used shall be subject to the approval of the Architects and in general immersion type vibrators shall be used. External vibrators shall also be used whenever directed.

The intensity and duration (of vibration shall be sufficient to cause complete settlement and compaction without any stratification of successive layers or separation of ingredients or formation of laitance. Vibrator shall be inserted vertically in the concrete at points not more than 45 cm. apart and withdrawn very slowly when air bubbles no longer come on the surface. Over vibration or vibration of very wet mixes is harmful and should be avoided. Care shall be taken to utilize the vibrator only to compact the concrete and not to spread it, sufficient number of reserve vibrator in good working condition shall be kept on hand at all times, so as to ensure that there is no slackening or interruption in compacting.

Construction Joints:

Concreting shall be carried out end to end continuously as far as possible and when construction joints are totally unavoidable; it shall be located in a predetermined position approved by the Architect. The joints shall be kept at places where the shear

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force is the minimum and these shall be straight and at right angles to the direction of main reinforcement. When the work has to be resumed, on a surface which has hardened, such surface shall be roughened. It shall be swept clean, thoroughly wetted and covered with a 13 mm. layer of mortar composed of cement and sand in the same ratio as the cement concrete mix. This 13 mm. layer of mortar shall be freshly mixed and placed immediately before the placing of the concrete.

Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the Wet surface with wire or bristle brushes, care being taken to avoid dislodgment of particles of aggregate. The surface shall then be coated with neat cement grout. In horizontal joints the first layer of concrete to be placed on this surface shall not exceed 15 cm. thickness and shall be well rammed against old work, particular attention being paid to corners.

Expansion Joint:

Expansion joint shall be provided where required as shown on the drawings or as directed by the Architect / Consultant. The joints shall be filled by the approved quality filler.

Curing:

Concrete shall be carefully protected during first stage of hardening from harmful effects of excessive heat, drying winds, rain or running water. It shall be covered with a layer of sacking, sand canvas, hessian, or similar absorbent materials and kept constantly, wet for ten days from the date of placing of concrete. Alternatively, the concrete being thoroughly wetted and covered by layer of approved water-proof material which should be kept in contact with it for seven days.

Form Work:

The form work shall conform to the shape, lines and dimensions as shown on the plans and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete and shall be sufficiently watertight to prevent loss of cement slurry from the concrete. Form work or centering shall be constructed of steel or timber and adequately designed to support the full weight of wet concrete without deflection and retain its form during laying, ramming and setting of concrete. Timber used shall be properly seasoned so as to prevent deformation when wetted.

All props shall be straight and of full height and no joints shall be allowed. Props shall be braced with thin bamboos or wooden battens and where additional staging is necessary, extra care shall be taken to use bigger diameters props with bracing at 4 or 5 levels. All props shall be supported on sole plates and double wedges. At the time of removing props these wedges shall be gently eased and not knocked out.

All rubbish, chippings, shavings and saw dust shall be removed from the interior of the forms before the concrete is placed and the form work in contact with the concrete shall be cleaned and thoroughly wetted or treated with non-staining mineral oil or any other approved materials is kept out of contact with the reinforcement.

All form work shall be removed without shock or vibration and shall be eased off carefully in order to allow the structure to take up its load gradually. Forms shall not be disturbed until concrete has adequately hardened to take up superimposed load coming on it and in no circumstances shall forms be struck until the concrete may be subjected at the time of striking.

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In the normal circumstances (generally where temperatures are above 21 degrees centigrade) and where ordinary cement is used, forms may be struck after expiry of following periods:

a)	Walls, Columns and Vertical sides of beam}	48 hours
b)	Bottom of slab up to 4.5 m. span.	7 days.
c)	Bottom of slab up to 4.5 m. span.	14 days.
d)	Bottom of beams and arch rib over 6 m. span.	21 days.

However, this period may be increased or decreased at the discretion of Architects. Special care shall be taken while striking the centering of cantilevered slab canopies, portal frames, folded plate construction and period of striking centering shall be as determined by the Architect. If directed, form shall be given an upward camber to ensure that the beams do not have any sag. Surface that becomes exposed on removal of forms shall be carefully examined and any fins, burrs, projections etc., that are detected shall be removed. Any honeycombing of minor nature shall be finished neatly with cement mortar 1:2.

Any work showing signs of damage through premature or careless removal of centering or shuttering, shall be reconstructed by the contractor at his own cost.

Strength:

Concrete mixed in the proportion desired shall have compressive strength after placing, not less than the following:

Concrete mixed in the proportion desired shall have compressive strength after placing, not less than the targeted strengths as per requirement.

Tests:

Tests on concrete shall be carried out in accordance with IS-456/- and any other is applicable. The frequency of work test shall be at such intervals as ordered by the Architect and subject to that every 150 cu.m. of concrete placed or part thereof and for a day's concrete exceeding 30 cu.m. a batch of 6 cubes shall be made for every sample and 3 of them tested after 7 days and the remaining 3 cubes shall be tested after 28 days. The criteria for acceptance of a concrete as confirming to a specified proportion / grade of concrete shall be in accordance with IS:456 and the Contractor shall entirely re-do the rejected work at his own cost. Strength of 28 days shall alone be considered for acceptance.

The Contractor shall arrange to carry out the tests in accordance with the relevant Indian Standards Specifications in an approved laboratory and the test reports in original be submitted to Architect. The entire cost of testing shall be borne by the Contractor.

Steel Reinforcement:

Reinforcement shall be accurately fabricated, placed and adequately maintained in position as shown on the drawings or as directed by the Architect. All finished bars shall be free from cracks, surface flaws, laminations, jagged and imperfect edges. Cement mortar blocks shall be used to give requisite cover as shown be firmly tied with binding wire of 16 to 18 gauge. Reinforcement shall be bent in accordance with the procedure stipulated in IS:2502-1963 and will not be straightened in a manner which will injure the material.

All reinforcement shall immediately before placing in concrete be thoroughly cleaned of loose mill scale, loose rust, oil and grease or other deleterious matter that would destroy or reduce bond. Reinforcement in reinforced concrete members shall not be connected by

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welding or coupling except in accordance with relevant ISS and with the previous approval of the Architect. Overlaps and joints shall be staggered and located at points, along the spans where neither shear nor bending moment is maximum.

Cover:

Reinforcement shall have cover as shown on the R.C.C. drawings and where not specified the thickness of cover shall be as follows.

- a) At each end of reinforcing bar not less than 25 mm. not less than twice the diameter of such rod or bar.
- b) For a longitudinal reinforcing bar in a column not less than the diameter of such rod or bar. In the case of columns of minimum of 20 mm. or under whose reinforcing bars do not exceed 13 mm. the cover of 25 mm. may be used.
- c) For longitudinal reinforcing bar in a column not less than 25 mm. not less than diameter of such rod or bar.
- d) For tensile, compressive, shear or other reinforcement in a slab not less than 13 mm. nor less than diameter of such reinforcement, and
- e) For any other reinforcement not less than 13 mm. not less than the diameter of such reinforcement.

BRICK AND STONE MASONRY**General:**

All brick work should be carried out as shown on the drawings with setbacks, projections, cuttings things, etc. Wherever the proportion of cement mortar has not been specifically mentioned, cement mortar in the proportion of 1:6 shall be used. Flat bricks arches shall be provided wherever required without any extra cost. Brick work shall be kept wet while in progress, till mortar has properly set. On holidays or when work is topped, top of all unfinished masonry shall be kept wet. Should the mortar become dry, white or powdery, for want of curing work shall be pulled down and rebuilt at the Contractor's expenses.

Brick Work 1stClass:

Bricks shall be thoroughly cleaned, well wetted and soaked for at least twelve hours in fresh water before being used on the work. Bricks shall be of locally, available best quality. English bond shall be used throughout in walling. A good bond shall be maintained throughout the work, both laterally and transversely. In walling, the courses shall be kept perfectly horizontal and in plumb with the frogs facing upwards. Vertical joints shall not exceed 10 mm. thickness and shall be full of mortar. No broken bricks shall be used except as closers. After day's work all joints shall be raked to 12 mm. depth to provide for proper key to plastering.

Mortar used shall be as specified in respective items and every third course of brick work shall be flushed with mortar grout.

Whole of the masonry work shall be brought up at one uniform level throughout the structure; but where breaks are unavoidable, joints shall be made in good long steps. All junctions of walls and cross walls shall be carefully bounded into the main walls. The rate of laying masonry may be up to a height of 60 cm. per day if cement mortar is used and 45 cm. Per day if lime mortar is used. Greater heights may be built only if permitted by the Architect. During rains, the work shall be carefully covered to prevent mortar from being washed away. Should any mortar or cement be washed away, the works shall be removed and rebuilt at the Contractor's expenses.

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Bricks Work 2ndClass:

Shall be similar to 1st class brick work except that 2nd class bricks shall be used and joints shall be 10 mm. to 12 mm. thick.

Half Brick Masonry:

Shall be set in cement mortar as specified. Hoop iron bands of 2.5 cm. x 0.16 (1" x 1/16") shall be embedded in every fourth course with thick mortar band or 2 Nos. 6 mm. (1/4") dia. bars shall be used in every sixth course otherwise as specified under item.

RUBBLE MASONRY

General:

Stones shall be of the kind specified in the item and shall be from an approved quarry. Stones shall be well wetted before laying in position. The mortar shall be as specified in the item. Face stone shall not be less than in breadth than in height, it shall also tail into the work more than its height. Jambs of doors, windows and openings shall be formed with quoins. In case of battered walls, the courses on battered surface shall be at right angle to the batter.

Through stones or headers shall be laid in every course at a distance not exceeding 2 meters part and shall be staggered. They shall be in one piece for walls up to 1.5-meter width and shall be lap jointed in case of wall having thickness more than half meter. The face area of each header shall not be less than 0.50 sqm. 1:2:4 cement concrete may also be allowed where good length headers are not available. Headers shall be marked with oil paint for ready identification.

Height of quoins shall be same as that of the course. Length of quoins shall be 0.50 m. and shall be laid header and stretcher alternatively. Faces of quoins shall be fair dressed. No quoins stones shall be less than 0.30 cum. in content. Joints of masonry shall be raked out and unless otherwise stated, shall be raised cement pointed by using cement mortar 1:1 to all exposed surfaces. All masonry work shall be well watered for a period of seven days.

a) Coursed Rubble Masonry - First Sort:

Height of course shall not be less than 15 cm. and all courses shall be of uniform height. All stones in the course shall be of same height. In no case height of course shall be more than any of the course below it. Bed and sides shall be hammer or chisel dressed back from the face 75 mm. and 35 mm. respectively.

Faces of stones shall be hammer dressed and bushing shall not be more than 35 mm. Thickness of joints shall not be more than 10 mm. Stones shall break joints at least half the height of the course. Work on interior face shall be precisely the same, as on exterior face. Quoins shall be at least 0.5 m. long laid square on their beds and shall be fair dressed to a depth of at least 10 cm.

b) Uncoursed Rubble Masonry:

Stones shall be hammer dressed. Nearly fifty per cent of stones shall not be less than 0.30 cum. in content each, and twenty-five per cent of stone shall tail back in masonry by 40 cm. or more. Stones shall be so arranged as to break joints as much as possible.

Long vertical joints shall be carefully avoided. Thickness of joints shall in no case exceed 12 mm.

Pillar offsets shall be properly dressed with hammer or chisel to form proper angle. Stones used for the backing shall be of fairly large size.

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c) Random Rubble Masonry - First Sort:

Stones shall be roughly chisel dressed. They shall be solidly bedded in mortar. Height of stone shall not be more than width of face or length of tail. Stones shall be of equal size and so arranged as to break joints as much as possible, avoiding long lines of horizontal or vertical joints. Quoins shall be same as described in Coursed Rubble Masonry - 1st Sort. All stones shall be carefully fitted. Thickness of face joint shall be not exceeded 25 mm. Edges of stones shall be chisel dressed for fitting in position properly.

Timber used shall conform to specifications described under Materials, Doors, Windows, Ventilators, walls, Paneling, False Ceiling, etc., shall be in accordance with Architect's drawing in every detail and all joiner's work shall be accurately set out, framed and finished in a proper workman-like manner, frames of doors, windows and ventilators etc. and shutter styles and rails shall be best solid teak of quality specified in the schedule of quantities. The scantlings shall be accurately planed smooth, rebates, rounding and mouldings shall be made as shown on the drawings, patching or plugging of any kind shall not be allowed. Joints shall be simple, neat and strong. Framed joints shall be coated with suitable adhesive like glue or synthetic resin before the frames are put together. All mortise and tenon joints shall be fit and fully and accurately without wedging on filling. The joints shall be pinned with hard wood or bamboo pins of 10 mm. to 12 mm. dia. or rust resisting star shaped metal pins 8 mm. after the frames are put together and pressed in position by means of press. The frames are put together and pressed in progress of work by suitable boxing. All portions of timber abutting against or embedded in masonry or concrete shall be treated against termites by giving a coat of any approved wood preservative.

Unless otherwise specified all doors, frames shall have six M.S. flat hold fasts and window frames shall have four hold fasts shall be provided to the ventilators, if directed. Size of hold fasts shall be 30 mm. x 40 mm. x 6 mm. M.S. flat bent to shape worth fish tail end and it shall be fixed to frame with sufficient number of screws as directed. When door / window frames are to be fixed to R.C.C. column or R.C.C. wall, hold fasts shall be substituted by suitable arrangements such as coach crews, rawl bolts etc., to secure frames to R.C.C. column or R.C.C. wall as directed by the Architect.

Frames and shutter shall not be painted or erected before being approved by Architect.

Paneled Shutter:

Panels shall be of pattern and size as shown on the drawings or as directed by Architect. Solid teak wood panels shall be in one piece wherever possible. Where two or more pieces are permitted, they shall be of equal width. Panels shall be framed into grooves made in styles and rails to the full depth of groove and faces shall be closely fitted to sides of groove.

Where panels specified are block board, it shall be solid core with teak internal lipping and of approved make.

Partly paneled and partly glazed shutter shall be similar to paneled shutters except that such parts as are directed shall be glazed with plain or ground glass as specified. Styles and rails shall be rebated 12 mm. to receive glass. Sash bars shall be moulded and rebated and mitered on sides to receive the glass which shall be fixed with putty and beads.

Hardware Fittings:

Supply and Installation of All hardware, fittings and fixtures shall be the scope of Contractor the cost of same shall be included in the rate quoted. The fixing shall be done in the best workman-like manner in accordance with the manufacture's specifications. The Contractor shall be held responsible for working of all moving parts dependent on

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proper fixing. He will also be responsible for any breakage due to negligence during fixing or lack of protection before the building is handed over. The Contractor shall also take delivery of all hardware fittings etc., as and when supplied and arrange for safe storage etc.

Hardware required for fixing false ceiling, wall paneling etc., shall be arranged by the Contractor at his cost. Apart from the hardware fittings required for the joinery items, the Contractor shall have to fix all other items of hardware fittings to be supplied by the employer viz. coat / picture hooks, numerical, letters to denote buildings, hanging rods etc., as directed by the Architects.

Painting and polishing of wood work shall be as per specifications under respective heads.

Flush Doors:

All flush doors shall be solid core unless otherwise specified. It shall conform to the relevant specifications of I.S. 2202 and shall be obtained from approved manufactures. The finished thickness of the shutter shall be mentioned in the items. Face veneers shall be of the pattern and colour approved by the Architect and an approved sample shall be deposited with the Architect for reference.

The solid core shall be wood laminae prepared from battens of well-seasoned and treated good quality wood having straight grains. The battens shall be of uniform size of about 2.5 cm. width. These shall be properly glued and machine pressed together, with grains of each piece reversed from that of adjoining one. The longitudinal joints of the battens shall be staggered and no piece shall be less than 50 cm. in length. Alternatively, the core shall be of solid teak particle board. Edges of the core shall be lipped internally with 1st Class teak wood battens of 4 cm. (1.5") minimum depth, glued and machine pressed along with the core.

The core surface shall then have two or three veneers firmly glued on each face. The first veneer (called cross band) shall be laid with its grains at right angles to those of the core and the second and the third veneers with their grains parallel to those of the core. The under veneers shall be of good quality, durable and well-seasoned wood. The face veneers shall be of minimum 1 mm. thickness and of well-matched and seasoned 1st class teak, laid along with grains of the core battens. The combined thickness of all the veneers on each face shall not be less than 4 mm. Thermosetting synthetic resin conforming to I.S. 303 or moisture-proof plywood grade MPF.I. shall be used in manufacture. In addition to internal lipping all doors shall have external lipping all round.

STEEL DOORS, WINDOWS, VENTILATORS, ROLLING SHUTTER, M.S. GRILLES ETC.

Steel used in the manufacture of rolled steel sections shall not have more than 0.060 per cent of Sulphur and 0.065 per cent of phosphorus. The carbon content shall not exceed 0.30 per cent and shall be of weldable quality. In all other respects, the rolled steel sections shall conform to I.S. 226-1955 and I.S. 1977-1962.

Frames shall be square and flat. Both the fixed and openable frames shall be constructed of sections which have been cut to length, mitered and electrically welded at corners. Subdividing bar units shall be tenoned and rivetted into the frames. All frames shall have the corners welded to a true right angle and welds shall be neatly cleaned off. Couplings, mouldings and weather bar shall be provided as directed by the Architects.

Outer frames shall be provided with fixing holes centrally in the web of the sections and fixing screws and lugs shall be used for fixing the frame to masonry. Mastic cement shall be used for making the joints watertight.

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Hinges shall be strong projecting type. If directed friction type hinges shall be used in which case windows shall not be fitted with peg stays.

Projecting type hinged shutter shall be fitted with bronze or brass peg stays, 30 cm. Long with peg and brackets welded / riveted to the frame or as stated under item.

All windows shall be provided with handles of brass or bronze or otherwise as stated under them. Top hung ventilators shall be fixed with plain hinges riveted / welded to the fixed frame. A brass or bronze peg stay 30 cm. long as in windows shall be provided or as stated under item.

Center hung ventilators shall be hung on two pairs of brass or leaded tin bronze cup pivots riveted to the inner and outer frames of the ventilators to permit the ventilators to swing through an angle of approximately 85. The opening position of the ventilator shall be so balanced to keep it open at any desired angle under normal weather conditions. A bronze spring catch shall be fitted in the center of the top bar of the ventilator for the operation of the ventilator. This spring catch shall be secured to the frame with brass screws and shall close into a mild steel malleable iron catch plate riveted or welded to outside of the outer ventilator frame bar. A brass cord pulley wheel in mild steel or malleable iron brackets shall be provided along with card eye.

The windows and ventilators shall be painted/Powder coated if applicable. All the steel surfaces shall be thoroughly cleaned free of rust, scale or dirt and mill scale by picking or phosphating and before erection painted with one coat of approved primer and after erection painted with two finishing coats of synthetic enamel paint of approved shade and quality.

Glazing of specified thickness shall be provided on the outside of frames and unless otherwise specified, metal beading of approved shape, and section shall be used for fixing glasses. Special metal sash putty of approved make shall be used, if directed.

Rolling Shutters:

Shall be of approved manufacture suitable for fixing in the position ordered i.e. outside, inside, on or below lintel or between jambs. Shutters up to 12 sqm. (130 Sq.ft.) in area shall be manually operated or Push Up type while bigger sizes shall be of reduction gear type mechanically operated chain or handles.

These shall be consisting of 8 gauges or as specified with 75 mm. (3") M.S. laths of best quality mild steel strips machine rolled and straightened with an effective bridge depth of 16 mm. (5/8") and shall have convex corrugation. These shall be interlocked together throughout their entire length with end locks. These shall be mounted on specially designed pipe shaft. The spring shall be of approved make coiled type. These shall be manufacture from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in positions. The spring pipe, shaft etc., shall be supported on strong M.S. or malleable cast iron brackets.

Both the side guides and bottom rail shall be jointless and of single piece of pressed steel.

Top cover of shaft, spring etc., shall be of the same material as that of lath.

For rolling shutter with wicket-gate, night latch shall be provided free of cost.

The shutter and cover etc., shall be painted with one coat of anti-corrosive paint and two coats of synthetic enamel paint of approved quality and shade.

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Collapsible Steel Gate:**

It shall consist of vertical double channels at 10 cm. centers. The sizes of channels T-Section for top and bottom shall be as approved by the Architects. The gate shall be provided with necessary bolts, nuts, locking arrangements, stoppers and brass handles on both sides. The gate shall be painted with one coat of anti-corrosive paint before erection and two coats of synthetic enamel paint of approved quality and shade.

Wrought Iron Grilles:

Grille's shall be manufactured as per drawings and the welded joints shall be smooth. The grilles shall be painted with one coat of anti-corrosive paint before fixing and two coats of synthetic enamel paint of approved quality and shade.

Aluminum Doors, Windows, Ventilators & Partitions etc.:

These shall be obtained from approved and established manufactures and shall be of Aluminum alloy conforming to I.S. 733 and sections shall generally conform to I.S. 1948.

These shall be fabricated as per the detailed drawings,

Frames for windows, ventilators etc., shall be square and flat. Both fixed and openable frames shall be constructed of section which have been cut to length, mitered and welded at corners. Sub-dividing bars shall be tenoned and rivetted into the frames. All frames shall have corners welded to a true right angle. For side hung shutters, hinges shall normally be of projecting type made of Aluminum alloy and rivetted / welded to frames. Handles, peg stays etc., or approved quality Aluminum or its alloy conforming to IS Specifications.

All types of shutters shall be fabricated, supplied and fixed as specified in the IS:1948. The rate shall include supplying and fixing all fittings and fixtures required for proper and safe operation.

The doors shall be fabricated by using standard aluminum alloy extruded sections as specified in IS:1948. The rate shall include supplying and fixing all fittings and fixtures including approved locking arrangement as directed.

All aluminum fabricated work shall be anodized to the British Standard 1616:1961 to give an anodized film of 25 micron.

The Contractor shall take to stack the fabricated frames etc., on site under cover. They shall be handled with care, stacked on edge on level bearers and supported evenly. Before erecting, the frames coming in contact with concrete, masonry, plaster of dissimilar metals shall be coated with a coat of Zinc Chromate conforming to IS:104-1950. The Contractor shall cover all anodized finish work with a thick layer of clear transparent lacquer based on methacrylate or cellulosebuty rate to protect the surface from wet cement during installation. This coating shall remove on completion. Before handing over, the aluminum work shall be washed with mild solution of non-alkali soap and water.

Glazing: Glazing shall be approved especially quality glass of specified thickness and unless otherwise directed it shall be provided the exterior with metal beading.

FLOORING, SKIRTING, DADO AND STONE VENEERING

All flooring, skirting, dado and stone veneering etc., shall be executed strictly as per relevant IS Specification and in workman-like manner.

Indian Patent Stone:

Selection of materials, method of mixing, placing and compacting shall generally conform

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to the specifications under plain and reinforced cement concrete described earlier. A stiff mix consistent with workability shall be used.

Preparation of Surface:

Before the operation for laying topping is started the surface of base concrete shall be thoroughly cleaned of all dirt, loose particles coked mortar droppings and laitance if any, by scrubbing with coir or steel wire brush. Where the concrete has hardened so much that roughening of surface by wire brush is not possible, the surface shall have roughened by chipping or hacking at close intervals. The surface shall then be cleaned with water and kept wet for 12 hours and surplus water shall be removed by mopping before the topping is laid.

Laying:

The screed strips shall be fixed over the base concrete dividing it into suitable panels. Before placing the concrete for topping, neat cement slurry shall be thoroughly brushed into the prepared surface of the base concrete just ahead of the finish. Concrete of specified proportion and thickness shall be laid in alternate panels to required level and slope and thoroughly tamped.

Finishing the Surface:

After the concrete has been fully compacted it shall be finished by troweling or floating with neat cement rendering. Finishing operations shall start shortly after the compaction of concrete and the surface shall be troweled three times at intervals so as to produce a uniform and hard surface. The satisfactory resistance of floor to wear depends largely upon the care with troweling is carried out. The time intervals allowed between successive troweling is very important. Immediately after placing cement rendering, only just sufficient troweling shall be done to give a level surface. Excessive troweling in the earlier stages shall be avoided as this tends to bring a layer rich in cement to the surface. Sometime, after the first troweling, the duration depending upon the temperature, atmospheric conditions and the rate of the set of cement used, the surface shall be re-troweled to close any pores in the surface and to bring to surface and to scrape off any excess water in concrete or laitance. No dry cement shall be used directly on the surface to absorb moistures or to stiffen the mix. The final troweling shall be done well before the concrete has become too hard but at such time that considerable pressure is required to make any impression on the surface.

If directed by the Architect, approved mineral pigment shall be added to the rendering to give desired colour and shade to the flooring at no extra cost.

When instead of 1:2:3 or 1:2.5:3.5 mix, 1:2:4 is specified the topping shall be rendered with 1:1 cement mortar with a suitable mineral pigment, if directed, instead of cement only. If specified in the Schedule of Quantities, the flooring shall be machine polished as per the Architect's instructions. Wherever the patent stone flooring is used as finishing on roof the joints shall be filled with an approved bitumastic filler in workman like manner.

Ironite Topping:

Instead of finishing the top with rendering coat of 1:1 cement mortar, the top shall be finished with 12 mm. thick ironite topping. Unless otherwise specified, one part of ironite and four parts of ordinary cement by weight shall be mixed dry thoroughly. This dry mixture shall be mixed with stone grit 6 mm. (1/4") and down size or as otherwise directed in the ratio of 1:2 by volume and well turned over. Just enough water shall be added to this dry mix and mixed thoroughly well and laid to uniform thickness of 12 mm. and compacted. After initial set has started the surface shall be finished as directed.

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Plain and Colored Cement Tiles, Marble Mosaic and Terrazzo Tiles Flooring:**

The tiles shall conform to IS : 1237 having the colour approved the Architect and the rate shall include provision of border tiles and tiles of different colours in pattern if directed. The mosaic topping of lighter shade tiles shall be made of White Cement with an approved shade pigment and neutral shade shall be of Grey cement with an approved shade pigment. The type of tiles shall be as specified in respective items.

The sub-grade shall be thoroughly wetted after cleaning of all dirt, laitance, and loose material. A bed of lime mortar consisting of one part of lime and two parts of sand shall be laid and properly leveled to an average thickness of 25 mm. and the surface shall be kept slightly rough to form a satisfactory key for tiles. Neat cement paste of honey like consistency shall be spread over mortar bed, over such area at a time as would accommodate about 20 tiles. Tiles shall be soaked in water for 15 minutes and allowed to dry for the same duration. Tiles shall then be fixed with a thin coat of cement paste on back of each tile and then each tile being gently tapped with a wooden mallet till it is properly bedded and in level with adjoining tiles. Joints shall be fine and as imperceptible as possible.

After tiles have been laid in a room or a day's fixing work is completed, surplus cement grout that may have come out of the joints may be wiped off gently and joints cleaned. A thin slurry of coloured cement matching to the colour of tiles shall be spread over it and rubbed so as to seal even a thinnest joint between the tiles and make it impervious and the flooring cured for 7 days. The tiles shall be polished and finished according to IS:1443.

Dado, Skirting and Risers:

Tiles shall conform to IS:1237 and shall be of approved design. The tiles shall be fixed near cement grout on a blacking coat consisting of 1:4 cement sand plaster of 15 mm. thick. The top and bottom junctions of tiles shall be rounded off neatly as directed. The joints shall be filled with matching shade coloured cement slurry. The surface shall be kept wet for 7 days and then polished with carborundum stone to obtain smooth surface and fine polish.

Shahabad / Tandur / Kotah / Cuddappa Stone Flooring:

The flooring shall be either with rough stone or machine cut and machine polished as specified in respective items and shall be of specified thickness and of approved quality and size, free from cracks and flakes and shall be uniform in colour with straight edges. The sides of machine cut and machine polished stone shall have perfect right angles and surface smooth. The stone slabs shall be laid and finished as described under plain cement or colour cement tiles on a bedding of 1:2 lime mortar 25 mm. (Average) thickness. The finished stone surface thus laid shall then be polished to the required degree as approved by the Architect.

In Dado, Skirting, Risers etc.:

Stone slabs shall be laid on backing plaster of cement mortar 1:4 of 15 mm. to 20 mm. thick and finished as described under plain and coloured cement tile dado.

Marble mosaic / Terrazzo in situ work in flooring, dado, skirting etc.:

The terrazzo / mosaic finish shall be laid on an under layer of thickness as specified in the respective items. The topping shall consist of a layer of marble chips of selected sizes, colour and design approved by Architect, mixed with cement with desire shade of pigment. For lighter shade mosaic. terrazzo white cement shall be used and for neutral shade, grey cement shall be used. The proportion of terrazzo mix shall be three parts of cement one part of marble powder by weight. For every part of cement marble powder mix, the proportion of marble aggregate by volume shall be 1.5 parts unless otherwise specified.

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The topping shall be mixed and laid in panels as described in IS:2114 and as per decorative designs prepared by Architects. The dividing strips of panels shall be Aluminum or as specified in the Schedule of Quantities. It shall be polished as specified in IS: 2114.

Broken Mosaic Flooring:

Broken mosaic finish shall be laid on an underlayer of thickness as specified in the item. Pieces of mosaic tiles shall be obtained from broken marble mosaic tiles of approved shade conforming to IS:1257. The sizes of pieces shall be suitable to obtain the desired pattern of flooring as shown on the drawings or as approved by Architect.

Broken pieces shall be thoroughly wetted before fixing them. Ordinary or coloured cement grout shall be spread on the bedding. Mosaic tile pieces shall be fixed piece by piece to the desired pattern. The flooring shall be laid to correct level and slopes and compacted by straight screed tamper. The grout shall cream up to the surface. The junctions of the flooring and the wall shall be rounded and the flooring shall be extended along the wall to about 15 cm. (6"). After the day's work, the surplus cement grout that may have come out of the joints shall be cleaned off. The flooring shall be cured for seven days and then polished with a machine as stipulated in IS:1443.

Broken China Mosaic:

Broken China Mosaic flooring shall be exactly as per broken mosaic tile flooring except that the broken pieces shall be of China of approved colour and manufacturer and the floor shall not be polished.

Marble Flooring:

Marble slabs shall be of the best Indian marble of White or other approved colour as specified in the item. They shall be hard, dense, uniform and homogeneous in texture. They shall have even crystalline grain and free from defects and cracks. The surface shall be machine polished to an even and perfectly plane surface and edges machine cut true to square. The rear face shall be rough enough to provide a key for the mortar. No slab thinner than the specified thickness at its thinnest part. The sizes of the slabs shall be as specified in the respective items.

The slabs shall be laid as described under mosaic tile flooring in every respect.

White Glazed / Ceramic Tiles / Vitrified Tiles in Flooring and Dado:

White Glazed Tiles from an approved manufacturer conforming to IS:777 shall be used. They shall be of specified size and thickness. All specials viz. coves, internal and external angles, corners, beads etc., shall be used wherever directed. Under layer of specified thickness and mortar of stipulated proportion shall be laid as described in marble mosaic flooring. Tiles shall be washed clean and set in cement grout and each tile being gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be kept as thin as possible and in straight lines or to suit the required pattern. After the tiles have been laid, surplus cement grout shall be cleaned off.

The joints shall be cleaned off the grey cement grout with a wire brush or trowel to a depth of 5 mm. (3/16") and all dust and loose mortar removed. Joints shall then be flush pointed with white cement. The floor shall then be kept wet for seven days. After curing, the surface shall be washed with mild hydrochloric acid and clean water. The finished floor shall not

PLASTERING**Scaffolding:**

Scaffolding for carrying out plastering work shall be double steel scaffolding having two sets of vertical supports so that the scaffolding is independent of the walls.

Preparation of surface:

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All put log holes in brick work and junction between concrete and brick work shall be properly filled in advance. Joints in brick work shall be raked about 10 mm. if not raked out while constructing brick masonry work and concrete surface hacked to provide the grip to the plaster, if not hacked earlier projecting burns of mortar formed due to gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brush / coir brush to removed dirt, dust etc., and the surface thoroughly washed with clean water to remove efflorescence, grease and oil etc., and shall be kept wet for a minimum of six hours before application of plaster.

Neeru Plaster:

Cement mortar of specified proportion and thickness shall be prepared in small batches and applied to the wall surface / ceiling. The ensure proper thickness, gauged patches shall be made at 1.5 to 2 m. apart and the surface plastered true to line, level and plumb taking special care to finish jambs of windows, doors, wall returns, corners, junctions etc. A thin layer of neeru shall then be applied and rubbed into surface and finished by means of trowel until the surface is even and smooth. The surface shall be kept moist for seven days and then given a coat of white wash.

Sand-faced Plaster:

The surface shall be prepared as above.

The coat of cement mortar in proportion of 1:4 or as specified, shall be applied uniformly all over the surface to a thickness of 12 mm. and finished true to level and line and keys shall formed on the surface. The surface shall be kept moist till the finishing coat is applied.

The finishing coat shall be applied a day or two after. The proportion of mortar for finishing coat shall be one part of cement and three parts of selected, well graded and washed sand, or as specified under item and it shall be applied in a uniform thickness of 6 mm. (1/4").

The surface shall be tapped to uniform grained texture by using sponge pads as directed. Curing shall start after 24 hours and the surface kept wet for seven days.

Rough Cast Plaster:

Except for the finishing coat the surface shall be prepared and base coat of plaster applied as under sand-faced plaster.

Finishing coat mortar shall be in proportion of one part of cement and one part of specially selected and graded sand and one part of gravel of 3 to 6 mm. size. It shall be flung upon the first coat with large trowel to form an even and decorative coat. The work shall generally conform to clause 16.5 of IS:1661-1960. The thickness of the coat shall be about 12 mm.

(1/2"). It shall be cured for seven days.

Rough coat plaster with colour finish:

This finish shall be similar to Rough cast plaster above except a high-grade mineral pigment of approved shade shall be mixed with white cement instead of ordinary grey cement while preparing the mortar.

Water-proofing Treatment :

Unless otherwise specified, the Contractor shall carry out waterproofing treatment of basements, terrace and water retaining structures through reputed firms having specialization in the line and approved by the Architects. The Contractor shall also furnish full details of such treatment to the Architects and provide all information / proof etc.,

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regarding the effectiveness of the treatment when called upon to do so. All such treatment shall have to be guaranteed in the form approved by the Employer for a minimum period of ten years. Any defects / leakages noticed during the guarantee period shall have to be rectified free of cost by the Contractor including reinstating the surface to its original condition and finish.

Waterproofing of sunk portions of floor slabs for baths, W.C. and kitchen moories etc., in residential buildings, unless otherwise specified, shall be done as specified in the schedule and shall generally comprise of :

- a) A coat of hot bitumen, min. 6 mm. thick screened with stone grit.
- b) Min. 20 mm. thick cement plaster in cement mortar 1:3 with approved water-proofing cement compound as per manufactures specifications. The plaster shall be cured by pounding for seven days.

The rate for the above treatment shall include drying and cleaning surfaces free of dust etc. and wiping with kerosene before application of bitumen. The vertical faces and returns shall also be treated similarly. The actual area treated including vertical faces and returns shall be measured and paid for. The work should be done in such a way that the finished flooring in bath has a minimum slope of 20 to 25 mm.

PAINTING

General:

Wherever scaffolding is necessary, it shall be double scaffolding.

The surface shall be thoroughly brushed free from mortar droppings and foreign matter. All steel work shall be cleaned of loose rust, mill scales etc. so as to expose the original surface. All broken edges, cracks, loose plaster and wavy surface shall be brought up either by patch plaster work or by plaster of paris.

All materials viz., dry distemper, oil bound distemper, oil paint, flat oil paint, synthetic enamel paint, plastic emulsion paint, cement primer, red lead and other primers and metallic paints shall conform to respective I.S. specifications and shall be obtained from approved manufactures. All paints shall be brought on site in sealed thins in ready mixed form and shall be applied directly with the addition of thinner, if recommended by the manufacturers.

White Washing:

White was shall be prepared from lime slaked on spot, mixed and stirred with sufficient water to make a thin cream. This shall be allowed to stand for 24 hours and shall be screened through clean cloth. Four kg. gum dissolved in hot water shall be added to each cubic meter of the cream (115 gm. per cft.).

Blue shall be added to give required whiteness. The approximate quantity of water to be added in making cream shall be five liters per kg. of lime.

White wash shall be applied in specified coats by using flat brushes or spray pumps. Each coat shall be allowed to dry before next coat is applied. If additional coats than what have been specified, are necessary to obtain uniform and smooth finish, it shall be given at no extra cost. The finished dry surface shall not show any signs of cracking and peeling nor shall it come off readily on the hand when rubbed.

If directed by the Architects one coat of chalk and glue shall be applied before application of white / colour wash at no extra cost.

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Colour Wash:

Colour wash shall be prepared by adding mineral colours not affected by lime to white wash. No colour wash shall be done until a sample of the colour wash to the required tint or shade has been got approved from the Architects.

Colour wash shall be applied as specified under white wash.

Dry Distemper:

Shade shall be got approved from the Architects before application of distemper.

The surface shall be prepared as specified earlier. A primer coat using approved primer or sizing shall be applied. Distemper prepared as per manufacturer's directions shall be applied and each coat shall be allowed to dry before subsequent coat is applied. The finished surface shall be free from chalking when rubbed, even uniform and shall show no brush marks. If additional coats are necessary, they shall be given at no extra cost.

Oil Bound Distemper:

The surface shall be prepared as specified above. A primer coat of either cement primer or any approved distemper primer shall be applied.

After the primer coat has dried, the surface shall be lightly sand papered and dusted to make it smooth to receive distemper.

Distemper shall be prepared as per the directions of the manufacturer and conforming to shade approved. It shall be applied in specified coats, taking care to allow for drying of each coat before subsequent coats are applied.

Water-proof Cement Paint / Sand-tex matt Paint:

The surface shall be prepared as specified above and thoroughly wetted with clean water before water-proof cement paint is applied.

The paint shall be prepared strictly as per manufacturer's specifications and in such quantities as can be used up in an hour of its mixing, as otherwise the mixture will set and thicken, affecting flow and finish.

The paint thus prepared shall be applied on clean and wetted surface with brush or spraying machine. The solution shall be kept stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The completed surface shall be watered after the day's work. Number of coats shall be as specified in the item.

Painting - Oil / Enamel / Plastic Emulsion etc.:

Ready mixed oil paint, flat oil paint, plastic emulsion paint, ready mixed synthetic enamel paint, etc., shall be brought in original containers and in sealed tins. If for any reason thinner is necessary, the brand and quantity of thinner recommended by the manufacturer or as instructed by the Architect shall be used. The surface shall be prepared as specified above and a coat of approved primer shall be applied. After 24 hours drying approved or specified quality paint shall be applied evenly and smoothly. A filler putty coating may be given to give a smooth finish. Each coat shall be allowed to dry out thoroughly and then lightly rubbed down with sand paper and cleaned of dust before the next coat is applied. Number of coats shall be as specified in the item and if the finish of the surface is not uniform, additional coats as required shall be applied to get good and uniform finish at no extra cost. After completion no hair marks from the brush or clogging of paint puddles in

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the corners of panels, angles or mouldings etc., shall be left on the work. The glass panes, floor etc. shall be cleaned of stains.

When the final coat is applied, if directed, the surface shall be rolled with a roller of if directed, it shall be stippled with a stippling brush.

Note:- All paints shall be of LOW VOC content as per Green Building Norms

POLISHING AND VARNISHING**French Polishing: (LOW VOC AS PER GREEN BUILDING NORMS)**

French spirit polish shall be of an approved make conforming to IS:348. If it has to be prepared on site, the polish shall be made by dissolving 0.7 kg. of best shellac in 4.5 liters of methylated spirit without heating. To obtain required shade pigment may be added and mixed.

Surface shall be cleaned. All unevenness shall be rubbed down smooth with sand paper and well dusted. Knots, if visible, shall be covered with a preparation of red lead and glue. Resinous or loose knots and gaps shall be filled with season timber pieces and make level with rest of the surface. Holes and indentations on surface shall be filled with putty made of whiting and linseed oil. Surface shall be give a coat of filler made of 2.25 kg. of whiting in 1.5 liter of methylated spirit. When it dries, surface shall again be rubbed down perfectly smooth with sand paper and wiped clean.

Piece of clean fine cotton cloth and cotton wool made into shape of pad shall be used to apply polish. The pad shall be moistened with polish and rubbed hard on the surface applying the polish sparingly but uniformly and completely over the entire surface. It shall have allowed to dry and another coat applied in the same way. To give finishing coat, the pad shall be covered with a fresh piece of clean fine cotton cloth, slightly damped with methylated spirit and fubbed lightly and quickly with a circular motion, till the finish surface attains uniform texture and high gloss.

Wax Polishing: (LOW VOC AS PER GREEN BUILDING NORMS)

Wax polish shall either be prepared on site or obtained ready made from market. Polish made on the site shall be prepared from a mixture of pure bee's wax, linseed oil, turpentine oil and varnish in the ratio of 2:1.5:1:½ by weight. The bees wax and the boiled linseed oil shall be heated over a slow fire. When the wax is completely dissolved the mixture shall be cooled till it is just warm, and turpentine oil and varnish added to it in the required proportions and the entire mixture is well stirred.

Surface shall be prepared as described under French polishing except that the final rubbing shall be done with sand paper which has been slightly moistened with linseed oil.

Mixture or polish shall be applied evenly, with a clean cloth pad in such a way that no blank patches are left and rubbed continuously for half an hour. When the surface is quite dry a second coat shall be applied in the same manner and rubbed continuously for an hour or until the surface is dry. Final coat shall then be applied and rubbed for two hours or more if necessary, until the surface has assumed a uniform gloss and is quite dry showing no sign of sickness when touched. Gloss of the polish depends on the amount of rubbing, therefore rubbing must be continuous and with uniform pressure and frequent change in direction.

Varnishing : (LOW VOC AS PER GREEN BUILDING NORMS)

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Surface shall be prepared as described above. After preparation of surface, two coats of clean boiled linseed oil shall be applied at sufficient interval of time. After the linseed oil has dried two coats of varnish obtained from approved manufacturer shall be applied at sufficient interval of time. If the surface fails to produce the required gloss an additional coat shall be applied without any extra cost.

GENERAL DEVELOPMENT AND ROAD WORK

EXCAVATION : As described previously

FILLING : As described previously

DRY RUBBLE PACKING : As described previously

Dry Rubble Pitching:

The pitching shall consist of large stones, regular in shape, as far as possible, and no stone shall be less than 20 cm. x 20 cm. on face and depth shall be as specified in the item. The edges of the stone shall be dressed even and regular by hammer and shall be laid regularly and evenly breaking joint as much as possible and shall be beaten down with heavy hammer so as to be embedded into the earth. The interstices between the stones shall be carefully filled in with stone chips, closely and firmly packed and well driven with hammer. Loose stone in packing shall on no account be allowed. The entire surface shall be thoroughly rammed, set in place and made compact with a log hammer so that the surface of entire pitching when completed shall be flat and even.

Water Bound Macadam:

6 cm. to 7.5 cm. size hand broken metal shall be spread over the prepared base to a thickness of 12 cm. The metal layer shall then be rolled and compacted by an 8 to 10-ton power roller. The thickness of the compacted layer after completing all the operations described below shall not be less than 7.5 cm.

Rolling shall start from edge of road and proceed towards the crown in longitudinal strips overlapping on successive strips by at least one half the width of the rear wheel of the roller. The operation shall continue till no visible settlement of the metal or movement under the roller is observed. The gradient and camber shall be checked from time to time by means of level stakes, strings camber board etc. Any depression or hump shall be corrected by removing completely the metal layer there at and rolling the same satisfactorily till refusal.

After the dry rolling is completed either murum or stone dust, grit or sand shall be spread. Moderate sprinkling of water and rolling shall be continued and stone dust shall again be spread if required till all voids are completely filled and movement of metal under the wheel ceases. If there is excess powder the same shall be removed by light brooming. The surface shall be checked for camber etc. The unevenness or undulations shall be rectified as required. The whole surface shall be then watered and extra powder added if required, brushed and rolled to obtain mosaic surface. This surface shall be maintained till an upper layer is laid.

The rate of spreading either hard core or earth shall not be less than 0.3 cum. to 0.35 cum. per 10 sqm. area. The first layer of either murum / stone / grit / sand shall not be spread over a wet or watered metal layer.

FULL - GROUT**Spreading of Metal:**

2.5 cm. to 4 cm. size stone metal shall be spread to a loose thickness of 10 cm. And compacted to a thickness of about 7.5 cm. by 8-ton power roller.

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Applied Bitumen:

Bitumen 30/40 penetration of approved manufacturer, heated to a temperature of 200 C. (400 F) shall be applied hot by means of a pressure distributor or hand spray at the rate of 65 kg. / 10 sqm.

Blinding the Surface:

Immediately following the application of bitumen and while it is still hot, key aggregate 12 mm. size shall be evenly spread at the rate of 0.2 cum. / 10 sqm. After spreading the aggregate, the whole area shall be thoroughly rolled with a six to eight-ton power roller. It is important that this rolling shall be done when the bitumen is still movement under the roller.

Protection of the Surface:

The surface shall be protected from all traffic.

SEMI - GROUT

Spreading of Metal:

2.5 cm. to 4 cm. size stone metal shall be spread to a loose thickness of 7.5 cm. thick and compacted to a thickness of about 5 cm. by 8-ton power roller.

Applied Bitumen:

Bitumen 30/40 penetration of approved manufacturer, heated to a temperature of 200 C. (400 F) shall be applied hot by means of a pressure distributor or hand spray at the rate of 25 kg. / 10 sqm.

Blinding the Surface :

As in Full-Grout.

Seal Coat (For Full Grout and Semi Grout Surface) :

The surface shall be brushed free of any loose blindage, taking care that the brushing is not so severe as to remove the blindage but of the voids into which it is set. The surface shall then be tested for depression, which shall be made up by painting with bitumen 30/40 penetration and blinding with aggregate of a size, equivalent to the depth of depression.

Application of Bitumen:

Bitumen 80/100 penetration of approved manufacturer, heated to a temperature of 177 to 190 C. (350 to 375 F) shall than be applied evenly to the road surface by means of a pressure distributor or hand-spray at the rate of 12.5 kg. / 10 sqm.

Blinding and Final Consolidation:

While the bitumen is still hot the surface shall be blinded evenly with stone aggregate of 6 mm. and down gauge size. The blindage shall be clean and not contain any dust and the rate of application shall be 0.1 cum. per 10 sqm.

After spreading of the blindage, the road shall be given a final rolling with a eight-ton power. Any soft or depressions detected at a later date shall be made up as directed by the Architect without any extra cost.

Premix Asphalt Carpet:

The rate shall include preparation of surface.

Preparation of Surface:

Clean the surface with wire brush and dust it with gunny bags. All pot holes, depressions and corrugations shall be made good and applying a tack coat of 80/100 penetration

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bitumen heated to 177 to 191 C. and the depressions made up with suitable size premix aggregate and consolidated by approved means. The surface shall then be painted with 80/100 penetration bitumen heated to 177 to 191 C. at the rate of 7.5 kgs. Per 10 sqm.

Preparation of Premix:

Premix shall be prepared as under:
2.5 cm. thick consolidated.

No	Item of Work	Per 100 Sft.	Per 1000 Sft.
1	Stone metal 2 cm. (3/4")	5 Cft.	15.25 Cum.
2	Stone chips 10 mm. (3/8")	3 Cft.	9 Cum.
3	Grit / sand (of desired grade and quality)	4 Cft.	12 Cum.
4	Asphalt 80/100 penetration from approved manufacturer heated to 177 C.	50 lbs.	2450 Kgs.
5	Solvent*	3 lbs.	150 Kgs.
6	Filler	Either clean lime stone powder or Hydrated lime in desired quantity	

4 cm. thick consolidated (to be done in 2 courses) Base Course (2.5 cm. Thick)

No	Item of Work	Per 100 Sft.	Per 1000 Sft.
1	Stone metal 2.5 cm. (1")	8 Cft.	24.5 Cum.
2	Stone chips 12 mm. (1/2")	4 Cft.	12 Cum.
3	Asphalt 60/70 penetration from approved manufacturer heated to 177 C.	36 lbs.	1760 Kgs.
4	Filler	As Above	

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Wearing Course (1.5 cm. Thick)

No	Item of Work	Per 100 Sft.	Per 1000 Sft.
1	Stone metal 12 cm. (1/2")	5 Cft.	15.25 Cum.
2	Stone metal 6 mm. (1/4")	2 Cft.	6 Cum.
3	Asphalt 60/70 or 80/100 penetration from approved manufacturer heated to 177 C	22 lbs.	1075 Kgs.
4	Solvent*	1.5 Lbs.	65 Kgs
5	Filler	As Above	

The quantity of solvent may vary depending upon the local weather conditions. Use of solvent and its quantity shall be determined by the Architects before commencement of the work. Batches should be proportioned in accordance with the capacity of the mixer being used. Place clean stone metal and chips in the mixer. Add 2/3 of the batch of quantity of the hot asphalt at the designed temperature along with solvent and mix well. Add grit / sand and filler and continue mixing until the sand / grit is uniformly disturbed throughout the mix. The add remaining quantity of hot asphalt and continue mixing till the whole mix is uniform and homogenous. If desired, the sand / grit shall be heated before use. The mix shall then be carried to the place of deposition by means of wheel barrows.

The proportion suggested above should in the normal course give a dense mix. If necessary the proportions may be varied to obtain a dense mix, at the discretion of the Architects, at no extra cost.

Laying of Premix:

The mix shall be laid to a uniform thickness and to proper level, grade and camber and rolled with six to eight-ton power roller. The surface shall be checked for grade and camber during rolling and premix added and removed as required. The thickness shall be as specified after consolidation. When the base course is rolled the wearing, course is laid similarly and rolled to give a consolidated thickness as specified in the time.

Premixed Seal Coat:

After the premix carpet is laid the surface shall be sealed with premix grit prepared as described under wearing course above with a suitable cutback added. The premixed seal must be brushed in to fill the interstices, additional material being applied during rolling if found necessary. The quantity of premixed seal shall be approximately 0.15 cum. Per 10 cum. The surface shall be finally dusted with stone powder and rolled to give a smooth finish.

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Road Concrete:

Specification for aggregate cement and concreting shall be as specified in the section under "Materials".

Before concreting, the surface shall be checked for the given profile. Wooden forms equal to the depth road slab thickness shall be erected to correct line and level and held by stakes driven into the ground along the outside edge at suitable intervals and two stakes being placed at each joint. Forms should be supported, strengthened or braced, whenever necessary so that they are able to prevent deformation and resist deformation under pressure of concrete or impact of tamping or vibrating. Working faces of all forms shall be thoroughly cleaned and oiled before use and forms which are used more than once, shall be carefully examined and trued, if necessary, before re-use.

Sub-grade shall be properly moistened before any concrete is deposited on it; care being taken to see that there are no standing pools of water. It may be advisable to have the sub grade watered 12 to 24 hours in advance of placing concrete. Concrete shall be laid in alternate bays not exceeding 30 sqm.

Concrete shall be deposited on sub-grade for the entire width of the slab and shall be kept sufficiently above the level of forms so that when tamped, it becomes a dense mass.

I.R.C. fabric reinforcement, if specified, shall be placed in correct position before commencing concreting.

The concrete shall be brought to the specified contour by means of heavy screed or tamper handles weighing not less than 10 kgs. / Meter and not less than 7.5 cm. wide or surface vibrator if directed by the Architects. This screed or tamper may be steel. It shall be drawn with a saw in motion in combination with a series of lefts and drops. At transverse joint tamper shall be drawn not closer than one meter towards the joint and shall then be lifted and set down at the joint and drawn backwards away therefrom. Surplus concrete shall then be taken up with shovels and thrown ahead of the joint. Immediately after the screeding or tamping has been completed the surface shall be inspected for high and low spots and any needed correction made by adding or removing concrete. The entire surface shall then be floated with hand floats one meter long and 7.5 cm. wide and this operation must be performed from bridge provided across the slab. The surface shall be roughened by brooming.

The longitudinal and transverse edges of the slab shall be properly formed with suitable tools and the same should be rounded to 10 mm. radius.

The finished surface of the slab must conform to the grade, alignment and contours as directed and cured for fourteen days.

After curing period is over the joints shall be filled up with approved bitumastic filler. Unless otherwise specified, the rate shall include filling of joints as specified.

STORM WATER DRAINAGE

The work shall be carried out in accordance with rules and regulations of local Drainage Authority. Necessary provision for sight rails, boning staves etc. shall be made.

Tests regarding watertightness of joint and cleanliness of pipes shall be performed before the trenches are covered.

Work of laying pipe lines and provided Manholes, Chambers, etc., shall include necessary excavation in any strata including old foundations of any description, refilling the trenches in layers of 20 cm. watering and consolidation.

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Pipes:

All Hume pipes (Reinforced) shall conform to the relevant I.S.S. and shall be new, perfectly sound, free from cracks, cylindrical, straight and of specified nominal diameter. They shall be made of reinforced cement concrete manufactured by centrifugal or spun process and shall have even texture.

Trenches:

The trenches for laying shall be excavated to lines and levels as directed. The bed of the trench shall be truly and evenly dressed throughout from one change of grade to the next.

The gradient is to be set out by means of boning rods and should the required depth be exceeded at any point; the trench shall be brought to proper grade by means of cement or lime concrete of the specification of the bed concrete without any extra cost.

The bed of the trench, if in soft or made-up earth, shall be well watered and rammed and depressions thus formed filled with sand or other suitable materials as directed by the Architects.

If rock is met with, it will be removed to 15 cm. below the level of the pipe and the trench will be refilled with bed concrete, sand or other suitable material approved by the Architects.

The trench shall be kept free from water. Shoring and timbering shall be provided wherever required.

The width of trench shall be nominal diameter of the pipe plus 38 cm. but it shall not be less than 52 cm.

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Laying of Pipes:

No concreting is ordinarily necessary. In cases where the soil is made up is very soft, concreting may be resorted to form the bed of the trench below the pipe, if directed by the Architects at no extra cost.

The pipes shall be carefully laid to levels and gradients shown in the plans and sections. Great care shall be taken to prevent sand etc., from entering the pipes. The pipes between two manholes shall be laid truly in straight lines without vertical or horizontal undulations. The body of the pipe shall for its entire length on an even bed in the trench and places shall be excavated to receive the collar for the purpose of jointing.

Jointing:

A few skeins of spun soaked in neat cement wash shall be inserted in the groove at the end of the pipe and the two adjoining pipes butted against each other. The collar shall then be slipped over the joint, covering equally both the pipes. Spun yarn soaked in neat cement wash shall be passed round the pipes and inserted in the joint by means of caulking tools from ends of the collar. More skeins of yarn shall be added and well rammed above.

The object of the yarn is to center the two ends of the pipes within the collar and to prevent the cement mortar of the joint penetrating into the pipes.

Cement mortar with one part of cement and one part of sand shall be slightly moistened and must on no account be soft or sloppy and shall be carefully inserted by hand in to the joint and more cement mortar added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall be finished off neatly outside the collar on both sides at an angle of 45.

Any surplus mortar projecting inside the joint is to be removed and to guard against any such projections sack or gunny bag shall be drawn past each joint after completion. Cement mortar joint shall be cured at least for seven days.

Testing:

All joints shall be tested to a head of 60 cm. of water above the top of the highest pipe between two manholes.

The lowest end of the pipe shall be plugged watertight. Water shall then be filled in manhole at the upper end of the line.

The depth of water in the manhole shall be 60 cm. plus the diameter of the pipe. The joint shall then be examined. Any joint found leaking or sweating shall be remade and embedded into 15 cm. layer of cement concrete (1:2:4) 30 cm. in length and the joint retested without any extra cost.

Manholes:

Size of manholes shall be as specified in the item and the sizes specified shall be internal size of the manhole. The work shall be done strictly as per standard drawing and specifications.

Bed Concrete:

Shall be in 1:4:8 cement concrete 23 cm. (9") thick.

Brick Work:

Shall be with best quality local bricks and proportion of mortar shall be 1:4 unless otherwise specified.

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Plaster:

Inside of the walls shall be plastered with 12 mm. thick cement plaster 1:3 and finished with floating coat of neat cement. The external face shall be pointed with 1:3 cement mortar.

Benching:

Channels and benching shall be done in cement concrete 1:2:4 rendered smooth with neat cement.

Foot Rests:

M.S. square rods of 22 mm. (7/8") diameter or C.I. rungs shall be embedded in masonry where the depth of manhole exceeds one meter and they shall be fixed 35 cm. apart and projecting 11 cm. from the wall. Foot rests shall be painted with bitumen as directed.

Manhole Covers:

Covers for manhole in the road proper shall not be less than 200 kgs. on footpaths and backyards. Lightweight covers shall be used whose weight for 45 cm. dia. shall not be less than 58 kgs. and that of 90 cm. x 45 cm. or 61 cm. x 45 cm. 90 kgs.

Drop Connection:

The case of drop connection C.I. pipes shall be provided with heel rest bend at the bottom and bend with access door at the top for cleaning purposes. The pipe shall be encased in 1:3:6 plain concrete.

Miscellaneous Items of Work:

The rates quoted by the Contractor for all miscellaneous items of work viz. Cooking platforms, moories, built-in cupboards, counters, partitions, railings, electrical meter, switchboard cupboards, etc., shall be for the work as described in the schedule of quantities and as show in detailed drawings and shall be to the entire satisfaction of the Architects.

Construction of Multi-Storey Building Vadodara Doors and Windows

Functional Need of WINDOW

1. Windows should be fabricated with “Fusion welded corners”. The Mullion /Transom can be either Fusion welded or mechanically joined with desired sealing.
2. Windows / doors must conform to the strength requirements based on wind load as per IS 875-3.
3. Appropriate thickness of steel reinforcement should be selected to meet the desired strength. The reinforcement must be installed within 6 to 50mm distance from the face of the weld.
4. For window size $\leq 1500\text{mm}$ tolerance is $\pm 3.0\text{mm}$ and sizes above $\geq 1500\text{ mm}$ tolerances $\pm 5.0\text{mm}$ on both height and width.
5. The window diagonal should be less than equal to 5mm for window up to 1500mm, above 1500mm, the diagonal difference should not be more than 10mm
6. The minimum overlap of sashes on Frame/ mullion should be 5mm, higher overlap is desirable.
7. Water drainage / ventilation slot should be provided in sash / frames as described in section 9 of relevant IS standard
8. Min Gap of 3mm should be maintained per face between aperture and window to allow expansion / contraction of uPVC windows
9. The gap between window and its aperture should be filled with weatherable & elastic material to allow expansion / contraction of PVC and performance over period of years.
10. Material Description: The Windows shall be manufactured using Rigid uPVC profile sections, using GI reinforcement.
11. Fabrication Description: uPVC Window, size as per drawing of wall thickness $1.2\text{mm} \pm 0.25\text{mm}$ made out of extruded section plain uPVC sections.
12. The window frame made out of rigid uPVC sections meter cut at 4 corners & joint with plastic fusion welding with internal reinforce required.
13. The shutter section made out of extruded rigid uPVC with internal reinforced with provision of 5mm glaze/wire mesh as per requirement.
14. The window shall be fixed to the wall using 65x100mm long M.S. fasteners at suitable place provided for each vertical and horizontal member etc. complete as per manufacture’s specification and direction of Engineer-in-charge.
15. All the surface of Window should be uniform smooth finish and free from crack and seam. Passing joints shall be finished ensuring that no gaps are visible.
16. Tolerance: All Dimensions (except thickness of profile sections) shall be as per drawing 1.2mm thickness should be in $\pm 0.25\text{mm}$.
17. Measurement: The unit of measurement shall be in square meter or square feet.

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18. Payment: Price shall be covering the fabrication, handling and installation including labor, material and equipment. Manufacture should provide maintenance manual and basic material test report for certification.

Technical Specifications For Fixed Furniture

SCOPE OF WORK: The work covered in this specification include providing, fixing and furnishing the Wardrobes, Overhead cabinets at given locations, as glass panes / wooden to teak wood or ply doors, strictly in accordance with the specifications and detailed drawings. Wardrobes, cabinets, etc. shall be fabricated and assembled in the workshop as far as practicable and then brought inside the building ready to set in place. The various members shall be worked in the best manner known to the trade, mortised and tenured, doweled, blocked and glued together so as to avoid the use of nails as far as possible. The details shall be closely followed, molding clearly cut and miters accurately made. Free edge of shutters, shelves, partitions, sides etc. shall be provided with first class rubber wood edging, glued and nailed in approved manner.

Preservative treatment: All wood work in contract with masonry shall be painted with approved asphalt or anti termite & fire-retardant coating before placing. Care shall be taken to keep exposed surfaces clear from tar etc. Felt shall be used to isolated wood from masonry wherever practicable. All concealed wood etc. shall be treated fully and liberally with lignum before placing in position.

Painting and Polishing: All exposed teak faces of partitions, glazing, doors, cabinet work etc. shall be painted / polished to approve finish. Door shutters, internal faces of cupboards and cabinets etc. shall be enamel painted to approve finish. All the paints & polishes should be of LOW VOC content as per Green building norms.

Protection of work: The contractor shall be responsible for the temporary doors and closing in opening necessary for the protection of the work during progress. He shall also provide and maintain any other temporary.

General Requirements:

1. All teak wood shall be of medium seasoned teak, free from sap, knots, cracks and shall be of lighter grains and shall be of approved range. If required, teak wood shall be tested in laboratories at Contractors expenditure. All Sal wood shall be seasoned, free from sap, knots and cracks and as per approved sample.
2. All teak wood, plywood's and any other wood used in the work shall be coated with approved quality anti-termite i.e. Touch wood or approved equivalent type. At site with a test certificate at contractors expenditure.
3. All door shutters shall be fitted with approved fittings.
4. All screws shall be machine made and of approved equivalent make.
5. Even if it is not mentioned in the specifications / drawings, it should be clearly understood that all open edges of fitted plywood (i.e. door, cupboard, shutter, drawers etc.) shall be provided with teak wood beadings. All teak wood beadings shall match laminate shade or in approved finish.
6. The rate quoted in all the items shall include the cost of all fixtures, materials, manufacturing, transportation, installation, sales tax and other taxes if any etc. All partitions / paneling shall have provisions for conducts of electricity/ telephone/

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computer / audio- visual / Fire alarm / Intercom etc.

7. No work shall be executed at the site without prior approval of samples of all parts.

Note : Regarding the availability of the material and that only materials called for under preference shall be supplied and installed. In the event of the materials of make called for are not available and alternative makes are approved for incorporation in the work, the rates quoted shall be suitable amended bases on the price variation between the specified marks and alternative makes on the day the alternative makes are accepted.

Material :

The material shall conform to IS:2095.

□ Plywood /Plywood Boards : Plywood boards are formed by gluing and pressing three or more layers of veneers with the grains of adjacent veneers running at right angles to each other. The veneers shall be either rotary cut or sliced and shall be sufficiently smooth to permit an even spread of glue. Face veneers may be either decorative on both sides or one side commercial and the other decorative. Plywood shall be of BWP grade.

□ Adhesive: Adhesive used for bonding BWP grade of plywood boards shall be BWP type synthetic resins conforming to IS 848 .

□ Thickness: Plywood boards shall be as mentioned in the specified item / detailed drawings. Tolerance in thickness shall be $\pm 10\%$ for boards up to and including 5 mm; $\pm 7\%$ for boards from 6 to 9 mm and $\pm 5\%$ for boards above 9 mm thickness. The boards shall be of uniform thickness and the surfaces of the boards shall be sanded to a smooth finish. Number of plies in plywood boards shall be as per the drawings.

□ Moisture content of the plywood boards when tested in accordance with IS 1734 (Part 1) shall not be less than 5 per cent and not more than 15 per cent.

□ Testing: One sample for every 100 sqm or part thereof shall be taken and testing done as per IS 303. However, testing may not be done if the total requirement of plywood boards is less than 30 sqm. All the samples tested shall meet the requirements of physical and mechanical properties of plywood boards

□ Particle Boards: Particle boards shall be of medium density and manufactured from particles of agro waste, wood or lignocelluloses i.e. material blended with adhesive and formed into solid panels under the influence of heat, moisture, pressure etc. The particle boards shall be flat pressed three layered or graded and of Grade-I as per Table 1 of IS 3087. Both surfaces of the boards shall be sanded to obtain a smooth finish and shall conform to IS 3087.

□ Thickness and Tolerance: Thickness of particle boards shall be as specified. Tolerance in thickness shall be $\pm 5\%$ for boards up to and including 25 mm thick and ± 2.5 per cent for boards above 25 mm thickness. Each board shall be of uniform thickness.

Testing: One sample for every 100 sqm or part thereof shall be taken and testing done as per IS 3087. However, testing may not be done if the total requirement of particle boards in a work is less than 30 sqm. All the samples tested shall meet the requirement of physical and mechanical properties of particle boards specified.

BLOCK BOARD:

Block boards have a solid core made up of uniform strip of wood each not exceeding 25mm in width, laid separately, or spot glued, or otherwise joined to form a slab which is glued. Between two or more outer veneers, with the direction of the grain of the core block running at right angles to that of adjacent veneers, in any one block board, the core strips shall be of one species of timber only. Face veneers may be decorative on one face and commercial on the other, Block boards shall be Grade I (Exterior Grade) as per IS : 1659. Both surfaces of the boards shall be sanded to a smooth finish.

Adhesives: the adhesives used for bonding shall be BWP type synthetic resin confirming to IS:848 for Grade I block boards.

Thickness and Tolerance: Block boards are available in thickness ranging from 12 to 50 mm. Tolerance in thickness shall be +5% for boards up to and including 25 mm thickness. Each board shall be of uniform thickness.

Testing: One sample for every 100 sqm or part thereof shall be taken and testing done as per IS: 1659. However, testing may not be done if the total requirement of block boards is less than 30 sqm. All the samples tested must meet the requirements of physical and mechanical properties of block boards specified in the relevant B.I.S. code Type of face veneers, thickness and grade of block boards shall be specified unless otherwise stated, grade I (exterior grade) block board bonded with BWP grade be used.

Laying

□ Panels are stored in a dry place and water should not come in contact with panels during or after construction. If the panels get wet, they should be dried before use.

□ The floor should be perfectly level before laying the first course. All panels must be properly aligned to the plumb. Successive layer of panels must be alternatively staggered so that vertical joints are not in the same line.

□ The recommended quantity of Gypsum Bonding Plaster must be used for joints and filling the grooves made for conduits, pipelines, etc. Excess Bonding Plaster must be scooped and removed, so that the joints and the places where the grooves are filled in are flush and even.

□ The walls should be dry and sanding done properly especially at joints before the primer is applied so that the surface is even and joints will not be visible after painting. Avoid chasing with chisel and hammer. Use electrical saw or grooving tools for conduiting etc.

□ The recommended span of walls is maximum 6 meters and maximum height is 4.5 meters

□ Gypsum panel can easily be cut with coarse tooth hand saw, electric jigsaw, etc. The panels can be cut, sawn, drilled, milled or dowelled on the job. For concealed piping and conduit, the depth of groove should not exceed 50 mm. Hammer and chisel techniques to form chases must be avoided.

Sanding: This application is to make the surface level without undulations. To make the gypsum wall surface level (in particular at joints, where there is excess bonding

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plaster), do sanding with sand paper at joints and other places, wherever you find uneven surface, otherwise joints will be visible after painting. It is important to sand all joints uniformly.

Primer Application: The purpose of the primer is to give a better adhesion to the paint and also to reduce consumption of paint on the wall. Water thinable (Low VOC) primers shall be used only.

WBP Glue Line -- BS 1088 plywood must use an adhesive, which has been proven to be highly resistant to weather, micro-organisms, cold and boiling water, steam and dry heat. The product's bonding must pass a series of BS tests. **Face Veneers** -- These must present a solid surface that is free from open defects.

Face veneers-- must be free of knots other than "sound pin" knots, of which there shall be no more than six(6) in any area of one(1) square foot, and there can be no more than an average of two(2) such knots per square foot area over the entire surface of the plywood sheet. The veneers must be reasonably free from irregular grain. The use of edge joints is limited, and end joints are not allowed.

Core Veneers -- Core veneers have the same basic requirements as face veneers, except that small splits are allowed, and there is no limit on the number of pin knots or edge joints. However, end joints are not permitted.

Limits of Manufacturing Defects -- Defective bonds, pleats and overlaps, and gaps in faces are not permitted. Occasional gaps may be repaired using veneer inserts bonded with the proper adhesive.

Moisture Content -- BS 1088 plywood must have moisture content between 6% and 14% when it leaves the factory.

Length & Width -- The length or width of a board produced as a standard size shall not be less than the specified size nor more than 6.3 mm (0.25") greater than the specified size. The lengths of the diagonals of a board shall not differ by more than 0.25% of the length of the diagonal.

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MATERIAL TEST LIST

The Contractors will have to take necessary material test as per I.S. code, which is applicable, at their own cost for the following materials or any other material using in construction work periodically or as and when required by the Architects / Consulting Engineer.

The materials should be got tested in an approved Laboratory as per IS standard and test reports in duplicate should be submitted to the Architect's Office.

Sr. No	Material	Tests to be Carried out
1	Sand	a) Silt Content.
		b) Bulking.
		c) Particle size distribution.
		d) Or as directed.
2	Stone Aggregates	a) Soft and deleterious Material
		b) Particle Size Distribution
3	Cement Concrete RCC Mix Design	a) Slump
		b) Cube Strength
		c) Or as per IS456-2000
4	Bricks/Blocks	a) Dimensions
		b) Water absorption and fluorescence.
		c) Compressive Strength
5	Timber	Moisture
6	Ceramic/Vitrified Floor Tiles	a) Transverse Test
		b) Water absorption
		c) Abrasion Test
7	Steel	a) Tensile Strength
		b) Ductility

Note: The Contractor will have to take necessary material test other than above test as per relevant I.S. code, if required and as directed by APMCF / SBI.

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MATERIAL TESTING FREQUENCY CHART

A chart showing the recommended time and quantity scheduled for conducting test on various building materials is given. Please ensure that tests are carried out according to the above guidelines. Contractor's rate should include for necessary expenditure for testing including transport of samples of following tests.

Sr. No.	Material	Test.	Frequency of Testing	Remarks.
1.	Sand	i)Fineness Modulus. ii)Silt Content.	At the beginning & if there is change in source.	
2.	Masonry Stone.	i)Comp. strength. ii)Specific Gravity. iii)Water Absorption.	A set of 5 stones for each quarry & for doubtful quality.	
3.	Metal.	i)Crushing Value. ii)Impact Value. iii)Abrasion value. iv)Water Absorption. v)Flakiness Index. vi)Stripping value. vii)Gradation.	One test per 200 cum or part thereof.	I.S. 2386 Part-II.
4.	Bricks.	i)Crushing Strength. ii)Water Absorption.	A set of 15 Bricks for each 50,000 bricks or part thereof.	I.S.1077
5.	Flooring Tiles.	i)Flexural strength. ii)Water Absorption.	A set of 12 Tiles for each 2,000 Tiles or part thereof.	I.S.1237-1989.
6.	Glazed Tiles	Water Absorption.	A set of 16 Tiles for each 2000 Tiles or part thereof.	IS 13630 (Parts 1 to 15) : 2006
7.	Design Mix	For Every Grade of Concrete	Initially and on every source change of materials	IS-456 & MORTH 1700 Structural Concrete

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Sr. No	Material	Test.	Frequency of Testing	Remarks.
8.	Cement Concrete.	i) Slump ii) Cube/Compressive Strength	For Each Batch Up to 5 cum. 1set. 6-15 cum- 2 sets. 16-30 cum- 3 sets. 31-50 cum- 4 sets. 51 & above-4sets + 1 additional set foreach additional 50 cum or part thereof.	IS 456
9.	Cement.	i) Comp. strength. ii) Initial setting time. iii) Final setting time. iv) Specific Gravity. v) Soundness. vi) Fineness.	One test for each consignment of 50 M.T. (1000 bags) or part thereof.	I.S.269-12269.
10.	Steel.	i) Wt. per meter. ii) Ultimate Tensile stress. iii) Yield stress. iv) Elongation. v) Chemical Test	As Specified in clause no 64 of Special Conditions of Contract.	I.S.432.
11.	AAC Block	i) Density Test ii) Compressive Strength. Thermal Conductivity Drying Shrinkage	Every lot of 10000 Nos Every lot of 10000 Nos Every lot of 10000 Nos Every lot of 10000 Nos	IS 6441 (Part-I) & IS : 2185 (Part 3 j -1984
12.	Paving Block	i)Compressive Strength ii)Water Absorption	Every lot Every lot	IS 15658 : 2021
13.	Aluminum Section	i) Thickness, Mass Per Running meter ii) Test on Powder Coating	Test to be carried as per IS codes & Instructions of Engineer In-charge.	IS: 1081-1960 IS 1949 (1961) IS 1948:1961

Note : The Contractor will have to take necessary material test other than above test as per I.S. code for above material or other than above material, if required and as directed by the APMCF / SBI.

The contractor shall install testing equipment as per requirement on site. The contractor shall ensure and certify the calibration of the equipment so installed and shall maintain the same in working order throughout the period of construction.

The contractor shall also provide the necessary trained staff for carrying out such tests for

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using such equipment.

The tests shall be carried out under the supervision of the Engineer-in-charge. 70% of the total tests to be done is to be carried out on site laboratory if the facilities are available as per tender terms and conditions, remaining 15% tests is to be carried out at govt./ Semi Govt. laboratory and 15% tests is to be carried out at Govt. recognized/NABL accredited laboratory.

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THEORETICAL CEMENT CONSUMPTION STATEMENT (BASE CPWD)

No	Description of item of work.	Quantity of cement to be used per Unit Quantity of work.	Unit.
1	Cement Concrete (Cast in Situ) Plain or Reinforced.		
a.	1:1:2 (1 Cement: 1 Sand :2 Graded Aggregate).	12.20 Bags.	Cubic Meter
b.	1:1.5:3(1 Cement:1.5 sand:3 Graded Aggregate).	8.00 Bags.	Cubic Meter
c.	1:2:4 (1 Cement: 2 Sand :4 Graded Aggregate).	6.40 Bags.	Cubic Meter
d.	1:3:6 (1 Cement: 3 Sand :6 Graded Aggregate).	4.40 Bags.	Cubic Meter
e.	1:4:8 (1 Cement: 4 Sand :8 Graded Aggregate).	3.40 Bags.	Cubic Meter
f.	1:5:10(1 Cement: 5 Sand :10 Graded Aggregate).	2.60 Bags.	Cubic Meter
g.	Providing and laying cement concrete 1:2:4 (1 Cement: 2 Coarse Sand: 4 Graded Aggregate of 20 mm. nominal size) including finishing exposed surface with 6 mm. thick cement mortar 1:3 (1 Cement: 3 Fine Sand). Krebs, Steps, and the like.	7.02 Bags.	Cubic Meter
h.	String or lacing courses, parapets, coping, bed blocks, anchor blocks, plain window sills and the like moldings in cornices, window sills etc.	7.62 Bags.	Cubic Meter
1.1	Ready Mix/Design mix Concrete M20 & Above Grades	As per Approved Design Mix /RMC Batch Report	As per Approved Design Mix /RMC Batch Report
2.	Cement Mortar		
a.	1:1 (1Cement: 1 Sand)	20.40 Bags.	Cubic Meter
b.	1:2 (1Cement: 2 Sand)	13.60 Bags.	Cubic Meter
c.	1:3 (1Cement: 3 Sand)	10.20 Bags.	Cubic Meter
d.	1:4 (1Cement: 4 Sand)	7.60 Bags.	Cubic Meter
e.	1:5 (1Cement: 5 Sand)	6.20 Bags.	Cubic Meter
f.	1:6 (1Cement: 6 Sand)	5.00 Bags.	Cubic Meter
g.	1:2 (1Cement: 2 Stone Dust)	13.60 Bags.	Cubic Meter
h.	1:2 (1Cement: 2 Marble Dust)	13.60 Bags.	Cubic Meter
i.	1:5 (1Cement: 5 Marble Dust)	6.20 Bags.	Cubic Meter
j.	1:1:3 (1Cement: 1 Marble Dust: 3 Stone Dust)	7.60 Bags.	Cubic Meter

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k.	White Cement Mortar 1:2 (1 White Cement: 2 Marble Dust)	13.60 Bags.	Cubic Meter
l.	White Cement Mortar 1:3 (1 White Cement: 3 Marble Dust)	10.20 Bags.	Cubic Meter
m.	White Cement Mortar 1:5 (1 White Cement: 5 Marble Dust)	6.20 Bags.	Cubic Meter
3.	Cement Lime Mortar		
a.	1:1:3 (1 Cement:1 Lime putty:3 Sand)	8.20 Bags.	Cubic Meter
b.	1:1:6 (1 Cement:1 Lime putty:6 Sand)	5.00 Bags.	Cubic Meter
4.	Brick Work in All Classes		
a.	In Cement Mortar 1:3 (1 Cement:3 Sand)	2.56 Bags.	Cubic Meter
b.	In Cement Mortar 1:4 (1 Cement:4 Sand)	1.90 Bags.	Cubic Meter
c.	In Cement Mortar 1:5 (1 Cement:5 Sand)	1.56 Bags.	Cubic Meter
d.	In Cement Mortar 1:6 (1 Cement:6 Sand)	1.24 Bags.	Cubic Meter
5.	Half Brick Work in All Classes		
a.	In Cement Mortar 1:3 (1 Cement:3 Sand) With or without hoop iron.	28.56 Bags per 100 Square Meter	
b.	In Cement Mortar 1:4 (1 Cement:4 Sand)	21.28 Bags per 100 Square Meter	
c.	In Cement Mortar 1:5 (1 Cement:5 Sand)	14.50 Bags per 100 Square Meter	
d.	Molding and cornices in brick masonry in cement mortar 1:4 Cement:4 Sand) Joining old brick work with new brick work.	0.18 Bags per 100 Square Meter per cm. Girth	
	a) Old Brick in metric or FPS. System with new brick work in metric system in cement mortar 1:4 (1 Cement: 4 Sand).	4.20 Bags per 100 Square Meter	
	b) Old Brick work in FPS. System with new brick work in cement mortar 1:4 (1 Cement: 4 Sand).	5.44 Bags per 100 Square Meter	
6.	Random Rubble Masonry		
a.	Cement Mortar 1:6 (1 Cement: 6 Sand)	1.70 Bags.	Cubic Meter
b.	Cement Lime Mortar 1:1:8 (1 Cement: 1 Lime Putty: 8 Sand)	1.32 Bags.	Cubic Meter
7.	Coursed Rubble Masonry		
a.	Cement Mortar 1:6 (1 Cement: 6 Sand)	1.50 Bags.	Cubic Meter

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8.	Ashlar Masonry In plain ashlar punched (ordinary) in superstructure in cement mortar 1:6 (1 Cement: 6 Sand) including pointing with cement mortar 1:2 (1Cement:6 Stone dust) with an admixture of pigment matching the stone shade.	1.08 Bags.	Cubic Meter
9.	Stone Veneering Work For wall lining etc., average thickness 40 mm. to 170 mm. in cement lime mortar 1:1:6 (1Cement:1 Lime Putty:6 Sand) including pointing in White cement mortar 1:2 (1 White Cement: 2 Stone Dust) with an admixture of pigment matching the stone shade.	17.50 Bags per 100 Square Meter	
10.	Marble work in steps jambs, walls, pillars and other plain work in cement mortar 1:4 (1 Cement: 4 Sand) including pointing in White cement mortar 1:2 (1 Cement: 2 Marble dust).	0.136 Bags per 1.52 Bags per	Cubic Meter (Grey Cement) Cubic Meter (White Cement)
11.	Marble work in steps jambs, walls, pillars and other plain work in cement mortar 1:4 (1 Cement: 4 Sand) including pointing in cement mortar (1 Cement : 2 Marble dust).	1.66 Bags per	Cubic Meter
12.	Marble work for wall lining (Veneer) work) 2.5 cm. thick in cement mortar 1:3 (1 Cement : 3 Sand) including pointing in White cement mortar 1:2 (1 Cement : 2 Marble dust).	1.1. Bags per 100 Square Meter (Grey Cement) a. Bags per 100 Square Meter (White Cement)	
13.	Marble work for wall lining (Veneer) work) 2.5 cm. thick in cement mortar 1:3 (1 Cement : 3 Sand) including pointing in cement mortar 1:2 (1 Cement : 2 Marble dust).	17.68 Bags per	Square Meter
14.	Marble work for wall lining (Veneer) work) 4 cm. thick in cement mortar 1:3 (1 Cement : 3 Sand) including pointing in White cement mortar 1:2 (1 Cement : 2 Marble dust).	20.40 Bags per 100 Square Meter. (Grey Cement) 1.1. Bags per 100 Square Meter (White Cement)	
15.	Marble work for wall lining (Veneer) work) 4 cm. thick in cement mortar 1:3 (1 Cement : 3 Sand) including pointing in cement mortar 1:2 (1 Cement : 2 Marble dust).	23.80 Bags per 100 Square Meter.	

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16.	Cement Concrete Flooring Flooring 1:2:4 (1 Cement: 2 Sand : 4 Graded Stone Aggregate) finished with a floating coat of neat cement including cement slurry rounding of edges and strips etc., but excluding cost of nosing of steps etc., complete.		
a.	25 mm. thick with 20 mm. nominal size stone aggregate.	0.244 Bags	Square Meter
b.	40 mm. thick with 20 mm. nominal size stone aggregate.	0.34 Bags	Square Meter
c.	50 mm. thick with 20 mm. nominal size stone aggregate.	0.404 Bags	Square Meter
d.	75 mm. thick with 20 mm. nominal size stone aggregate.	0.564 Bags	Square Meter
17.	Cement Plaster Skirting (up to 30 cm. height) with cement mortar 1:3 (1 Cement: 3 Coarse Sand) finished with a floating coat of neat cement including rounding of junctions with floor, including slurry complete.		
a.	18 mm. thick.	0.32 Bags	Square Meter
b.	21 mm. thick.	0.35 Bags	Square Meter
18.	Pavement (25 to 50 mm. thick) with 1:2:4 (1 Cement: 2 Coarse Sand : 4 Graded Stone Aggregate 20 mm. nominal size) including finishing complete.	6.80 Bags	Cubic Meter
19.	Terrazzo Flooring 40 mm. thick marble chips flooring rubbed and polished to granolithic finish, under layer 34 mm. thick cement concrete 1:2:4 (1 Cement: 2 Coarse Sand: 4 Graded Stone Aggregate 12.5 mm. nominal size) and top layer 6 mm. thick with white, black or white and black marble chips of size 1 mm. to 4 mm. nominal size laid in cement marble powder 3:1 mix. (3 Cement: 1 Marble Powder) by weight in proportion of 4:7 (4 Cement marble powder) by weight in marble powder mix:7 Marble chips) by volume including cement slurry etc., complete.		
a.	Dark shade / Light shade pigment with ordinary cement.	0.339 Bags per	Square Meter
b.	Light shade pigment with white cement.	0.258 Bags per 0.081 Bags per	Square Meter (Grey Cement) (White Cement)

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c.	Medium shade pigment with approximately 50% white cement and 50% ordinary cement.	0.298 Bags Per 0.0440 Bags per	Square Meter (Grey Cement) (White Cement)
20	40 mm. thick marble chips flooring rubbed and polished to granolithic finish, under layer 31 mm. thick cement concrete 1:2:4 (1 Cement: 2 Coarse Sand: 4 Graded Stone Aggregate 12.5 mm. nominal size) and top layer 9 mm. thick marble chips, chips, size 4 to 7 mm. size, laid in cement marble powder mix. 3:1) (3 Cement : 1 Marble Powder) by volume in proportion of 4:7 (4 Cement marble powder mix. 7 Marble chips) by volume including cement slurry etc., complete.		
a.	Dark shade / Light shade pigment with ordinary cement.	0.357 Bags	Square Meter
b.	Light shade pigment with white cement.	0.241 Bags 0.116 Bags	Square Meter (Grey Cement) Square Meter (White Cement)
c.	Medium shade pigment with approximately 50% white cement and 50% ordinary cement.	0.299 Bags 0.058 Bags	Square Meter (Grey Cement) Square Meter (White Cement)
21	40 mm. thick marble chips flooring rubbed and polished to granolithic finish, under layer 28 mm. thick cement concrete 1:2:4 (1 Cement: 2 Coarse Sand: 4 Graded Stone Aggregate 12.5 mm. nominal size) and top layer 9 mm. thick marble chips, chips, sizes 7 mm to 10 mm. nominal size, laid in cement marble powder mix. 3:1) by weight in proportion of 2:3 (2 Cement Marble Powder mix. 3 Marble Chips) by volume including cement slurry etc., complete.		
a.	Dark or Light shade pigments with grey cement.	0.381 Bags	Square Meter
b.	Light shade pigment or without any pigment with white cement.	0.219 Bags 0.162 Bags	Square Meter (Grey Cement) Square Meter (White Cement)
c.	Medium shade pigment with approximately 50% grey cement and 50% white cement.	0.300 Bags 0.081 Bags	S.M. (Grey Cement) S.M. (White Cement)
22	Marble chips skirting (up to 300 mm high) rubbed and polished to granolithic finish top layer 6 mm.		

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	thick marble chips of sizes from smallest to 4 mm. nominal size laid to cement marble powder mix. 3:1 (3 Cement: 1 Marble Powder mix. By weight in proportion of 4:7 (4 Cement Marble Powder mix: 7 marble chips) by volume including cement slurry complete.		
a.	18 mm. thick with under layer 12 mm. thick cement plaster 1:3 (1 Cement: 3 Coarse Sand) dark or light shade pigment with grey cement.	0.298 Bags	Square Meter
b.	Light shade pigment or no pigment with cement.	0.217 Bags Per Square Meter (Grey Cement) 0.081 Bags Per Square Meter (White Cement)	
c.	Medium shade colour pigment with 50% grey cement and 50% white cement.	0.258 Bags Per Square Meter (Grey Cement) 0.0406 Bags Per Square Meter (White Cement)	
d.	21 mm. thick with under layer 15 mm. thick cement plaster 1:3 (1 Cement: 3 Course Sand) dark or light shade pigment with grey cement.	0.327 Bags	Square Meter
e.	Light shade pigment or no pigment with white cement.	0.246 Bags Per Square Meter (Grey Cement) 0.081 Bags Per Square Meter (White Cement)	
f.	Medium shade pigment with 50% grey cement and 50% white cement.	0.286 Bags Per Square Meter (Grey Cement) 0.04 Bags Per Square Meter (White Cement)	
23.	Tile Flooring:		
a.	Precast terrazzo tiles 20 mm. thick white, black or white and black marble chips of size up to 6 mm. laid in floors treads of steps and landings jointed with neat cement slurry mixed with pigment to match the shade of the tile including rubbing polishing with precast tiles of 30 mm. thick bed of lime mortar 1:1.2 or 1:3 light shade using white cement.	0.088 Bags Per Square Meter (Grey Cement) 0.088 Bags Per Square Meter (White Cement)	
b.	Medium shade colour pigment with 50% white cement and 50% grey cement.	0.132 Bags Per Square Meter (Grey Cement) 0.044 Bags Per Square Meter (White Cement)	

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c.	Dark shades using ordinary cement precast terrazzo tiles 20 mm. thick with marble chips of size 6 mm. in skirting and risers of steps not exceeding 30 cm. in height on wall, laid on 12 mm. thick cement plaster 1:3 mix. (1 Cement: 3 Sand) joint with neat cement slurry, light shades using white cement.	0.235 Bags Per Square Meter (Grey Cement) 0.044 Bags Per Square Meter (White Cement)	
d.	Medium shade colour pigment with 50% white cement and 50% ordinary cement.	0.257 Bags Per Square Meter (Grey Cement) 0.022 Bags Per Square Meter (White Cement)	
e.	Dark shades using ordinary cement.	0.279 Bags	Square Meter
24.	Checkered Terrazzo Tile Flooring		
a.	Checkered Terrazzo Tile 22 mm. thick with marble chips of sizes up to 6 mm. in floors, jointed with neat cement slurry mixed with pigment to match the shade of the tiles including robbing, polishing complete on 28 mm. thick bed of lime mortar 1:1.2 or 1:3.		
a.	Light shade using white cement.	0.088 Bags Per Square Meter (Grey Cement) 0.096 Bags Per Square Meter (White Cement)	
b.	Medium shades using 50% grey cement and 50% white cement.	0.136 Bags Per Square Meter (Grey Cement) 0.048 Bags Per Square Meter (White Cement)	
c.	Dark shade using grey cement.	0.184 Bags Per Square Meter (Grey Cement)	
d.	Checkered Terrazzo Tile 30 mm. thick with marble chips of sizes up to 6 mm. in stairs, treads, jointed with neat cement slurry mixed with pigment to match the shade of the tiles including rubbing polishing rounding of nosing etc., complete on 20 mm. bed of : Lime mortar 1:1:1 (1 Lime putty:1 Surkhi:1 Coarse Sand) :		
i.	Light shade using white cement.	0.088 Bags Per Square Meter (Grey Cement) 0.136 Bags Per Square Meter (White Cement)	
ii.	Medium shades using 50% grey cement and 50% white cement.	0.154 Bags Per Square Meter (Grey Cement) 0.066 Bags Per Square Meter (White Cement)	
iii.	Dark shade using grey cement.	0.220 Bags Per Square Meter (Grey Cement)	
e.	Cement mortar 1 :4 (1 Cement :4 Coarse Sand)		
i.	Light shade using white cement.	0.258 Bags Per Square Meter (Grey Cement) 0.132 Bags Per Square Meter (White Cement)	

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ii.	Medium shades using 50% grey cement and 50% white cement.	0.324 Bags Per Square Meter (Grey Cement) 0.066 Bags Per Square Meter (White Cement)
iii.	Dark shade using grey cement.	0.39 Bags Square Meter (Grey Cement)
25.	White Glazed Tiles.	
	White Glazed Tiles 5,6 or 7 mm. thick in flooring treads risers of steps skirting and dado on 12 mm. thick cement plaster 1:3 (1 Cement: 3 sand) in base and cement joined with white cement slurry etc. complete.	0.188 Bags Per Square Meter (Grey Cement) 0.050 Bags Per Square Meter (White Cement)
26.	Marble Stone Flooring	
	Marble Stone slab flooring over 20 mm. thick base of lime mortar 1:1:1 (1 Lime putty:1 Surkhi:1 Sand) and jointed with grey cement slurry etc. (all marble slabs).	
a.	20 mm. thick	0.098 Bags Per Square Meter
b.	30 mm. thick	0.102 Bags Per Square Meter
c.	40 mm. thick	0.107 Bags Per Square Meter
	Marble stone slab flooring over 20 mm. thick base of cement mortar 1:4 (1 Cement:4 Sand) and jointed with grey cement slurry etc., (all marble slabs).	
d.	20 mm. thick	0.268 Bags Per Square Meter
e.	30 mm. thick	0.273 Bags Per Square Meter
f.	40 mm. thick	0.277 Bags Per Square Meter
g.	Extra if white cement slurry is used instead of grey cement slurry in joints of marble stone flooring.	0.015 Bags Per Square Meter (White Cement)
h.	Marble slabs 30 mm. thick in risers of steps, skirting dado, wall and pillars, laid on 12 mm. thick cement mortar 1:3 (1 Cement : 3 Sand) and jointed with grey cement slurry.	0.246 Bags Per Square Meter (White Cement)
27.	Kotah Stone Flooring	
	Kotah stone slab flooring over 20 mm. thick base of lime mortar 1:1:1 (1 Lime putty:1 Surkhi:1 Sand) and jointed with neat cement slurry etc.	
a.	25 mm. thick	0.128 Bags Per Square Meter
b.	30 mm. thick	0.136 Bags Per Square Meter
c.	40 mm. thick	0.152 Bags Per Square Meter
	Kotah Stone slab flooring over 20 mm. thick base of cement mortar 1:4 (1 Cement:4 Sand) and jointed with neat cement slurry etc.	

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d.	25 mm. thick	0.298 Bags Per Square Meter
e.	30 mm. thick	0.306 Bags Per Square Meter
f.	40 mm. thick	0.322 Bags Per Square Meter
g.	Kotah stone slab 25 mm. thick risers of steps, skirting, dado and pillar laid on 12 mm. thick cement mortar 1:3 (1 Cement:3 Sand) and jointed with neat cement slurry etc.	0.275 Bags Per Square Meter
28	Sandstone Flooring	
a.	40 mm. thick sandstone flooring over 20 mm. thick base of cement mortar 1:5 (1 Cement :5 Sand) with joints finish flush.	0.155 Bags Per Square Meter
b.	40 mm. thick sand stone flooring over 20 mm. thick base of cement mortar 1:5 (1 Cement :5 Sand) including pointing with cement mortar 1:2 (1 Cement: 2 Stone Dust).	0.186 Bags Per Square Meter
c.	40 mm. thick sandstone flooring over 20 mm. thick base of lime mortar 1:1:1 (1 Lime :1 Surkhi:1 Sand) including pointing with cement plaster 1:2 (1 Cement :2 Stone Dust).	0.031 Bags Per Square Meter
d.	40 mm. thick fine dressed and rubbed stone flooring over 20 mm. thick base of cement mortar 1:5 (1 Cement :5 Sand) with joints 5 mm. thick finished flush.	0.166 Bags Per Square Meter
e.	40 mm. thick fine dressed and rubbed stone flooring over 20 mm. thick base of lime mortar 1:5 (1 Cement : 5 Sand) with joints 5 mm. thick including pointing with cement mortar 1:2 (1 Cement : 2 Stone Dust).	0.196 Bags Per Square Meter
f.	25 mm. thick cast iron grid flooring using grid tiles of required size weighing 47 kg. per square meter on bed of 12 mm. thick cement concrete 1:2 (1 Cement : 2 Stone Aggregate 6 mm. nominal size) including filling the hollows with cement concrete same mix and tamping with 10 mm. dia. iron bars and grouting the joints with neat cement slurry complete.	0.025 Bags Per Square Meter

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g.	Filling cement concrete 1:2:4 (1 Cement :2 Coarse Sand : 4 Graded Stone Aggregate 12.5 mm. nominal size) in gaps of A.C.Sheet corrugations and wings of ridges.	3.82 Bags Per Square Meter
29.	Cement Plaster	
a.	12 mm. 1:3 (1 Cement: 3 Sand).	14.68 Per 100 Square Meter
b.	12 mm. 1:4 (1 Cement: 4 Sand).	10.94 Per 100 Square Meter
c.	12 mm. 1:5 (1 Cement: 5 Sand).	8.92 Per 100 Square Meter
d.	12 mm. 1:6 (1 Cement: 5 Sand).	7.20 Per 100 Square Meter
e.	15 mm. 1:3 (1 Cement: 3 Sand).	17.54 Per 100 Square Meter
f.	15 mm. 1:4 (1 Cement: 4 Sand).	12.08 Per 100 Square Meter
g.	15 mm. 1:5 (1 Cement: 5 Sand).	10.66 Per 100 Square Meter
h.	12 mm. 1:6 (1 Cement: 6 Sand).	8.60 Per 100 Square Meter
i.	20 mm. 1:3 (1 Cement: 3 Sand).	22.84 Per 100 Square Meter
j.	20mm. 1:4 (1 Cement: 4 Sand).	17.02 Per 100 Square Meter
k.	20 mm. 1:5 (1 Cement: 5 Sand).	13.88 Per 100 Square Meter
l.	20 mm. 1:6 (1 Cement: 6 Sand).	11.20 Per 100 Square Meter
30.	Cement Plaster with a Floating Coat of neat cement	
a.	12 mm. 1:3 (1 Cement: 3 Sand).	19.08 Per 100 Square Meter
b.	12 mm. 1:4 (1 Cement: 4 Sand).	15.34 Per 100 Square Meter
c.	12 mm. 1:3 (1 Cement: 3 Sand).	21.94 Per 100 Square Meter
d.	12 mm. 1:4 (1 Cement: 4 Sand).	17.48 Per 100 Square Meter
e.	15 mm. 1:3 (1 Cement: 3 Sand).	27.24 Per 100 Square Meter
f.	15 mm. 1:4 (1 Cement: 4 Sand).	21.42 Per 100 Square Meter
31.	Cement Plaster in two coats	
a.	20 mm. Cement Plaster in two coats under layer 12 mm. cement plaster 1:4 (1 Cement :4 Sand) finished with a top layer 8 mm. thick cement plaster 1:3 (1 Cement: 3 Sand)	20.00 Bags per 100 Square Meter
b.	18 mm. thick Cement Plaster in two coats under layer 12 mm. thick cement plaster 1:5 (1 Cement :5 Sand) finished with a top layer 6 mm. thick cement plaster 1:3 (1 Cement: 3 Sand)	16.26 Bags per 100 Square Meter
32.	6 mm. Cement Plaster	
a.	6 mm. Cement Plaster to ceiling 1:3 (1 Cement :3 Sand)	7.34 Bags per 100 Square Meter
b.	6 mm. Cement Plaster to ceiling 1:4 (1 Cement :4 Sand)	5.48 Bags per 100 Square Meter
c.	6 mm. Cement Plaster to ceiling 1:3 (1 Cement :3 Sand) finished with a floating coat of neat cement.	11.74 Bags per 100 Square Meter
d.	Neat Cement Punning.	4.40 Bags per 100 Square Meter
33.	Sand Cement Neeru Finished Plaster	

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a.	Sand cement smooth neeru finished plaster for ceiling in cement mortar mix 1:4 (1 Cement :4 Sand), 10 to 15 mm. thick average, finished top smooth with neeru.	13.00 Bags per 100 Square Meter
b.	Sand cement smooth neeru finished plaster for walls in cement mortar mix 1:4 (1 Cement :4 Sand), 18 to 20 mm. thick average, finished top smooth with neeru.	19.00 Bags per 100 Square Meter
34.	Rough Cast Plaster	
	Rough Cast Plaster with a mixture of sand and gravel or crushed stone from 2.36 mm. to 12.5 mm. nominal size dashed over and including the fresh plaster in two layers, top layer 10 mm. cement plaster 1:3 (1 Cement: 3 Sand) mixed with 10% finely ground hydrated lime by volume of cement and under layer 12 mm. cement plaster : 1:4 (1 Cement: 4 Sand)	
a.	With ordinary cement finish or cement pigment finish.	23.18 Bags per 100 Square Meter
b.	With white cement and pigment finish.	10.94 Bags Per 100 Sqm. (Grey Cement) 12.24 Bags Per 100 Sqm. (White Cement)
	1:5 Cement Sand (1 Cement:5 Sand)	
c.	With ordinary cement finish or cement and pigment finish.	21.16 Bags Per 100 Sqm. (Grey Cement)
d.	With white cement and pigment finish.	8.92 Bags Per 100 Sqm. (Grey Cement) 12.24 Bags Per 100 Sqm. (White Cement)
35.	Pointing on Stonework	
a.	Flush or ruled pointing on stone work with cement mortar 1:3 (1 Cement: 3 Sand)	2.34 Bags per 100 Square Meter
b.	Raised and cut pointing in stone work with cement mortar 1:3 (1 Cement: 3 Sand)	3.88 Bags per 100 Square Meter
36.	Waterproofing	
a.	Proprietary waterproofing treatment to the terrace with brickbat coba, cement base.	55.00 Bags per 100 Square Meter
b.	Proprietary waterproofing treatment to the canopy with brickbat coba, cement base.	45.00 Bags per 100 Square Meter
c.	Waterproofing chajja with sand cement plaster average 25 mm. thick in cement mortar 1:3 (1 Cement :3 Sand)	25.00 Bags per 100 Square Meter

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d.	Proprietary waterproofing treatment to the sunk portion of toilet, cement base.	30.00 Bags per 100 Square Meter
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No	Description of item of work.	Quantity of cement to be used per Unit Quantity of work.	Unit.
1.	Cast Iron Pipes		
	Providing and fixing on wall face C.I. rain water pipes including filling the joints with spun yarn soaked in neat cement slurry and cement mortar 1:2 (1 Cement: 2 Sand)		
a.	75 mm. dia pipe	0.132 Bags per 100 Running Meter	
b.	105 mm. dia pipe	0.176 Bags per 100 Running Meter	
c.	150 mm. dia pipe	0.264 Bags per 100 Running Meter	
2.	Cast Iron Accessories		
	Providing and fixing on wall face C.I. Accessories for rain water pipes including filling the joints with spun yarn soaked in neat cement slurry and cement mortar 1:2 (1 Cement : 2 Fine Sand)		
a.	75 mm. dia pipe C.I. Plain bend.	0.0052	Each
b.	100 mm. dia pipe C.I. Plain bend.	0.0062	Each
c.	150 mm. dia pipe C.I. Plain bend.	0.010	Each
d.	75 mm. dia C.I. head flat or corner type.	0.003	Each
e.	100 mm. dia C.I. head flat or corner type.	0.003	Each
f.	150 mm. dia C.I. head flat or corner type.	0.0052	Each
g.	75 mm. dia C.I. plain shoe.	0.003	Each
h.	100 mm. dia C.I. plain shoe.	0.003	Each
i.	150 mm. dia C.I. plain shoe.	0.0052	Each
j.	75 mm. dia C.I. single branch (plain)	0.0052	Each
k.	100 mm. dia C.I. single branch (plain)	0.0062	Each
l.	150 mm. dia C.I. single branch (plain)	0.0010	Each
m.	75 mm. dia C.I. double branch (plain)	0.008	Each
n.	100 mm. dia C.I. double branch (plain)	0.009	Each
o.	150 mm. dia C.I. double branch (plain)	0.0052	Each
p.	C.I. off-sets (plain) 75 mm. dia. 50 mm. projection.	0.0052	Each
q.	C.I. off-sets (plain) 75 mm. dia. 150 mm. projection.	0.0052	Each
r.	C.I. off-sets (plain) 100 mm. dia. 50 mm. projection.	0.0052	Each
s.	C.I. off-sets (plain) 100 mm. dia. 50 mm. projection.	0.0062	Each

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	mm. projection.				
t.	C.I. off-sets (plain) 100 mm. dia. 750 mm. projection.	0.0062			Each
3.	A.C. Fittings & Pipes				
	Providing and fixing on wall face asbestos cement rainwater pipes including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 Cement 2 Coarse Sand) complete.				
a.	50 mm. dia.	0.150			Per 100 Running Meter
b.	80 mm. dia.	0.250			Per 100 Running Meter
c.	100 mm. dia.	0.300			Per 100 Running Meter
d.	150 mm. dia.	0.320			Per 100 Running Meter
e.	Providing and fixing A.C. Pipe (or any diameter) wall plugs and standard holder bat clamps comprising of two semi-circular halves of flat and cast-iron base screwed on wooden plugs.	0.0004			Per 100 Running Meter
f.	Providing and fixing on wall face asbestos cement rainwater pipes including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 Cement 2 Coarse Sand) complete.				
		50 mm. (2")	80 mm. (3")	100 mm. (4")	Unit
g.	Bend of required degree with door or without door.	0.0072	0.012	0.015	Each
h.	Off-set 52.2 mm. projection.	0.0058	0.0090	0.0116	Each
i.	Off-set 76.2 mm. projection.	0.0058	0.0090	0.011	Each
j.	Off-set 114.3 mm. projection.	0.0058	0.0090	0.0116	Each
k.	Off-set 152.4 mm. projection.	0.0058	0.0090	0.0116	Each
l.	Off-set 228.6 mm. projection.	0.0058	0.0090	0.0116	Each
m.	Off-set 304.8 mm. projection.	--	0.0090	0.0116	Each
n.	Off-set 457.2 mm. projection.	--	0.0090	0.0116	Each
o.	Off-set 609.6 mm. projection.	--	--	0.0116	Each
p.	Junction equal single of required degree with or without door.	0.0072	0.0116	0.0146	Each
q.	Junction equal double with or without door or required degree.	0.0108	0.0174	0.0220	Each
r.	Standard shoe.	0.00400	0.0058	0.0058	Each
4.	Sanitary Fittings				
a.	Fixing long pan pattern or Orissa pattern squatting pan or pedestal type water closet 12.5 liters or 15 liters flushing cistern and brackets, telescopic flush pipe or bend with fittings and clamps,	0.10			Each

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	overflow pipe with specials and mosquito proof coupling complete including cutting and making good the walls and floors.		
	Fixing flat back or wall corner type, lipped front, urinal basin of 430 x 260 x 350 mm. and 340 x 430 x 265 mm. size respectively, white glazed earthenware with automatic C.I. flushing cistern with fittings, brackets, standard size flush pipe and spreaders with brass union and G.I. clamps complete including painting of cistern and fittings, cutting and making good the walls and floors.	0.050	Each
b.	One urinal basin with 5 liters C.I. automatic flushing cistern.	0.050	Each
c.	Range of two urinal basins with 10 liters C.I. automatic flushing cistern.	0.08	Each
d.	Range of three urinal basins with 10 liters C.I. automatic flushing cistern.	0.134	Each
e.	Range of four urinal basins with 15 liters C.I. automatic flushing cistern.	0.190	Each
	Fixing white glazed fire clay stall urinal with automatic C.I. flushing cistern with fittings R.S. or C.I. brackets standard size C.P. brass flush pipe and spreaders with unions and clamps, C.I. trap with outlet grating and other coupling in C.P. brass including painting of cistern and fittings, cutting and making good the walls and floors.		
f.	Single stall urinal with 5 liters C.I. automatic flushing cistern.	0.102	Each
g.	Range of two urinal basins with 10 liters C.I. automatic flushing cistern.	0.204	Each
h.	Range of three urinal basins with 10 liters C.I. automatic flushing cistern.	0.306 Bags	Each
i.	Range of four urinal basins with 15 liters C.I. automatic flushing cistern.	0.406 Bags	Each
	Fixing one-piece construction white squatting plate urinal with an integral longitudinal flushing pipe 100 mm. dia. half round channel automatic C.I. flushing cistern with fittings R.S. or C.I. brackets, standard size. G.I. flush pipe for back and front flush with standard spreader pipes with fittings G.I. clamps, white vitreous tiling 1200 mm. high to the front and side walls with white vitreous china corners and angles set in neat cement,		

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	standard urinals C.I. trap 65 mm. diameter with vent arm and outlet grating and coupling in C.P. brass complete, including painting the cistern and fittings and making good the walls and floors.		
j.	Single squatting plate with 5 liters C.I. automatic flushing cistern.	0.102 Bags	Each
k.	Range of two squatting plates with 10 liters C.I. automatic flushing cistern.	0.204 Bags	Each
l.	Range of three squatting plates with 10 liters C.I. automatic flushing cistern.	0.306 Bags	Each
m.	Range of four squatting plates with 15 liters C.I. automatic flushing cistern.	0.406 Bags	Each
n.	Fixing lavatory basin with brackets, pillar taps, rubber plug, waste of standard pattern, trap and unions complete including cutting and making good the walls.	0.050 Bags	Each
o.	Fixing white pedestal for wash basin completely recessed at the back for reception of pipes and fittings.	0.032 Bags	Each
p.	Fixing sink with brackets, 40 mm. rubber plus, brass chain, waste, trap with necessary unions complete including cutting and making good the walls.	0.050 Bags	Each
q.	Fixing teal-wood draining board with skirting and beading, wax polished with brackets painted white complete including making good the walls.	0.028 Bags	Each
5.	Sanitary Fittings (Items separately ordered)		
a.	Fixing long pan pattern or Orissa pattern squatting, or pedestal type W.C. pan.	0.050 Bags	Each
b.	Fixing a pair of white glazed earthenware or vitreous china footrests of standard pattern for Indian type W.C. pan.	0.010 Bags	Each
c.	Fixing flat back or wall corner type lipped front urinal basin of 430 x 260 x 350 mm. and 340 x 430 x 265 mm.	0.020 Bags	Each
d.	Fixing white glazed fire clay stall urinal of standard size.	0.04 Bags	Each
e.	Fixing white squatting plate urinal with integral longitudinal flush pipe. .	0.040 Bags	Each
f.	Fixing wash basin including making all connections excluding cost of fittings.	0.030 Bags	Each

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g.	Fixing kitchen sink including making all connections complete.	0.030 Bags	Each
h.	Fixing in position 32 mm. diameter galvanised steel telescopic flush pipe complete including cutting and making good the walls and floor.	0.020 Bags	Each
6.	Sand Cast Iron Pipe and Fittings		
a.	Fixing M.S. holder bat clamp to 100 mm. dia. sand cast iron pipe embedded in cement concrete blocks 10 x 10 x 10 cm. of cement concrete 1:2:4 (1 Cement: 2 Sand : 4 Stone Aggregate) including cost of cutting holes and making good the walls etc.	0.010 Bags	Each
b.	Fixing M.S. stays and clamps for 100 mm. diameter sand cast iron pipe.	0.010 Bags	Each
c.	Fixing M.S. holder bat clamps for 50 mm. diameter sand cast iron pipe embedded in cement concrete block 10 x 10 x 10 cm. of 1:2:4 (1 Cement: 2 Sand : 4 Stone Aggregate) including cost of cutting holes and making good the walls etc.	0.010 Bags	Each
d.	Fixing M.S. stays and clamps for 50 mm. diameter sand cast iron pipe.	0.010 Bags	Each
e.	Fixing sand cast iron trap 100 mm. inlet 100 mm. outlet of self-cleaning design with sand cast iron screwed down or hinged grating with or without vent arm complete including cost of cutting without and making good the walls and floor.	0.050 Bags	Each
f.	Fixing 100 mm. inlet and 50 mm. outlet sand cast iron floor trap of self-cleaning design with sand cast iron screwed down or hinged grating with or without vent arm complete including cost of cutting and making good the walls and floors.	0.050 Bags	Each
7.	Asbestos Cement Soil, Waste and Vent Pipes and Fittings		
	Providing and fixing on wall face asbestos cement soil waste and vent pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 Cement: 2 Sand) complete.		
a.	For 100 mm. diameter.	0.300 Bags	100 Meter
b.	For 50 mm. diameter.	0.150 Bags	100 Meter
	Fixing wooden plugs and standards holder bat clamps comprising of two semicircular halves of flat iron and cast-iron base screwed on wooden plugs.		

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c.	For 100 mm. diameter.	0.0004 Bags	Each
d.	For 50 mm. diameter.	0.0004 Bags	Each
	Providing and fixing A.C. bends of required degree with access door insertion rubber washer 3 mm. thick, bolts and nuts or plain bend of heel rest unitary bend including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 Cement: 2 Sand)		
e.	For 100 mm. diameter.	0.0020 Bags	Each
f.	For 50 mm. diameter.	0.0010 Bags	Each
	Providing and fixing double equal or unequal A.C. junctions of required degree plain or with access door, insertion, rubber washer 3 mm. thick bolts and nuts, including jointing with spun yarn cement mortar 1:2 (1 Cement: 2 Sand) complete.		
g.	100 x 100 x 100 x 100 mm. double equal junctions or 100 x 100 x 50 x 50 mm. double unequal junctions.	0.004 Bags	Each
h.	50 x 50 x 50 50 mm. double equal junctions.	0.002 Bags	Each
	Providing and fixing single equal or unequal A.C. junctions of required degree plain or with access door, insertion, rubber washer 3 mm. thick bolts and nuts, including jointing with spun yarn cement mortar 1:2 (1 Cement: 2 Sand) complete.		
i.	100 x 100 x 100 x 100 mm. single equal junctions or 100 x 100 x 50 x 50 mm. single unequal junctions.	0.0030 Bags	Each
j.	50 x 50 x 50 50 mm. single equal junctions.	0.0016 Bags	Each
	Providing and fixing plain A.C. invert branch of required degree including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 Cement: 2 sand).		
l.	50 x 50 x 50 x 50 mm.	0.002 Bags	Each
m.	50 x 50 x 50 x 50 mm.	0.0016 Bags	Each
	Providing and fixing A.C. offset including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 Cement: 2 Sand)		
n.	100 mm. dia. A.C. offset with any projection.	0.002 Bags	Each
o.	50 mm. dia. A.C. offset with any projection.	0.0010 Bags	Each
	Providing and fixing A.C. loose socket including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 Cement: 2 Sand)		

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	complete.		
p.	100 mm.	0.002 Bags	Each
q.	50 mm.	0.0010 Bags	Each
	Providing and fixing A.C. Terminal guard including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 Cement: 2 Sand).		
r.	100 mm.	0.002 Bags	Each
s.	50 mm.	0.0010 Bags	Each
t.	Cutting chase in brick masonry walls for fixing 100 mm diameter sand cast iron pipes and making good the same with brick work in cement mortar 1:3 (1 Cement: 3 Sand)	10.00 Bags	100 Meter
u	Cutting chase in brick masonry walls for fixing 50 mm. diameter sand cast iron pipes and making good the same with the brick work in cement mortar 1:3 (1 Cement: 3 Sand).	6.66 Bags	100 Meter
8.	Drainage		
	Jointing glazed stone ware pipes grade "A" with stiff mixture of cement mortar in the proportion of 1:1 (1 Cement: 1 Sand)		
a.	100 mm. dia.	4.34 Bags	100 Meter
b.	150 mm. dia.	6.46 Bags	100 Meter
c.	200 mm. dia.	8.66 Bags	100 Meter
d.	230 mm. dia.	9.74 Bags	100 Meter
e.	250 mm. dia.	10.80 Bags	100 Meter
f.	300 mm. dia.	12.94 Bags	100 Meter
g.	450 mm. dia.	19.54 Bags	100 Meter
	Laying cement concrete 1:5:10 (1 Cement: 5 Sand : 10 Graded Stone Aggregate 40 mm. nominal size) around S.W. pipe including bed concrete 15 cm. thick.:		
h.	100 mm. dia. S.W. Pipe.	47.32 Bags	100 Meter
i.	150 mm. dia. S.W. Pipe.	50.70 Bags	100 Meter
j.	200 mm. dia. S.W. Pipe.	58.24 Bags	100 Meter
k.	230 mm. dia. S.W. Pipe.	62.92 Bags	100 Meter
l.	250 mm. dia. S.W. Pipe.	66.04 Bags	100 Meter
m.	300 mm. dia. S.W. Pipe.	73.58 Bags	100 Meter
n.	350 mm. dia. S.W. Pipe.	81.12 Bags	100 Meter
o.	400 mm. dia. S.W. Pipe.	88.40 Bags	100 Meter
p.	450 mm. dia. S.W. Pipe.	96.20 Bags	100 Meter
	Laying cement concrete 1:5:10 (1 Cement: 5 Sand : 10 Graded Stone Aggregate 40 mm. nominal size) up to haunches of S.W. pipe including bed concrete 15 cm. thick.:		
q.	100 mm. dia. S.W. Pipe.	31.72 Bags	100 Meter
r.	150 mm. dia. S.W. Pipe.	34.84 Bags	100 Meter
s.	200 mm. dia. S.W. Pipe.	40.56 Bags	100 Meter
t.	230 mm. dia. S.W. Pipe.	44.20 Bags	100 Meter

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u.	250 mm. dia. S.W. Pipe.	46.54 Bags	100 Meter
v.	300 mm. dia. S.W. Pipe.	52.26 Bags	100 Meter
w.	350 mm. dia. S.W. Pipe.	58.24 Bags	100 Meter
x.	400 mm. dia. S.W. Pipe.	62.96 Bags	100 Meter
y.	450 mm. dia. S.W. Pipe.	69.94 Bags	100 Meter
z.	Laying light duty non-pressure NP2 or P1 class R.C.C. pipes with collars jointed with stiff mixture of cement mixture of cement mortar in the proportion of 1:2 (1 Cement: 2 Sand) including joints etc.		
Z1.	100 mm. dia. R.C.C. pipe (NP2) or (P1)	1.00 Bags	100 Meter
Z2.	150 mm. dia. R.C.C. pipe (NP2) or (P1)	1.20 Bags	100 Meter
Z3.	250 mm. dia. R.C.C. pipe (NP2) or (P1)	1.80 Bags	100 Meter
Z4.	300 mm. dia. R.C.C. pipe (NP2) or (P1)	2.20 Bags	100 Meter
Z5.	450 mm. dia. R.C.C. pipe (NP2) or (P1)	4.80 Bags	100 Meter
Z6.	500 mm. dia. R.C.C. pipe (NP2) or (P1)	5.20 Bags	100 Meter
Z7.	600 mm. dia. R.C.C. pipe (NP2) or (P1)	6.40 Bags	100 Meter
Z8.	700 mm. dia. R.C.C. pipe (NP2) or (P1)	7.40 Bags	100 Meter
Z9.	800 mm. dia. R.C.C. pipe (NP2) or (P1)	8.40 Bags	100 Meter
Z10.	900 mm. dia. R.C.C. pipe (NP2) or (P1)	9.80 Bags	100 Meter
Z11.	1000 mm. dia. R.C.C. pipe (NP2) or (P1)	11.00 Bags	100 Meter

B.TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS

SR.NO	PARTICULARS
1	General Instructions for Electrical Works
2	General Instructions for HT panel.
3	General Instructions for HT Cable.
4	Technical Specification for CSS With Dry Type Transformer.
5	Technical Specification for Diesel Generator.
6	Technical Specification for LT Panels.
7	Technical Specification for APFCR Panels.
8	Technical Specification for LDBs & PDBs.
9	Technical Specification for LT Cables & Cable Tray.
10	Technical Specification for Internal Wiring.
11	Technical Specification for Lighting Fixtures
12	Technical Specification for Earthing System.
13	Technical Specification for Lightning Protection system.
14	Technical Specification for External Lighting System.
15	Technical Specification for Lifts
16	Technical Specification for Solar Generation System
17	Technical Specification for Pumps & Accessories.
18	Technical Specification for Erection, Testing , Commissioning of Electric Equipments

1 GENERAL INSTRUCTIONS FOR ELECTRICAL WORKS

4) PREAMBLE :

The scope of this section is to describe materials and systems for electrical installation works which form together with the project documents, a complete volume of work and quality description.

All electrical installations shall be of high quality, safe, complete and fully operational including all necessary items and accessories whether or not specified in details. All electrical works shall be completed in accordance with the regulations and standards as per the statutory requirement to the satisfaction of the Employer. The general provisions, special provisions and general requirements apply to all items of this specification.

The work shall be carried out simultaneously with building work, civil work, etc. and shall be continued till it is completed satisfactorily along with the completion of essential portions of the building works.

During the progress of work, completed portion of the building may be occupied and be put to use by Employer but the contractor will remain fully responsible for the maintenance of electrical installations till the entire work covered by this contract is satisfactorily completed by him and handed over to Employer.

It is the intention of the specification and drawings to call for finished work, tested and ready for operation. Whenever the words "Supply" or "Provide" are used, it shall mean delivery of material as specified in an assembled manner, ready for installation. Any apparatus, material or work not shown on drawings but mentioned in the specification or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the contractor without additional expenses to Employer. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work and in the contract.

Electrical contractor shall be Class A licensed Contractor registered with R&B Department of Gujarat and shall have completion certificate of three similar project Electrical jobs completed of same cost in last 3 years.

Civil Contractor shall provide the MOU signed with Electrical contractor (Class A) with Technical bid during bidding process.

5) INTERPRETATION OF PROJECT DOCUMENTS :

The Specification, Drawings and Bill of quantity shall be interpreted in accordance with good installation practice defined in the appropriate regulations and standards whether specifically referred to or not. If there are any discrepancies or shortfall in the application of the regulations to any aspect of this contract or the contractor considers there is anything detrimental to the standards or inconsistent with his obligations and guarantees, Employer shall be informed prior to signing the contract and thereafter inform the contractor in writing the course to be followed. Where the drawings are to a small scale or are expressed in symbolic terms or are in the form of a diagram, then exact location of items shall not be inferred and in all cases, the work shall be fully integrated with the work of other traders and with the fabric of the building. The contractor shall appraise the duties of all plants and equipments taking account of any additions or variations and shall inform the Employer of any matters which may affect the design. In all cases the equipment installed shall be of appropriate rating for the duty it performs.

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The Specifications and bill of quantity shall be considered as part of this contract and any work or material shown on BOQ and not called for in the specification or vice versa, shall be executed as if specifically called for in both. The drawings indicate the extent and general arrangement of the Transformer, L.T. panel, H.T. & L.T. cable route layout etc. and are essentially diagrammatic.

The work shall be installed as indicated on the drawings, however, any minor changes found essential to co-ordinate the installations of this work with other services shall be made without any additional cost to the Employer. The drawings are for the guidance of the contractor, exact locations, distances and levels will be governed by the building. The contractor shall examine all structural and electrical drawings before starting the work, and report to Employer or its representative, any discrepancies, which in his opinion appear on them, and get them clarified.

If any discrepancy is noticed between General Conditions of Contract, specification, Bill of quantity and Drawings, the most stringent of the above shall apply. Bill of quantities, for electrical items, shall be read in conjunction with respective specification. However, in case of conflict between bill of quantities and the specification, former shall govern.

6) SYSTEM PARTICULARS :

LV	:	433 V, 3 Phase, 4 wire, 50 Hz.
Neutral earthing	:	Solid

7) ABBREVIATIONS :

The following abbreviations have been used in the accompanying specifications, drawings and bill of quantity.

IS	:	Indian Standard
BS	:	British Standard
HRC	:	High Rupturing Capacity
GI	:	Galvanised Iron
CU	:	Copper
MS	:	Mild Steel
MV	:	Medium Voltage
LV	:	Low Voltage
PVC	:	Polyvinyl Chloride
AMP	:	Amperes
V	:	Volts
KV	:	Kilo Volts
HV	:	High Voltage

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KW	:	Kilo Watt
KVA	:	Kilo Volt Ampere
PF	:	Power Factor
Hz	:	Frequency
KWH	:	Kilo Watt Hour
XLPE	:	Cross Linked Polyethelene
ACB	:	Air Circuit Breaker
LED	:	Light Emitting Diode
PLC	:	Programmable Logic Controller
UPS	:	Uninterrupted Power Supply
DP	:	Double Pole
IEE	:	Institute of Electrical Engineers, London
MCB	:	Miniature Circuit Breaker
TPN	:	Triple Pole and Neutral
SP	:	Single Pole
MCCB	:	Moulded Case Circuit Breaker
VCB	:	Vacuum Circuit Breaker
CT	:	Current Transformer
DB	:	Distribution Board
DG	:	Diesel Generator
BOQ	:	Bill of quantity
SITC	:	Supply, Installation, Testing and Commissioning
L.O.I.	:	Letter of Intent / Acceptance letter

8) REGULATIONS AND STANDARDS :

The installation shall conform in all respects to Indian Standard Code of Practice for Electrical Wiring Installation IS : 732-1983 and IS : 2214 - 1983 (Silver Nitrate Pure and analytical reagent). It shall also be in conformity with the current Indian Electricity, Rules, Indian Electricity Act, National Electrical Code and Regulations of the Local Electrical Supply Authority in so far as these become applicable to the installation. Wherever this specification calls for a

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higher standard of material and/or workmanship than those required by any of the above regulations then this specification shall take precedence over the said regulations and standard. In general, the materials equipment and workmanship not covered by the above shall conform to the relevant Indian Standards.

The electrical installation work shall follow Codes, Indian Standard specifications and rules (Within the best meaning of the same) under this contract.

The following list is given for general guidance only in addition to list given in each individual section, however all other latest editions of Codes, Indian Standard specifications and Rules shall also be followed when it is required.

IS : 8623	Low voltage switchgear & control gear assemblies
IS : 10118	Code of Practice for selection, installation and maintenance of switchgear and control gear
IS : 4237	General requirement for switch gear and control gear for voltage not exceeding 1000 Volt A.C. or 1200 Volt D.C.
IS : 13947	Low voltage switchgear and control gear
IS : 9224	Low voltage fuses
IS : 8828	Circuit breakers for out protection for household and similar installations
IS : 12640	Earth leakage circuit breaker
IS : 1248	Direct acting indicating analog electrical measuring instruments
IS : 2705	Current transformers
IS : 4201	Application guide for voltage transformers
IS : 6875	Control switches for voltage upto and indicating 1000 V A.C. and 1200 V D.C.
IS : 5578	Guide for marking of insulated conductors
IS : 11353	Guide for uniform system of marking and identification of conductors and apparatus transmission
IS : 8197	Terminal markings for electrical measuring instruments and their accessories
IS : 694	Specifications for PVC insulated cables for working voltage upto and including 1100 volts
IS : 2551	Danger notice plates
IS : 3043	Code of practice for earthing
IS : 5216	Guide for safety procedures and practices in electrical work

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IS : 1646 Code of practice for fire safety of building : Electrical
Installation

Indian Electricity Act as amended up to date

Indian Electricity Rules as amended up to date

Rules and Regulations of Bombay Regional Council of Fire Insurance & Association of
India for Electrical wiring.

9) ACTUAL ROUTE OF CABLE :

The location of the cables, panel boards etc. is only indicative, therefore, the actual route of cables and the location of panel boards may differ from the plans according to the details of the building construction and the conditions of executions of the installations.

The contractor shall supply and install at his expense all secondary materials and special fittings found necessary to overcome the interference and to supply the modifications on the route of cables and conduits that are found necessary during the work, to the complete satisfaction of the Employer's representative.

10) MATERIAL AND EQUIPMENT :

All material and equipment shall conform to the relevant standards and shall be new, good quality, of the approved make and design. The materials and equipment shall conform to relevant Indian Standards. The Contractor shall be responsible for the safe custody of all materials and shall insure them against theft, damage by fire, earthquake etc. A list of items of materials and equipment, together with sample of each shall be submitted to the Employer within 10 days of the award of the contract. Any item which is proposed as a substitute, shall be accompanied by all technical details giving sizes, particular of materials and the manufacturer's name and shall be submitted along with the tender or bid offer. At the time of the submission of proposed substitute the Contractor shall state the credit, if any due to the Employer. In the event the substitution is approved, all changes and substitutions shall be requested in writing and approvals obtained in writing from Employer. Employer's decision in the matter shall be final.

All materials of the same kind of service shall be identical and made by the same manufacturers. Any deviation to this rule shall be approved by the Consultant. Top priority shall be given to the products that have a permanent agent providing spare parts and maintenance facilities in the same city where the project is situated.

The makes of electrical equipments, components, accessories etc. have been mentioned in Tender document. However, Client / Electrical Consultant reserves the right to select from the specified make. Contractor shall clearly indicate in the bid document, the make they have considered. No extra claim shall be applicable if client / consultant suggests from the alternative make specified in the tender document.

11) MANUFACTURERS :

Where manufacturers have furnished specific instructions relating to the materials used in this job, covering points not specifically mentioned in these documents, these instructions shall be followed in all cases.

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Where manufacturer's names and/or catalogue numbers are given, this is an indication of the quality, standards and performance required.

When interfacing occurs, equipment shall be mutually compatible in all respects.

12) RATING :

Rating of all items shall be appropriate for the conditions on the particular site on which the items will be used. All the equipment shall be fit for continuous work under the worst conditions of site and shall be rated for the following ambient condition.

- Outdoor temperature 50 deg.c.
- Temperature under shed 45 deg.c.
- Salty, dusty and humid
- Coastal area

13) INSPECTION AND TESTING :

Employer's representative reserves the right to request inspection and testing at manufacturer's works at all reasonable times for this contract. Tests on site of completed works shall demonstrate, among other things :

1. That the equipment installed complies with specification in all particulars and is of the correct rating for the duty and site conditions.
2. That all items operate efficiently and quietly to meet the specified requirements.
3. That all circuits are correctly fused and protected and that protective devices are properly co-ordinated.
4. That all non current carrying metal work is properly and safely grounded in accordance with the specifications.
5. The contractor shall provide all necessary instruments and labour for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the Employer and shall provide test certificates signed by a properly authorised person. Such test certificates shall cover all works.
6. If tests fail to demonstrate the satisfactory nature of the installation or any part thereof then no claims for the extra cost of modifications, replacements or re-testing will be considered. Employer's decision as to what constitutes a satisfactory test shall be final.
7. The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

14) TEST CERTIFICATES :

The contractor shall submit test certificates for all the electrical material / system installed. These shall be issued by a government recognized inspection office certifying that all equipment, materials, construction and functions are in agreement with the requirements of these specifications, ISI and when ISI is not applicable other approved certifying agencies.

15) INSTRUCTION MANUAL :

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The contractor shall prepare and produce instruction, operation and maintenance manuals in English for the use, operation and maintenance of the supplied equipment and installations, and submit 3 sets to Employer, at the time of handing over.

16) SAMPLES AND CATALOGUES :

Before ordering the material necessary for these installations, the contractor shall submit to Employer for approval, a sample of every kind of material such as cables, conductors, conduits, switches, socket outlets, circuit breakers, lighting fixtures, boxes etc. along with the catalogues.

For big items such as switchboards, the submission of catalogues shall be enough. Prior to ordering any electrical equipment / material / system, the contractor shall submit to Employer, the catalogues, alongwith the samples, atleast from three different manufacturers. After the selection of manufacturer by Employer, the contractor shall arrange inspection and testing at the manufacturer's factory or assembly shop for final approval. No material shall be procured prior to the approval of the Electrical consultant & Data sheets shall be signed and stamped by consultant and one copy to be submitted to Client.

17) VENDOR AND SHOP DRAWINGS :

The contractor shall prepare and submit to Employer, for his approval, two sets of vendor detailed drawings of all distribution boards, switch boards, outlet boxes, special pull boxes and other likewise material, equipment to be fabricated by the contractor, or other vendor within 15 days of signing of the contract.

Before starting the work, the contractor shall submit to Employer for his approval in the prescribed manner, the shop / execution drawings for the entire installation, specially the main connections and junctions, the route of conduits and cables, no. and size of wires drawn through the conduits, location of all the outlet points, and switch boards and distribution boards and any other information required by Employer. Employer reserves the right to alter or modify these drawings if they are found to be insufficient or not complying with the established technical standards or if they do not offer the most satisfactory performance or accessibility for maintenance.

18) AS BUILT DRAWINGS :

At the completion of work and before issuance of certificate of virtual completion the contractor shall submit to Employer, three sets of layout drawing drawn at appropriate scale indicating the complete wiring system "as installed". These drawings must provide (in plan, folded elevation and section)

- a. Location and details of distribution boards, main switches, switchgear and other particulars.
- b. Location of all earthing stations, route and size of all earthing conductors, manholes etc.
- c. Route and particulars of all cables.
- d. Lighting layout plans with conduit routing layout/cable tray for all the floors along with circuit distribution details.
- e. External Area Lighting Plan

19) GUARANTEE :

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At the close of the work and before issuance of final certificate of virtual completion by Employer, the contractor shall furnish written guarantee indemnifying Employer against defective materials and workmanship for a period of one year after completion. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to Employer, the following :

- a. Any defective work or material supplied by the contractor.
- b. Any material or equipment supplied by Employer, which is damaged or destroyed as a result of defective workmanship by the contractor.
- c. Any material or equipment damaged or destroyed as a result of defective workmanship by the contractor.

20) SPECIAL NOTES FOR BIDDER :

- a. All the major electrical components like Transformers, DGs, HT MV LT switchgears, DBs, UPS, etc including the external & internal electrical distribution system, earthing systems & various equipments (which is supplied &/or installed by the contractor) shall be maintain for 2 years from the date of virtual completion of work at free of cost.
- b. The contractor should co-operate & coordinate for LT connections to LT panel board of various blocks, so that day to day work should not suffer.
- c. It is in the scope of Contractor to preparing necessary drawing submitting to authorities (i.e. Local supply co., pollution control board, Electrical Inspector, etc), getting their approval / senction and final certificate to energize the sub-station equipment's. Filling the necessary application to supply co. following up and getting the supply filling the necessary test report to the supply co. inclusive. All official / statutory fees shall be paid by clients & all other required expenses shall be on the contractors account; no extra payment shall be paid to contractor for said job.
- d. LT Panels shall be approved on site by Engineer in Charge & Electrical Consultant.
- e. Contractor shall submit Shop drawings for approval to Electrical consultant based on tender drawings before execution which shall not be on chargeable basis.
- f. The MCB and MCB DBs must be of same make.
- g. Make of components required to be used by contractor to complete the installation, if not mentioned anywhere, shall be required to GOT IT APPROVED by Client/Architect/Consultant before installation in writing manner.

2 TECHNICAL SPECIFICATION FOR HT PANEL

1) DESIGN CONDITIONS & SCOPE OF WORK:

The said panel is Four Way HT VCB breaker panel. All equipment and materials will be selected and rated for use at the following site conditions.

Ambient air temperature. 50° C.

Ground temperature. 30° C.

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Solar gain	1100 w / m ²	
Earth resistivity	200 deg. C. cm / w	
Relative Humidity.	95% Max.	
Atmospheric condition Humid and Dusty		Non corrosive,

2) GENERAL REQUIREMENTS

1. The scope generally describes to design, manufacture, assemble, connect, wire, supply, test and commission 11 kv vacuum circuit breaker panel.
2. The unit shall consist off tee off spring assisted three position , three pole vacuum circuit breaker.
3. All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) except where modified and/or supplemented by this specification.
4. The equipment shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Codes of Practice. In addition, other rules and regulations as applicable to the work shall be followed. In case of any discrepancy, the more restrictive rule shall be binding.

3) COMPLETENESS OF SUPPLY

1. It is not the intent to specify completely herein all details of the equipment. Nevertheless, the equipment shall be complete and operative in all aspects and shall conform to highest standard of engineering, design and workmanship.
2. Any material or accessory which may not have been specifically mentioned but which is necessary or usual for satisfactory and trouble free operation and maintenance of the equipment shall be furnished without any extra charge.

4) DESIGN CRITERIA

The Switchgear shall be capable of continuous operation at specified rating under the following condition:

Voltage variation	:	+ / - 10 %
Frequency variation	:	+ 3%, -6%
Combined voltage & frequency variation	:	10 %

1. The de rating of the equipments shall be done taking 50 deg C as an ambient temperature if it is designed at lower temperature. The maximum temp. in any part of the equipment at specified rating shall not exceed 85 deg C considering reference ambient temperature as 50 deg C.
2. The system fault level for 11KV system is 350MVA. The breakers of the respective system shall have the breaking capacity corresponding to above fault levels specified.

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3. The breaker shall be Vacuum type. The circuit breaker shall be fitted with micro processor based self powered relay inside the front cover.
4. ver.
5. The breaker ratings shall be as per drawing and bill of quantity.
6. The cable termination shall be done by heat shrinkable termination method. The compartment should have sufficient height space for proper Termination / Bonding of cable leads.

5) SPECIFIC REQUIREMENTS

1. The switchgear enclosure shall conform to the degree of protection IP-4X. The minimum thickness of sheet steel used shall be 2mm CRCA steel.
2. The switch gear assembly shall comprise a continuous, dead-front, line-up of free standing, vertical cubicles. Each cubicle shall have a front hinged door with latches and a removable back cover. All covers and doors shall be provided with recessed neoprene gaskets. All doors shall have pad locking arrangement. Switchgear shall be fire retardant type.
3. Circuit breakers, instrument transformers, bus-bars, cable compartment etc., shall be housed in totally isolated air tight separate compartments within the cubicle. The design shall be such that failure of one equipment shall not affect the adjacent units. Suitable venting arrangement shall be provided to release the gas pressure developed due to the operation of the breaker or due to live arc of fault.
4. Each cubicle shall be separated from adjacent one by grounded sheet steel barrier and bus sealing arrangement.
5. The switchgear panel shall be of arc proof version. Test report as per DIN VDE 0670 part 601, IEC-694/IEC-298 shall be furnished.
6. All relays, meters, switches and lamps shall be flush mounted on the respective cubicle door or on control cabinet built on the front of the cubicle.
7. Each switchgear cubicle shall be provided with a thermostat controlled space heater and single phase plug point operated at 230 V AC. 50 Hz.
8. Bus connection from bus compartment to breaker compartment & breaker compartment to cable compartment and bus compartment to adjacent panels shall be through sealed resin cast bushing assembly.
9. Each breaker cubicle shall be provided with 'service' and 'test' position limit switches, each having at least 4 NO & 4 NC contacts. All fixing bolts, screws, etc. appearing on the panel shall be so arranged as to present a neat appearance. The swing of the door shall be more than 90 deg C.

6) BUS AND BUS TAPS

1. The main buses and connections shall be of high conductivity copper, sized for specified continuous and fault current ratings with maximum temperature limited to 85 deg C (i.e. 35 deg C rise over 50 deg C ambient).

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2. Adequate contact pressure shall be ensured by means of two bolts connection with plain and spring washers and locknuts.
3. Bimetallic connectors shall be furnished for connections between dissimilar metals.
4. All Busbars, Jumpers and connection shall be fully insulated for working voltage with adequate phase/ground clearances. Epoxy cast-resin shrouds for joints shall be provided. All jointing hardware shall have nylon caps. All busbars, links, jumpers etc. shall be sleeved with sleeves of Raychem/DSG make and non-in flame able heat shrinkable type. Busbars, links, live parts etc. shall have nonflammable shrouds.
5. No paper/cotton based insulation shall be used any where in the switch gear. Minimum amount of combustible and low smoke generation type insulating material shall be used.
6. Safety shutter, phase barrier, busbar seal-off bushing plate, support insulators etc. shall be non-inflammable high tracking fiber glass/epoxy insulation system of grade 94V-0 as per UL.
7. All buses and connections shall be supported and braced to withstand dynamic electromagnetic stresses due to maximum short circuit current and also to take care of any thermal expansion.
8. Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear, when viewed from front of the switchgear assembly.
9. The successful tenderer shall submit the calculation in support of selection of busbar conductor size, spacing and short time withstand capability.

7) CIRCUIT BREAKER

1. Circuit breaker shall be triple pole, single throw, Vacuum type.
2. Circuit breaker shall be drawout type, having SERVICE, TEST and DISCONNECTED positions with positive indication for each position.
3. Circuit breakers of identical rating shall be physically and electrically interchangeable.
4. Circuit breaker shall have motor wound spring charging facility with Mechanical & Electrical anti-pumping features and shunt trip. In addition facility for manual charging of spring shall be provided. The motor shall be suitable for operation with voltage variation from 85% to 110% of rated voltage. Spring charging motor shall be in a standard enclosure.
5. For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor.
6. Mechanical safety interlock shall be provided to prevent:
7. The circuit breaker from being racked in or out of the service position when the breaker is closed.
8. Racking in the circuit breaker unless the control plug is fully engaged.

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9. Closing & opening of the breaker in an intermediate position between 'service' & 'test' and between 'Test' and 'Disconnected' position.
10. Automatic safety shutters shall be provided to fully cover the female primary contacts when the breaker is withdrawn from service position.
11. Each breaker shall be provided with an emergency manual trip, mechanical ON-OFF indication, an operation counter and mechanism charge/discharge indicator. The manual trip device shall be located on the front door. Indicators with shrouds will be visible from front door even when breaker is closed.
12. Suitable padlocking arrangement shall be provided as stated below:
13. Circuit Breaker operating handle in the OFF position.
14. Each feeder panel operating handle in CLOSED , OPEN , EARTH position.
15. Each breaker shall be provided with following :
16. Auxiliary switch, with 6 NO + 6 NC contacts, mounted on the drawout portion of the switchgear.
17. Position/cell switch with minimum 3 NO + 1 NC contacts, one each for TEST and SERVICE position.
18. Auxiliary switch, with 4 NO + 4 NC contacts, mounted on the stationary portion of the switchgear and operated mechanically by a sliding lever from the breaker in SERVICE position.
19. Limit/auxiliary switches shall be convertible type that is facility for changing N.O. contact ton N.C. and vice-versa. Switch contact shall be rated 10A A.C. and 2A D.C. at operating voltage.
20. Circuit breaker shall be draw out type, complete with transfer trucks, self-aligning primary and secondary disconnects, positive guides to ensure proper alignment.
21. Each breaker shall be provided with suitable encased rollers.
22. The trip coils shall be operated satisfactorily at voltage between 70 % and 110 % of rated control supply voltage.
23. Each circuit breaker cubicle shall be provided with an earthing facility to earth the incoming or outgoing feeders by the arrangement specified below. Earthing facilities shall be fully interlocked to prevent faulty operation e.g. earthing of live parts.
24. Separate earthing truck, which can be inserted in place of circuit breakers, one truck suitable for incoming and the other for outgoing circuits shall be provided.
25. Positive earthing of circuit breaker frame shall be maintained when it is in the connected position and in all other positions in which the safety shutters are in open position.
26. Insulation used for auxiliary switches shall be anti tracking type.

8) INDICATION & MONITORING

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1. Each breaker cubicle shall be equipped with following:
2. One (1) number heavy duty spring return type TRIP-NORMAL-CLOSE control switch with pistol grip handle.
3. Three (3) indicating lights front of compartments:
 - 3.1. GREEN : Breaker Open
 - 3.2. RED : Breaker Closed
 - 3.3. Amber : Trip
 - 3.4. Blue : Spring charged/Low vacuum

Lamp shall be LED type with series resistor, Lamp and lens shall be replaceable from the front.

9) CURRENT TRANSFORMER

1. Current transformers shall be bar primary, cast resin type. All secondary connections shall be brought out to terminal blocks where Y or D connection will be made.
 - 1.1. Class PS for differential & restricted earth fault relaying.
 - 1.2. Class 5P20 for other relaying.
 - 1.3. Class 1.0 and ISF < 5 for metering.
2. The current transformer shall be capable of safely withstanding the short circuit, stresses corresponding to the fault level as indicated & shall be able to meet the short-time requirement specified.
3. All CT secondary shall be earthed through separate switch link on terminal block. The secondary terminals of the CTS shall have the provision of shorting and disconnecting facilities by links.
4. CT terminals & their polarities shall be clearly marked.

10) VOLTAGE TRANSFORMER

1. Voltage Transformer shall be cast-resin, draw out type and shall have an accuracy class of 1.0, 3P. Voltage Transformer mounted on breaker carriage is not acceptable.
2. High voltage windings of voltage transformer shall be protected by current limiting fuses. The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully draw-out position.
3. Low voltage fuses, sized to prevent overload, shall be installed in all ungrounded secondary leads. Fuses shall be suitably located to permit easy replacement while the switchgear is energized.
4. The connections from main circuit to PT shall be capable of withstanding short circuit stresses.

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11)RELAYS

1. Protective relay shall be micro processor based.
2. Relays shall be of drawout design with built-in site testing facilities. Small auxiliary relays may be in non-drawout execution and mounted within the cubicle.
3. Relays shall be rated for operation on 110 V secondary voltage and 5 A secondary current as shown on drawings. Number and rating of relay contacts shall suit the job requirements.

12)METERS

1. All meters are digital type of 96 x 96 mm accuracy class of $\pm 2\%$.

13)SECONDARY WIRING

1. The switchgear shall be fully wired at the factory to ensure proper functioning of control, protection, transfer and interlocking schemes.
2. Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, switches and other devices shall be wired upto terminal blocks.
3. Wiring shall be done with flexible, 650V grade, FRLS PVC insulated switchboard wires with stranded copper conductors of 1.5 mm² for control and current circuits and 1.5 mm² for voltage circuits. All power wiring like space heater supply etc. shall be carried out with min. 4 mm² Cu, conductor, Wiring of trip circuit shall be with fluoro-plastic wires.
4. Each wire shall be identified, at both ends, with dependent & cross addressing permanent markers bearing wire numbers as per Contractor's Wiring Diagrams. Trip circuit shall have red colour ferrule.
5. Wire termination shall be made with crimping type ring connectors with insulating sleeves. Wires shall not be spliced between terminals.
6. The wires shall run preferably through metallic through adequately supported along its run to prevent sagging due to flexibility or vibration. The control & power wires shall be routed through separate troughs.
7. Inter-panel wiring trough shall be furnished for wiring between switchgear cubicles. All wiring required for interlocking between the cubicles of any switchgear shall be furnished and installed. Wherever wires are passing through cutouts or openings they shall be protected by providing suitable grommet or gasket around the openings. Inter panel wiring at shipping sections shall be through terminal blocks placed suitably at intersection points.
8. The colour of wire shall be taken as follows :
 - 8.1.AC System Black
 - 8.2.DC System Grey
 - 8.3.Earthing System
 - 8.4.CT & PT Wiring System Red, Yellow, Blue colour code.

14) TERMINAL BLOCKS

1. Terminal blocks shall be 660 V grade box-clamp type with marking strips ELMEX 10 mm² or equal. Terminal for C.T. Secondary leads shall be disconnecting link type and shall have provision for shorting. Terminal for P.T. Secondary lead shall also be disconnecting link type.
2. Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished. Multi connection terminal strip to be used if required.
3. Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
4. Terminal blocks for inter panel / external / Space Heater wiring shall be separate from inter panel wiring.
5. All control wire shall be terminated with ring type insulated lug only.
6. The terminal block shall be grouped according to circuit functions and individual terminals in each block shall be serially numbered in accordance with the drawings. Such numbering shall be legible, permanent and indelible.
7. The terminal blocks of different voltage classes shall be segregated.
8. Similar type of terminal block shall be used for inter panel wiring at shipping sections.

15) CABLE TERMINATION

1. Switchgear shall be designed for cable entry from the top. Sufficient space shall be provided for ease of termination and connection.
2. Power cables shall be XLPE insulated, armored, overall PVC sheathed with stranded Aluminum/copper conductor.
3. Control cables shall be PVC/XLPE insulated, armored, overall PVC sheathed with 1.5mm² stranded copper conductor.
4. All provisions and accessories shall be furnished for termination and connection of cables, including removable aluminium gland plates, cables supports etc.
5. The gland plates shall be minimum 4mm thick aluminium sheet. The gland plate and supporting arrangement for 1/C power cables shall be such as to minimise flow of eddy current.
6. Sufficient space shall be provided between the power cable termination (end-boxes) and gland plate. Core balance C.T.s, wherever specified, shall be accommodated within this space.

16) GROUND BUS

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

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2. The ground bus shall be provided with two-bolt drilling with G.I. bolts and nuts at each end to receive 50 x 6 mm G.I. flat.
3. Each stationary unit shall be connected directly to the ground bus. The frame of each circuit breaker and drawout P.T. unit shall be grounded through heavy multiple contacts at all times except when the primary disconnecting devices are separated by a safe distance.
4. Wherever the schematic diagrams indicate a definite ground at the switchgear, a single wire for each circuit thus grounded shall be run independently to the ground bus and connected thereto.
5. C.T. and P.T. secondary neutrals shall be earthed through removable links so that earth of one circuit may be removed without disturbing other.
6. Suitable ground terminal, directly connected with the ground bus shall be provided in the cable chamber for grounding connection of cable screen / armour.
7. All hinged doors shall be grounded using silver plated and braided copper flexible of adequate size.

17) NAMEPLATES

1. Nameplates of approved design shall be furnished at front & back side of each cubicle and at each instruments & device mounted on or inside the cubicle.
2. The material shall be 3ply lamicold or approved equal, 3 mm thick with white letter on black background. The letters of the nameplates shall be engraved.
3. The nameplate shall be held by self-tapping screws. Nameplate size shall be minimum 20 x 75mm for instrument/device and 40 x 150mm for panels.
4. Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.

Following plate size & letter size shall be considered for nameplate.

SR. NO.	NAMEPLATE NO.	PLATE SIZE (mm × mm)	LETTER SIZE (mm× mm)
1.0	Main nameplate	40 × 150	25 × 25
2.0	Equipment & device (Front)	20 × 75	5 × 5
3.0	Equipment & device (Internal)	6 × 20	3 × 3

18) SPACE HEATERS AND PLUG SOCKETS

1. Each cubicle shall be provided with thermostat controlled space heaters and 10A, 3 pin plug socket.
2. Cubicle heater, Plug/socket circuits shall have Individual MCBs.

19) A.C. POWER SUPPLY

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1. The following power supplies will be made available to the switchgear: A. C. supply : Double Feeder with manual change over switch.
2. Isolating MCB will be provided at the switchgear for the incoming supplies.
3. Bus-wires of adequate (minimum 4 sq.mm copper) capacity shall be provided to distribute the incoming supplies to different cubicles. Isolating MCB shall be provided at each cubicle for A.C. supplies.
4. A.C. load shall be so distributed as to present a balance loading on three-phase supply system.

20) TROPICAL PROTECTION

1. All equipment, accessories and wiring shall have fungus protection involving special treatment of insulation and metal against fungus, insects & corrosion.
2. Screens of stainless steel shall be furnished on all ventilating louvers to prevent the entrance of insects.

21) PAINTING

1. All surfaces shall be sanding blasted, pickled and grounded as required to produce a smooth, clean surface free of scale, grease rust and foreign adhering matter.
2. After cleaning, the surfaces shall be given a phosphate coating followed by 2 coats of high quality primer and staved after each coat.
3. The switchgear shall be finished in powder coat, shade RAL-7032 MATT finish.
4. Sufficient quantity of touch-up paint (approx. 5 ltrs.) shall be furnished for application at site.

22) ACCESSORIES

1. The following accessories shall be furnished along with the Switchgear:
2. Earthing equipment suitable for earthing the bus or outgoing cable.
3. Breaker carrier trolley if C.B. is of that design.
4. Cubicle door opening key (1 for each panel).
5. Withdrawal handles for breaker.
6. Commissioning spares (Provide list of spares along with offer)

23) TESTS

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

24) ROUTINE TEST

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1. The tests shall include but not necessarily limited to the following for switchgear :
2. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme & proper functioning of the equipment.
3. All wiring and current carrying part shall be given appropriate High Voltage test.
4. Test for meter/ relays for the respective function.
5. Primary current and voltage shall be applied to all instrument transformers.
6. Routine test shall be carried out on all equipment such as circuit breakers, instrument transformers, meters etc.
7. One minute power frequency withstands insulation test as per relevant-IS.

25)TEST CERTIFICATE

1. Certified reports of all the tests carried out at the works shall be furnished in six (6) copies for approval of the Owner.
2. The equipment shall be dispatched from works only after receipt of Owner's written approval of the test reports.
3. The test report shall furnish complete identification of the equipment such as serial no., rating, equipment designation as per schematic etc. & date of test.

26)SPARES

1. The Bidder shall submit a list of recommended spare parts for two (2) years satisfactory and trouble free operation, indicating the itemized price of each item of the spares in the appropriate annexure. Self life of consumable spares would be indicated specifically.

27)DRAWINGS, DATA & MANUALS

1. Drawings, Data & Manuals shall submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of contract and/or elsewhere in the specification for approval & subsequent distribution after the issue of Letter of intent.

1.1.1.Drawing / Document to be submitted:

2. Outline dimensional drawing of the switchgear showing general arrangement,space requirements and cable entry points, location of breaker, CT, Pt busbar chamber, grounding arrangement etc.

2.1.Bill of Materials.

2.2. Typical foundation plan.

2.3. Typical breaker control schematic.

2.4. Test reports on circuit breaker/CT/PT.

2.5. Technical leaflets on & complete specifications & OEM address for bought out items.

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2.6. Bus bar & circuit breaker sizing calculation along with relevant Test Reports.

3. Instruction manuals of switchgear & individual equipment. The manual shall clearly indicate that the installation method, check-up and tests to be carried out before commissioning of the equipment as well as monitoring tests, their interval & maintenance / overhauling procedure & schedule.

TECHNICAL DATA SHEET FOR H. V. INDOOR SWITCHGEAR:

Sr. No.	DESCRIPTION	
1.0	GENERAL :	
1.1	Ambient temperature	50° c.
1.2	Atmosphere	Non corrosive, Humid and Dusty
1.3	Location	Indoor
1.0	ELECTRICAL DATA :	
1.1	Type of breaker	Vacuum Circuit Breaker (4 Breaker Panel)
1.2	Service	Continuous
1.3	Voltage	AS PER TENDER
1.4	System earthing	Solidly earthed
1.5	Frequency	50 Hz. +/- 3%
1.6	No. of phase	3
1.7	System fault level	AS PER TENDER
1.8	Fault current	AS PER TENDER
1.9	Max. system voltage	AS PER TENDER
1.10	Auxiliary supply :	24V D.C derived from batteries
1.11	Rated short time current	AS PER TENDER
1.12	Making capacity	AS PER TENDER
1.13	Busbar current rating and Material	AS PER TENDER
1.14	Cable entry	AS PER TENDER
1.15	Cable size	AS PER TENDER
1.16	Breaker particulars :	
(a)	Operating duty	0 - 3 M CO - 3M - CO
(b)	Operating mechanism	Motor charged spring / manual trip & close
(c)	Spring charging motor	230 V AC, 200 W

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Sr. No.	DESCRIPTION	
(d)	Trip / Closing coil	24 V DC, 180 W
(e)	Anti pumping feature	To be provided
(f)	Latching requirement	Trip free
(g)	Emergency trip push button	Required
(h)	Space heater and cubicle lamp	Required
1.17	Constructional requirements	Simplex Type
(a)	Thickness of sheet steel for frame, enclosure, doors, covers & partitions	CRCA sheet - 2 mm, hinge type door with neoprene rubber gasket
(b)	Degree of protection	IP 44X
(c)	Colour	Powder coating - RAL-7032 MATT
(d)	Earth bus size	50 × 6 mm GI
(e)	Foundation frame	ISMC-75, Suitable for five breakers with necessary bed plate and foundations bolt.
1.18	Annunciation : (1) Main incoming - Trip	To be Provided
1.19	PANEL ACCESSORIES	
(a)	Toggle switch for space heater and socket	230 V A.C, 10 A
(b)	Socket	3 pin 10 A
(c)	MCB for spring charging motor circuit	6 A, DP MCB
(d)	MCB for ON / OFF	Double pole,16 A, 110 V D.C for D.C ckt. Double pole, 16 A, 230 V A.C for A.C ckt.
(e)	Local / Remote selector switch	4 ways, 2 positions, lockable in any position, angular movement, stay put, lever type handle.
(f)	Auto- Off - Manual switch	18 ways, 3 positions, lockable in all position, stay put, wing type handle.
(g)	Breaker control switch (Trip - Neutral - Trip)	6 ways, 3 position, spring return to neutral, angular movement, pistol grip type handle.

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Sr. No.	DESCRIPTION	
(h)	LED indicating lamp (230V A.C)	Breaker RYB On - Red colour Breaker RYB Off - Green colour Auto trip - Amber colour Trip ckt healthy - Amber colour Spring charged - Blue colour Low vacuum - Blue colour 100 ohm, 3 / 4 W resistor
(i)	Filament Bulb	2 / 3 W bulb for R, Y, B, Healthy indication
(j)	Space Heater	230 V A.C, 100 W
(k)	Limit switch for test and service position	Not applicable
1.0	RELAY	
1.1	Instantaneous Phase Over Current Relay : 50/50n	To be Provided
1.2	AC Inverse Definite Minimum Phase Over Current Relay : 51/51n	To be Provided
1.3	Lock out relay : 86	To be Provided
1.4	Under Voltage Relay : 27C	To be Provided
1.5	Buchholz relay : 63 GP & Aux. Relay for alarm & trip – 63 GP X1 & X2	To be Provided
1.6	Oil Temperature Indicator : 49-2 & Aux. Relay for alarm & trip 49-2 X1 & X2	To be Provided
4.0	METERING	
4.1	Digital Multi Function Meter including parameters Amp., Voltage, KW, KWH, KVAR, KVARH, PF, Frequency etc.	To be Provided
5.0	CURRENT TRANSFORMER / POTENTIAL TRANSFORMER	
5.1	CT For Metering. Accuracy Class VA burdon	Cast Resin type 1.0 15 VA
5.2	CT For Protection. Accuracy Class VA burdon	Cast Resin type 5P15 / PS 15 VA

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Sr. No.	DESCRIPTION	
5.3	PT For Metering. Accuracy Class VA burdon	Cast Resin type 1.0 100 VA
5.4	PT For Protection. Accuracy Class VA burdon	Cast Resin type 5P15 100VA

28) METHOD OF MEASUREMENT

- All the items will be measured as mentioned in Bill of quantity.

3 TECHNICAL SPECIFICATION FOR HT CABLE

1) SCOPE

1. The scope shall cover supplying, laying, testing and commissioning of 3 core H.T cables which shall be capable of operating at a sustained conductor temperature of 90°C and suitable for a maximum conductor short-circuit temperature of 250°C.
2. This specification gives the general requirement of cables. However, it is the responsibility of the vendor to take the joint measurement and obtain client's approval before the placement of orders to the main supplier / manufacturer. Cut lengths will not be accepted.

2) REFERENCE CODES & STANDARDS:

- 1.1. IS : 8130 – 1984 Conductors of Insulated Cables.
- 1.2. IEC : 228 - Conductors of Insulated Cables.
- 1.3. IS : 10810 - Methods of various tests on cables and their accessories
- 1.4. IEC : 502 - Extruded solid dielectric-insulated power cables for rated voltage from 1 KV up to 30 KV.
- 1.5. IEC : 287 - Calculations of continuous current rating of cables (100% load factor).
- 1.6. IS : 7098 (Part II) - Cross-linked polyethylene insulated PVC sheathed cable for Voltage from 1.3 KV up to 33 KV.
- 1.7. IS : 5831 - 1984 PVC insulation & sheath of electrical cables.

3) OPERATING CONDITIONS

Electric system

- System Voltage : 11 KV/1.6 KV
- Frequency : 50 Hz.

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Environment

- Ground temperature : 40°C.
- Ambient air temperature : 50°C.
- Solar gain : 1100 w/m²
- Earth resistivity : [The bidder shall confirm the Earth Resistivity Test]
- Atmospheric conditions : Humid, salty and dusty

CONSTRUCTION

4) CONDUCTORS

1. The conductor shall be of circular stranded Aluminium to IS : 8130 & IEC : 228. It shall be clean, reasonably uniform in size & shape smooth & free from harmful defects. Any other form of conductor may also be accepted if in line with modern trends.

5) CONDUCTOR SCREEN

1. The conductor screen shall consist of an extruded layer of thermosetting semi-conducting compound which shall be extruded simultaneously with the core insulation.

6) INSULATION

1. The insulation shall be super clean XLPE compound applied by extrusion and vulcanized to form a compact homogenous body.

7) INSULATION SCREEN

1. Each insulation have an insulation screen in two parts consisting of :
2. Non-metallic semi-conducting compound tape part and a metallic screen part.
3. The non-metallic part shall be directly applied upon the insulation of each core and may consist of an extruded semi-conducting material extruded simultaneously with the conductor screen and insulation (triple extrusion).
4. The semi-conductor shall be readily strippable and must not be bonded in such a manner that it has to be shaved or scraped to remove.
5. The metallic part shall consist of a copper tape helical applied with a 10% overlap. A binder tape of copper shall be applied over the copper wire metallic screen.

8) LAYING UP

1. The cores shall be identified on the non-metallic part of the insulation screen by legible printing on the length of each conductor or, by the inclusion of a marker tape.
2. The cores shall be laid up with a right hand direction of lay.
3. No cables shall be directly buried in the ground. They shall be laid in trenches, trays, racks or in conduits or pipes. The cables of different voltage grade shall be laid in different trays. 2 mtr loop to be provided on both the sides.

Binder tape / Moisture barrier:

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4. During lay up, a suitable open spiral binder may be applied, at the manufacturer's discretion, before the application of an extruded inner covering.

9) FILLERS

1. Fillers shall be PVC.

10) INNER COVERING / SHEATH

1. The inner covering shall be extruded over the laid up cores to form compact and circular bedding for the metallic layer.

11) METALLIC LAYER

1. The metallic layer shall be galvanized steel wire.

12) OUTER SHEATH

1. The tough outer sheath, black coloured best resisting PVC polyethylene compound type ST-2 as per IS : 5831 for the operating temperature of the cable shall be provided over the armour as specified in relevant standards by extrusion process.

13) CABLE MARKING

Embossing on outer sheath:

1. The PVC outer sheath shall be legibly embossed with the legend: "ELECTRIC CABLE 11000 VOLT "etc.
2. The letter and figures shall be raised and shall consist of upright block characters. The maximum size of the characters shall be 13 mm. And the minimum size 15% of the cable circumference or 3 mm. whichever be the greater. The gap between the end of one set of embossed characters as above and the beginning of the next shall not exceed 150 mm.

Identification of Manufacturer and year of manufacture:

3. An identification of the manufacturer, the year of manufacturing, cable size shall be embossed at regular intervals on the PVC outer sheath. This shall not affect the spacing between repetitions of the legend as given above.

14) SEALING AND DRUMMING

1. After tests at the manufacturer's works, both ends of the cable shall be sealed to prevent the ingress of moisture during transportation and storage.
2. Cable shall be supplied in lengths of 500 mtrs. or as required in non-returnable drums of sufficiently sturdy construction.
3. The spindle hole shall be 110 mm. minimum diameter.
4. Each drum shall bear on the outside flange, legibly and indelibly in the English language, a distinguishing number, the manufacturer's name and particulars of the cable viz. voltage, length, conductor size, cable type, insulation type and gross weight shall also be clearly visible. The direction for rolling shall be indicated by an arrow.

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1. Type tests and Routine tests shall be carried out in accordance with the relevant IEC standards / IS. The copies of routine test results shall be submitted along with each drum length or part thereof.

16) TRANSPORTATION & DELIVERY

1. The cable shall be supplied in the actual length as per joint measurement at site.
2. The cable shall be dispatched at client's store or at site as per detailed instructions given by Client at later stage.
3. The cables shall be loaded from the main vendor's store, transported, unloaded at Client's stores and properly stocked as per instruction of client's local representative.

TECHNICAL DATA SHEET FOR H. T. XLPE CABLE :

Sr. No.	Particulars	Description
1.0	ENVIRONMENT DETAILS	
1.1	Ambient Temp In Degree Celsius	50 Degree Celsius
1.2	Ground Temp In Degree Celsius	35 Degree Celsius
1.3	Relative Humidity	90 % At 35 Degree Celsius
1.4	Altitude	< 1000 Meter Above MSL
1.5	Atmosphere	Non Corrosive, Humid and Dusty
1.0	SYSTEM DETAILS	
1.1	System Voltage	AS PER TENDER
1.2	System Frequency	AS PER TENDER
1.3	Grounding	AS PER TENDER
1.4	Fault Level	AS PER TENDER AS PER TENDER
1.0	CABLE	
1.1	No. of Cores	3 (Three)
1.2	CABLE CONDUCTOR	
1.1.1	Size Of Conductor	As per BOM
1.1.2	Material	High Purity Aluminium
1.1.3	Construction	Stranded
1.1.4	Shape	Compacted Circular
1.1.5	Confirming To	Is-8130
1.3	Conductor Screen	Extruded Semi-conducting Material
1.4	CONDUCTOR INSULATION	
1.4.1	Material	High Purity Void And Moisture Free Cross

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Sr. No.	Particulars	Description
		Linked Polyethylene (XLPE) Using Gas Curing Process
1.4.2	Thickness	> = 5.5mm
1.5	INSULATION SCREEN	EXTRUDED SEMI-CONDUCTING MATERIAL HAVING COPPER TAPE OVER IT
1.6	CORE IDENTIFICATION TAPE	Yes Required
1.7	CORE LAYING	Right Hand Direction
1.8	INNER SHEATH / COVER	Extruded
1.9	ARMOURING	
1.9.1	Material	Flat Steel GI Strip
1.9.2	No Of Strip	4
1.9.3	Size Of Strip	0.8 mm
1.10	OUTER SHEATH	
1.10.1	Material	PVC
1.10.2	Type	St-2 As Per Is-5831-1984
1.10.3	Thickness	> = 1.4 Mm
1.10.4	Colour	Black
1.11	MARKING ON OUTER SHEATH	YES
1.11.1	Voltage Grade	Yes
1.11.2	No. of Cores/Size of Conductor / Material of Conductor	Yes
1.11.3	Type Of Insulation	Yes
1.11.4	Details About Armour	Yes
1.11.5	Details Of Standards	Yes
1.11.6	Year Of Manufacturer	Yes
1.11.7	Any Other Details	Yes
4.0	TESTING	
4.1	Type Test As Per Is	Certificate To Be Provided for each drum
4.2	Routine Test As Per Is	Yes To Be Witnessed By Client
4.3	Acceptance Test	Yes To Be Witnessed By Client
5.0	CABLE DRUM	Non Returnable
5.1	Material	Wooden / Steel
5.2	Marking On Cable Drum	As Per Manufacturer's Standard

17) MODE OF MEASUREMENTS

1. The cables will be measured in meters. The unit rate shall include cutting the cable into required lengths, packing, loading, unloading, insurance, transportation, delivery to

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stores/site as per work order, stocking in stores, testing of cables at stores etc. of medium voltage cable. Total quantity in meters shall be measured lug to lug basis.

4 TECHNICAL SPECIFICATION FOR CSS WITH DRY TYPE TRANSFORMER

1) COMPACT SUBSTATION

Covers the general requirements for the Design, manufacture, testing and supply of indoor COMPACT SUBSTATION with HT Switchgear , Cast Resin Dry Type Transformer With LT Switchgear including installation, testing and commissioning at site . (having general requirements listed in the following paragraphs). This specification is accompanied by the transformer data sheet.

SERVICE CONDITIONS:

The Package substation shall be suitable for continuous operation under the basic service conditions indicated below

Ambient Temperature: 50 Deg C
Relative Humidity upto 95%
Altitude of Installation upto 1000m

The Enclosure of High Voltage switchgear-control gear, Low Voltage switchgear-control gear & Transformer of the package substation shall be designed for use at sea shore. The enclosure should take minimum space for the installation including the space required for approaching various doors & equipment inside.

2) SCOPE OF WORK

The scope covers design, manufacture, supply test, and on site sample commissioning of 11/0.433 kV Factory Assembled Compact Sub station with all safety accessories, tools and tackles in line with IS and approved by statutory authorities.

3) BILL OF QUANTITY

ELECTRICAL 11kV Package Substation consisting of 1 No. feeder with manually operated VCB 630A, 1 No. 11kV/433V, 750kVA DRY Type Transformer with OLTC & 1 set of LT device as follows

1) HT Switchgear 11kV, 21kA for 3 sec. Non - Extensible Compact switchgear (Type 1 CB) consisting of 1 No. Fixed manually operated 630A Vacuum Circuit Breaker in SF6 insulated stainless steel enclosure along with below mentioned items. Interconnection between HT switchgear and transformer shall be using Al. Armorured XLPE Cable. Each VCB Feeder consists Manually spring charging arrangement and manual close & open push buttons, ON / OFF indication. Self powered O/C & E/F relay type Manually operated 630A load breaker switch with built-in earth switch having full making capacity. Mechanical position indicator. Switch ON/OFF/EARTHED. , SF6 gas manometer, cable boots, 3 nos. CTs with Ratio -/1A, Cl: 5P10, 2.5 VA for protection Live Cable Indication Cable compartment cover interlocked with earth switch. Cable termination bushings suitable for 3 no. 1CX300mm² XLPE cable. Cable termination cover boots (Push on type), Air Insulating Metering Panel 2) Transformer :- 3 phase 50 Hz 750KVA Copper wound 11KV /433 V DYn11, Dry Cast resin type Transformer with tapping range +10 to -10% @ 2.5% (with tolerance), class F , with surge restorers, Digital WTI, as per IS1171 Tappings +5% to -10% in steps of 2.5% shall be provided at line end of HV winding. Changing of taps shall be carried out by means ON load tap changing. Max. allow losses at 50% Load shall be 2.2 KW & and at 100% Load shall be 6.7 KW at 75% temp., Impedance shall be 5.00 at -10 to +10 Tolerance shall be as per IS 1180 : 2014 Part-I (Level-

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II) 3) LT Switchgear 433V LT Switchgear : 1250A FP 50KA EDO Type ACB Microprocessor Based release for O/L S/C E/F protection with Digital Multifunction Meter. 4) Outdoor Enclosure Outdoor type enclosure having modular construction of Galvanised Sheet Steel in corrugated type wall design for better heat dissipation and providing robust construction. The Enclosure shall have IP54 degree of protection for HT & LT switchgear compartment & IP23 degree of protection for Transformer compartment.

4) CODES & STANDARDS

The dry type transformer shall comply with the applicable clauses of the latest editions of the following standards. In case of any conflict, the requirements of these standards shall prevail.

Sr.	Item	Relevant IS	Relevant IEC
1	Power transformer	IS 2026	IEC 726
2	Dry type transformer	IS 11171	
3	Fittings & Accessories	IS 3639	
4	Classification of Insulating Materials	IS 2026	
5	Bushings	IS 8603	IEC 144
6	Degree of Protection	IS 2147	IEC 76
7	Testing, Tolerances on guaranteed Particulars	IS 2026	IEC 726
8	High Voltage Low Voltage Pre-Fabricated Substation		IEC:61330
9	High Voltage Switches		IEC 60265
10	Metal Enclosed High Voltage Switchgear		IEC 60298
11	High Voltage Switchgear		IEC 60694
12	Low Voltage Switchgear and Control gear		IEC 60439
13	Power Transformers		IEC 60076
14	Self-contained medium voltage apparatus		IEC 298
15	High voltage circuit breakers		IEC 56
16	AC switches and earthing switches		IEC 129
17	Switches and dis-connectors		IEC 265
18	Combined switch/dis-connectors		IEC 420
19	Current transformers		IEC 185
20	Voltage transformers		IEC 186
21	Classification of degrees of protection for enclosures		IEC 529
22	Enclosure and sheet metal		RAL 7030
23	Front plate		RAL 9002

5) DESIGN BASIS

TECHNICAL REQUIREMENTS

All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard, IEC standard and CBIP manuals except where modified and / or supplemented by this specification.

Equipment and material conforming to any other standard which ensures equal or better quality may be accepted. In such case copies of English version of the standard adopted shall be submitted

The electrical installation shall met the requirement of Indian Electricity Rules as amended up to date relevant IS code of practice and Indian electricity act. In addition other rules of regulations applicable to the work shall be followed. In case any discrepancy the most stringent and restrictive one shall be binding.

The high tension switchgear, distribution transformer, LT switchgear & its accessories offered shall in general comply to the following specification attached.

- Specification for 11kV Breaker
- Specification for Distribution Transformer
- Specification for LT system
- Specification for enclosure for package substation

HV SWITCHBOARD : 11KV VCB Non-extensible Circuit Breaker:

This self-contained totally insulated unit constitutes the MV component of the MV/LV transformer substation or the branching point of an MV network. The breaker shall be in a single stainless steel enclosure, all the medium voltage functions enabling transformers to be connected, supplied and protected.

Electrical requirements

Description	
Rated voltage kV rms	12kV
Operating voltage kV rms	11kV
H.V. Insulation level:	
Rated withstand voltage at power frequency: 50Hz/1 min kV rms	28kV
Rated impulse withstand voltage: 1.2/50µs kV peak	75kV
H.V. Network and busbars	
Rated current A	630A
Rated short-time current (modify if 3sec	21kA

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rated) kA 3 sec	
Making capacity for switch-disconnections and earthing switches KA peak	52.5kAp
Breaking capacity of Breakers KA peak	630A
Internal arc withstand sec KA 1	20kA

TECHNICAL DESCRIPTION

The Circuit Breaker should be Vacuum Circuit Breaker with seamless SS tank
The Breaker should have Over current and Earth Fault Protection Trip Release
CT should have necessary Bushings
The Cable accessible should be from front.

FAULT CURRENT INDICATOR :

Fault current indicator shall be installed on the incomer cables of MV switchboard
Fault indicator type Bardin Flair 279 or equivalent Quantity: 1 No.

Vacuum Circuit Breaker:

The Unit shall consist 630A Tee-off spring assisted three position, three pole circuit breaker, with integral fault making / dead breaking earth switch. The function shall be naturally interlocked to prevent the main & earth switch from being switched 'ON' at the same time & the CB not allowed to trip in 'Earth On' position. The selection of the main/earth switch lever on the panel, which is allowed to move only if the main or earth switches in the off position. The lever shall be able to pad locked in either the main or earth position. The manual operation of the circuit breaker shall not have an effect on the trip spring. This should only be discharged under a fault (electrical) trip condition; the following manual reset operation should recharge the trip spring & reset the CB mechanism in 'main off' position.

Protection Relay:

The CB shall be fitted with self-powered relay inside the front cover to avoid any tampering. The relay should be 3 Over Current + 1 Earth Fault, fed by protection CTs mounted in the cable box.

Cable Box:

Every VCB shall be provided with suitable and identical cable boxes in front for connecting 3 core X 300 Sq.mm, 11kV cable from vertically below. The cable boxes shall be so located at convenient height to facilitate easy cable jointing work. The height available for cable termination should be minimum 500 mm. The Cable termination shall be done by Heat shrinkable Termination method so adequate clearances shall be maintained between phases for Termination. It shall be possible to terminate 2 runs of 3 Core X 300 sq.mm or 1 run of 1 core X 300 Sq.mm XLPE cable.

Locking Arrangement:

Suitable padlocking arrangements shall be provided as stated below. a) CB manual operating handle in the "OFF" position. b) Each feeder Panel operating handle in 'Closed' 'Open" or 'Earth' position

Earth Switch:

Earth switch should be rated equal to switchgear rating. Earth switch should be quick make type capable of making rated fault current. Earth switch should be operated from front of the cubicle.

GENERAL CONSTRUCTIONAL FEATURES FOR DRY TYPE TRANSFORMAR

The Transformer shall be resin impregnated dry type. Air Natural cooled suitable for indoor installation. This shall be provided with welded sheet steel, freestanding enclosures with expanded metal screens of suitable size or louvers backed by wire mesh. Transformer and upper body shall be suitably reinforced to prevent distortion during handling. Base channels shall be provided with skids and pulling eyes to facilitate handling.

All the fasteners and bolts shall be hot dip galvanized or zinc passivated.

The Transformer shall be double wound core type with cold rolled grain oriented silicon steel laminations perfectly insulated and clamped to minimize vibrations and noise. Core fastening bolts shall be insulated to reduce losses and avoid hot spots. All parts of the magnetic circuit shall be effectively connected to earth system.

The winding shall be of copper and shall be designed for full load current to withstand the thermal and electromagnetic stresses arising due to maximum fault level. The current carrying winding joints shall be electrically brazed.

The windings shall be provided with Class F insulation temperature 1400 C. As applicable to resin impregnated dry type transformers as per IS 11171 part II for dry type power transformers.

The transformer shall be designed with particular regards to suppression of harmonic voltages.

6) TERMINALS AND MARSHALLING BOX

Winding shall be brought out and terminated on outdoor bushing, cable boxes or bus duct chamber which will be located as specified on data sheet.

Cable boxes shall be supplied with cable lugs and glands. H.T. cable box shall be suitably dimensioned to accept terminations of XLPE cable specified in data sheet.

The H.V./L.V. terminal boxes shall be located on the side/top respectively and at right angle or opposite to each other as specified in the data sheet. Suitable flange shall be provided for bus duct on LV side where specified in the Data sheet.

For L.T. PVC control cables compression glands shall be supplied. Gland plate shall be removable type. For single core cables, gland plate shall be of non- magnetic material. Such cable boxes shall have arrangements for grounding the armour or unarmoured cables.

Cable lugs shall be non-soldering crimping type.

Terminal chamber for bus duct termination shall have a gasketed cover plate bolted to it. A separate cover plate shall be provided to facilitate the connection and inspection. Phase sequence of bus bar shall be as specified in MR or data sheet.

Marshalling box shall be weather - tight. All prospective devices and neutral CTs shall be wired by means of PVC insulated armoured cable up to marshalling box. Terminals shall be Elmex type or approved equal. Removable gland plate with compression type cable glands shall be as described earlier.

For transformers having provisions for terminating TPN bus duct on 433 V side neutral of the star connected secondary winding shall be brought out to a secondary terminal chamber. A.C.T. shall be mounted (if specified) on the neutral terminal with C.T. Secondary wired up to marshalling box.

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7) TAPS AND TAP CHANGE GEAR

Tapings shall be On Load / Off Load (where ever applicable as mention in data sheets) and brought out from HV winding and terminated in an external motor operated tap switch with position indicator. Transformer output shall remain unaffected for any tap position.

8) ON LOAD TAP CHANGE WITH RTCC

The tap changers shall be of ON circuit type mechanically rugged and arranged to provide for convenient inspection and maintenance without necessity for un-tanking.

The position indicators shall be positive and there shall not be any ambiguity resulting into incomplete tap change with respect to the mechanical tap position indication.

The operating handle of tap exchanger shall be brought out of the tank at the side at an accessible height from ground level.

Tap changer operating switch mounted on the top of the transformer tanks will not be acceptable.

Provision of padlocking the tap changers without interfering with visual tap position indicator shall be provided.

9) LOSSES.

Bids will be evaluated based on the formula furnished.

For the purpose of evaluation of Bids, the quoted load losses and iron losses shall be increased to take into consideration tolerance as permitted by applicable standards.

In case of non-achievability of the losses at the time of testing, the contractor shall be penalized at the rate of Rs. 298308.97 per KW for iron losses & Rs. 184951.5 per KW for Cu loss (as per CBIP).

10) REJECTION

The client may reject any transformer if during tests or service any of the following conditions arise:

No load loss exceeds the guaranteed value by 20% or more.

Load loss exceeds the guaranteed value by 20% or more.

Impedance value exceeds the guaranteed value by + or - 10% or more.

Impedance value exceeds the guaranteed value by + or - 10% or more

The difference in impedance values of any two phases during single phase short circuit impedance test exceeds 2 percent of the average value guaranteed by the BIDDER

Winding temperature rise exceeds the specified value by 5 Deg. Cent.

Transformer fails on impulse test.

Transformer fails on power frequency voltage withstand test.

Transformer is proved to have been manufactured not in accordance with agreed specification.

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The client reserves the right to retain the rejected transformer and take it into service until the BIDDER replace, at no extra cost, the defective transformer by a new transformer. Alternatively, the BIDDER shall repair or the replace the transformer within a reasonable period to the client satisfaction at no extra cost.

11) LOADING CAPABILITY

Continuous operation at rated KVA on any tap with voltage variation of $\pm 10\%$ corresponding to the voltage of the tap as well as in accordance with IEC 354.

12) FLUX DENSITY

Not to exceed 1.9 tesla at any tap position with $\pm 10\%$ voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations.

1. 10% for continuous rating
2. 25% for at least one minute
3. 40% for at least five seconds

13) NOISE

Noise level shall be between 57 DB to 66 DB depending on the rating of transformers as per IEEE-141

ACCESSARIES

Accessories as specified in the attached data sheet shall be included in the scope of supply. Tappings and control gears shall be provided on the H.V. side. Tap changer shall be as specified in data sheet. The tap changing equipment shall be suitable for carrying the fault current under condition of external or internal faults.

1. Winding temperature indicator (WTI) shall be Platinum resistance type temperature detector in each limb
2. Thermistors shall be embedded in each limb with alarm and trip contacts for remote annunciation.

14) PAINTING

All metal parts shall be thoroughly cleaned to remove rust, scale, grease etc. and painted with two coats of approved colour shade over one coat of rust resisting primer.

The paint shall not scale-off crinkle or removed due to normal handling. All metal surfaces not accessible for painting shall be made of corrosion resistant material.

15) RATING PLATE DETAILS

Each transformer shall be provided with a rating plate giving the details as per IS: 2026 (Pt. I). The marking shall be indelible and the rating plate shall be located on the front the side. Exact value Transformer % impedance, as determined during tests shall be marked on it and also on the final submission of nameplate drawing.

SPECIFICATION FOR LT SYSTEM

LT compartment shall be suitable to house following equipment,

1. Bus bar connection from transformer to LT BUSBAR of 2000A, Cu, 25kA Rating.
2. Air circuit breaker as mentioned in SLD
3. CT., Multifunction meter
4. Cable glands for outgoing feeders

EQUIPMENT SPECIFICATION – AIR CIRCUIT BREAKER (ACB)

These shall be Draw out type with manually operated mechanism. The short circuit mechanism and breaking capacity as shall be supported by test certificate. The test certificates should be from CPRI / any Govt. approved test house.

- Overload releases to be preset at 85% of the rated capacity and be tamper proof with an accuracy of + 10%.
 - Ambient temperature compensated type and there should not be de-rating of ACB current carrying capacity at 50°C. The testing of ACB for the temperature rise shall be carried out by the manufacturer as per the prevailing, IS / IEC or any other international standards.
 - ACB shall be provided with overload and short circuit release. Short circuit release shall have a preset setting of 4 times the rated current and shall be provided with an adjustable times having setting range of 100 – 500 milliseconds, to have a proper co-ordination with short circuit release of outgoing MCCBs.
- 1) 3 phase, 4 wire, neutral earthed having link arrangement.
 - 2) Rated current thermal current 3200 Amps
 - 3) Service voltage 433 volts
 - 4) No. of break / pole one
 - 5) Frequency 50 c / s
 - 6) Rated insulation voltage - 690 volts
 - 7) Rated short circuit breaking capacity
 - Rated services S/C breaking capacity Ics (rms) - 25kA
 - Rated ultimate S/C breaking capacity Icu (rms) - 25kA
 - 8) Power factor - 0.25
 - 9) S/C making capacity 1cm (peak) - 73.5kA
 - 10) Rated short time withstand current Icw 25kA for 1 second.
 - 11) Suitable for outdoor installation.
 - 12) It shall conform to IS 13947 / pt.2 / 1993 with latest amendment, if any.
 - 13) Performance category : Utilization category – B with operation cycle O – t – Co – t – Co.
 - 14) The status of open and close shall be clearly visible.
 - 15) The trip indication / indication separated for overload and short circuit shall be provided.
 - 16) The ACB shall have the provision to lock the operating mechanism in off position.
 - 17) The operating mechanism should be from front and the compartment should have the degree of protection IP – 55.
 - 18) Separator shall be provided between all phases inside. ACB enclosed to prevent travel of arc during short circuit.
 - 19) The CTs mounted for thermal overload release shall have secondary winding inaccessible including tripping mechanism of O/L and magnetic releases to avoid tampering CTs should also have provision of separators.
 - 20) Two nos. earthing bolts for propose of earthing of ACB may also be provided & suitable for G.I stay wire of size 7 / 10 SWG.
 - 21) The bus bar size shall be confirming to relevant IS and the neutral bus bar shall be of same wire of size as phase bus bar and should be suitable for connecting neutral.
 - 22) The ACB shall be tested in accordance with the provision of IS 13947 – Part I or relevant IEC

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The 11 kV side of the transformer shall have arrangement for connecting 11 kV 1 No. 3C x 300 sq mm AL. XLPE ARMOURED CABLE.

On LT side, ACB should be suitable for connecting 4 No. 3.5C x 00 sq mm CU. XLPE ARMOURED CABLE which will emanate from common bus. The LT bus should be CU bars of 2000 Amps rating.

EQUIPMENT SPECIFICATION – INTERCONNECTING BUS BAR

Bus bar shall be of high conductivity copper supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in BIS. The main bus bars shall have uniform current ratings throughout their length as specified in data sheet / job specification. The current rating of the neutral shall be half that of the phase busbars. Removable neutral links shall be provided on feeders to permit isolation of the neutral bus bar.

Both horizontal and vertical bus bars, bus joints and supports shall be capable of withstanding dynamic and thermal stresses of the specified short circuit currents for 1 second. Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar, joints and supports. The short circuit capacity of the neutral bus bars shall be in line with IS: 13947

The hot spot temperature of bus bars including joints at design ambient temperature shall not exceed 95°C for normal operating conditions.

The current rating of the bus bars shall be 3200A for design ambient temperature at site conditions and for being inside the cubicle at fully loaded condition. The vendor shall suitably de-rate the nominal rating to suit the above condition.

All bus bars shall be insulated with heat shrink PVC sleeves of 1100V grade, red yellow and blue color shall be used for phase bus bars and black color shall be used for neutral bus bars. Removable type shrouds shall be provided for joints.

Minimum clearance between live parts, between live parts / neutral to earth shall be 19mm. However clearances between terminals at components shall be as per applicable individual standard for components.

Interconnections between the main bus bars and individual units shall be made using vertical / horizontal aluminum bus bars of adequate rating. All joints surfaces at aluminium to copper joints shall be silver / tin plated, alternatively cup – al- washers (bimetallic washers) may be used.

SPECIFICATION FOR ENCLOSURE FOR PACKAGE SUBSTATION

1. The package substation shall have the following features.
2. Enclosure for the entire package substation shall be preferable of Galvanised Iron Sheet painted with the colour suitable for outdoor use.
3. Pre-Fabricated Substation shall be factory assembled only. NO site assembly shall be allowed.
4. Separate compartment for 11 kV Breaker, Distribution Transformer & LT Switchgear

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5. Door of the HT and LT compartment shall be designed such as complete door is divided into minimum four fold / parts vertically for minimum space requirement while opening.
6. The protection degree of the Enclosure shall be IP55 for LT & HT switchgear compartment & IP23 for Transformer compartment. Proper / adequate ventilation aperture shall be provided for natural ventilation by way of Louvers etc
7. The painting specification and color shade of the enclosure shall be approved by the purchaser.
8. There should be proper earthing arrangement for the entire substation i.e. 11 kV Breaker, Distribution Transformer, LT Switchgears along with the enclosures.

All metallic components shall be earthed to a common earthing point. It shall be terminated by an adequate terminal intended for connection to the earth system of the installation, by way of flexible jumpers/strips & Lug arrangement. The continuity of the earth system shall be ensured taking into account the thermal & mechanical stresses caused by the current it may have to carry. The components to be connected to the earth system shall include:

- a) The enclosure of Package substation,
 - b) The enclosure of High voltage switchgear & control gear from the terminal provided for the purpose,
 - c) The metal screen & the high voltage cable earth conductor,
 - d) The transformer tank or metal frame of transformer,
 - e) The frame &/or enclosure of low voltage switchgear,
9. Design of Transformer Compartment shall be such to accommodate oil type 1600 KVA transformer
 10. Non-metallic barrier shall be provided between ACB
 11. Non-metallic phase separator shall be provided between the three phases connected to ACB.
 12. Layout of package substation shall have approval of Chief Electrical Inspector. It is the responsibility of bidders to make changes as per the requirement of Chief Electrical Inspector, without any time and cost implication to the purchaser.
 13. Connected between LT terminal of transformer to ACB shall be by Copper busbar.
 14. The Factory Assembled Pre-Fabricated Compact Substation should have adequate arrangements of ventilation and should be inclusive of all safety accessories like voltage detection rod, fire extinguishers, gloves etc. Adequate illumination is to be provided for Factory Assembled Pre-Fabricated Substation. There should be provision for providing enclosure around the entire Factory Assembled Pre-Fabricated Compact Substation. There should be barrier for HT Breaker section, Transformer section and LT Switchgear section for safety purpose. There should be easy access to all these three compartments independently.
 15. The Factory Assembled Pre-Fabricated Substation should have ample arrangement to meet the requirements of protection of all electrical equipments. The clearances between live parts and minimum clearances to earth have to be maintained to the respective standards. The size of the substation should be compact to meet the traffic and road requirements.
 16. The bidder has to specify the total weight of the Factory Assembled Pre-Fabricated Substation.

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17. Doors of HT & LT compartment: Separate Lockable doors shall be provided for the HT and LT Compartments to prevent unauthorized access to personnel.
18. There shall be an arrangement for internal lighting activated by associated switch for HV, Transformer & LV compartments separately.
19. The Factory Assembled Pre- Fabricated Substation should have passed internal arcing withstand tests at 18.4 kA 1s.
20. Labels for warning, manufacturer's operating instructions etc. shall be durable & clearly legible.
21. Internal Fault: Failure within the package substation & 11kV RMU due either to a defect, an exceptional service condition or mal-operation may initiate an internal arc. Such an event may lead to the risk of injury, if persons are present. It is desirable that the highest practicable degree of protection to persons shall be provided. The Design for Internal arc fault shall be tested for 20KA for 0.1sec as per IEC 61330/62271-200.

16) DRAWINGS & INFORMATION

ALONGWITH OFFER

The bidder shall submit completely filled data sheet as per the given format along with GA drawing indicating list of accessories.

Submit list of spare parts required for safe operation of equipment for Two years.

17) HANDING OVER DOCUMENTS

The supplier shall submit following:

1. GA drawing
2. HV / LV Cable Box
3. Foundation layout
4. Rating and Diagram Plate
5. Data sheet indicating results of tests
6. Test reports
7. O & M manuals

18) INSPECTION AND TESTING

Purchaser's representative shall be given free access in the works from time to time for stage wise inspection and progress reporting.

The following routine and type test shall be performed on the transformers as per IS-2026 in the presence of purchaser's representative and certified test reports submitted. About three week's notice shall be given to the purchaser to witness the tests at the vendor's works.

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19) ROUTINE TEST

The routine tests, including but not limited to the following shall be performed on each of the transformers, as per the relevant standards

Measurement of winding resistance

Measurement of voltage ratio and check of voltage vector relationship

Measurement of impedance voltage/short circuit impedance ,load loss and No load loss

20) TYPE TEST

Type test as indicated in IS: 2026 shall be conducted on the transformers. One transformer of each rating shall be subjected to heat run tests if specified.

21) TRANSFORMERS RATED FOR UPTO 2 MVA

The Contractor shall submit for Client's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Client and submit the reports for approval.

22) LIST OF TYPE TESTS

1. Short circuit test
2. Temp. rise test
3. Lightning impulse voltage test on all three limbs
4. Partial discharge test on dry type transformers
5. Tank Pressure test on oil filled transformers
6. Tank vacuum Test on oil filled transformers
7. Noise level
8. Degree of protection test for marshalling box
9. Zero sequence Impedance

23) METHOD OF MEASUREMENT

Supply of the transformer including transport to site, loading and unloading at site store or directly to the place of installed etc. as specified will be treated as one unit for measurement and payment.

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24) TRANSPORT, DELIVERY AND STORAGE

The prices shall be F.O.R. site basis including packing & forwarding charges. The quoted price must include all the costs for necessary mode of transportation up to the final location of transformer or site store. All incidental expenses during transportation shall be part of quoted prices including transit insurance. The charges for loading and unloading of equipments at site should form part of offer.

The transportation for any auxiliary item or detachable part of equipment should be simultaneous and carry necessary instructions for assembling and storage requirements.

25) GUARANTEE AND WARRENTY

The quotes values of parameters shall be within given tolerance for given period of service life.

26) SPARES

The bidder shall quote for minimum spares required for two years safe operation of transformer along with the offer separately.

27) MAKE OF COMPONENTS

The bidder should indicate the list of manufactures for bought out items. The client /Consultant reserve the right to select or change the make of material from the submitted list.

DATASHEET

SR.	PARTICULAR	DETAILS
1.0	GENERAL FEATURES	
1.1	Make	As per Make List
1.2	Installation	Indoor
1.3	Service	Continuous
1.4	Climate	Tropical
1.5	Type of cooling	Air natural
1.7	Allowable temperature rise	Winding - 55 deg.c.
1.8	Painting	Epoxy, shade no. 631 as per IS : 5
1.9	Position	Floor mounted
2.0	ELECTRICAL DATA :	
2.1	Earthing : L.V. side	Solid
2.2	No. of windings	Two
2.3	Phase	3
2.4	Frequency	50 Hz.
2.5	Voltage ratio	11 / 0.433 V
2.6	Phase connection	Delta - Star
2.7	Vector group	Dyn - 11
2.8	% impedance	As per Tender
2.9	Rating in KVA	As per Tender
2.10	Winding insulation class	"F"

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SR.	PARTICULAR	DETAILS
2.11	Terminations :	
2.11.1	H.V. side HV & LV separation : 180 Degree	Cable box Size: 1 No., 3 c x 300 mm. ² AL HT XLPE (E) CABLE.
2.11.2	L.V. side	LT Cables suitable
3.0	TAP CHANGER :	
3.1	Tapings	H.V.
3.2	Tap changer	ON load
3.3	Tapping range	As per Tender
3.4	No. of steps	As per Tender
4.0	Limit for transformer operation under over load condition as per IS	Required
5.0	ACCESSORIES :	
5.1	1. Marshalling box 2. Sampling valve 3. Bidirectional rollers 4. Double diaphragm Explosion vent 5. Silica-gel breather 6. Air release plug	Required Required Required
5.2	1. Separate neutral bushing 2. Jacking pads 3. Lifting lug 4. Earthing terminal 5. 1 set of detachable radiator with shutoff valve (above 1000 kva) 6. Winding temp. indicator with alarm & trip contacts (above 500 kva) 7. Rating and diagram plate HV & LV glands	Required Required Required Required
6.0	PERFORMANCE DATA :	
6.1	Rated guaranteed losses without IS tolerance	
6.1.1	No load at 100% voltage	Required
6.1.2	No load at 110% voltage	Required
6.1.36	Full load Cu. Loss	Required
6.2	Rated No load current	Required
6.2.1	No load at 100% voltage	
6.3	Rated efficiency at 0.8 P.F.	Required
6.3.1	At full load	
6.3.2	At 75% load	
6.3.3	At 50% load	
6.4	Rated regulation	Required
6.4.1	At 0.9 P.F. lag	
6.4.2	At 0.8 P.F. lag	
6.4.3	At unity P.F.	
6.5	Impedance voltage	Required
6.5.1	Primary - Secondary	
6.6	Load at which max. efficiency occurs	Required
6.7	Maximum efficiency	Required
6.8	Maximum flux density	Required
6.9	Current density	Required

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SR.	PARTICULAR	DETAILS
7.0	MECHANICAL DATA :	Required
7.1	Weight :	Required
7.1.1	Core & windings	
7.1.2	Oil (Weight & Qty in Liters)	
7.1.3	Total	
7.2	Dimensions (mm.) : (Dimensions should be considered including accessories)	Required

NOTES :

- The bidder should have to supply the makes from above in consultation with the client/Consultant.
- The bidder should have to specify the list of makes considered in the tender while quoting the rates in the tender, in covering letter of separate letter enclosure. However, the final decision for accepting make specified would be of client / Consultants.
- Make of components required to be used by contractor to complete the installation, if not mentioned anywhere, shall be required to GET APPROVED by Client/Consultant before installation in writing manner.
- Client/ Consultant reserves the right to select / change the make of material from above mentioned makes.

5 TECHNICAL SPECIFICATION FOR DIESEL GENERATOR SET.**1) SCOPE:**

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1. This specification covers the design, construction features, manufacture and performance of emergency diesel generator. The scope includes supply, installation, testing and commissioning of D.G. set along with fuel pipeline, residence type exhaust pipe insulation and all the accessories required for trouble free operation.

2) CODES AND STANDARDS:

The DG set shall meet the requirements of the following standards and rules:

IS : 2253	Designation for type of construction and mounting arrangement of rotating electrical machines.
IS : 4691	Degree of protection providing by enclosures of rotating electrical machinery.
IS : 4728	Terminal marking of rotating electrical machines.
IS : 7132	Guide for testing 3 Phase Synchronous Machines.
IS : 5422	Turbine type generators.
IS : 4889	Methods of determination of efficiency of rotating electrical machines.
IS : 1271	Insulating materials for Electric machinery and apparatus in relation to their thermal stability service, classification.
IS : 4722	Specification for rotating electrical machines.
IS : 13947	AC circuit breakers.

3) DESIGN CONDITIONS:

All equipment and materials will be selected and rated for use at the following site conditions.

Summer outdoor design temperature	50° C.
Surface temperature	80° C.
Relative Humidity	95% Max.

CONSTRUCTION

4) GENERAL :

1. The diesel engine offered shall be of the regular production models of the manufacturer for industrial applications and already type tested either at the manufacturer's works or outside. The type test report shall be furnished to the purchaser for his review if so desired.
2. In case the proposed engine model has not been type tested, vendor shall furnish with the offer, a reference list of its existing industrial installation and at least three of these engines should have completed, 5000 hours of running at site.
3. Unless otherwise specified in the equipment data sheets, the diesel engine shall be provided with class A1 governing as per the latest edition of B.S. 5514.

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4. The "Cyclic irregularity" of the diesel engine for direct coupling to an electric generator, "angular deviation of A.C. generators" given by diesel engine for parallel operation, and the "engine governor speed droop characteristics", shall be restricted to the values specified under the latest edition of B.S. 5514.
5. The vendor shall be responsible for carrying out torsional analysis of the dynamic system as specified in the latest edition of British Standard-5514. The results in the form of a report shall be submitted to the purchaser for scrutiny and reference, if desired.
6. Vendor shall provide the flexible exhaust connections to connect the engine exhaust to the exhaust piping. The required size of the exhaust piping should be clearly specified by the vendor.
7. The common base plate for mounting the diesel engine and the driven equipment as well as the flexible coupling, shall be supplied by the vendor.
8. Vendor shall indicate in the bid, the IS Noise Level rating of the diesel engine with the offered exhaust silencer, which should not exceed more than 75 db at 1 Mtr. Distance.

5) ENGINE STARTING:

1. Diesel engines shall be capable of starting without the use of cold starting aids so long the ambient temperature at the site is not below 4° c.
2. Where the diesel engine is specified / offered with battery starting arrangement, the starter motor shall be capable of starting the engine without having to disengage the driven machine with the help of a clutch. Where the diesel engine is equipped with a dual starter the synchronizing switch and the corresponding wiring / connection with the starter motor shall be provided by the vendor.
3. In case of diesel engines driving the engine mounted battery charging alternator, the Vendor shall also provide Battery, automatic Electronics float & boost type battery charger suitable for taking power from supply authority's power source and mounted on a free standing type of a panel.
4. The battery charger as specified in the equipment data sheet, shall be capable of delivering a current equal to 100% of the 20 hour discharge rate of the battery and also equipped with charging rate selector device.
5. As specified in the data sheets, the diesel engine is required to start / stop automatically, the vendor shall provide the necessary controls (automatic – cum -manual) in the engine panel and the interconnecting wiring and piping from the panel to the engine and starting equipment. A pilot lamp shall be provided in the line side of the starting equipment circuit to indicate that the controller is in the automatic position. In the event the engine does not start after three attempts have been made, the controller shall stop all further cranking and operate the audio-visual alarm. Shaft driven lubrication system is acceptable,

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alternatively D.C. motor driven lubrication pump with timer suitably interlocked with the starting system is acceptable.

6) ENGINE COOLING:

1. Vendor shall supply radiator based cooling system.

7) ENGINE FUEL SYSTEM:

1. Engine fuel system shall be complete in all respects but not limited to following :
2. The daily service fuel tank capacity 990 liters shall be equipped with shielded level gauge, strainer and a hand hole of not less than 150mm diameter, besides the required fuel connections and a drain plug. One tanks of suitable capacity to be provided.
3. The inside surfaces of the fuel tank and the float tank shall be coated with Enamel Red or Black of I.C.I. or its equivalent and the outside surface to be given two coats of the oil resistant primer paint. The fuel tank shall be hydrostatically tested at a pressure not less than 0.35 Kg./Cm.²
4. Fuel oil transfer pump to transfer oil from barrels to day tank shall also be provided.
5. All piping, valves, fittings and supports inside D.G. house shall be part of supply.

8) INSPECTION & TESTING:

1. The vendor shall have the responsibility of providing purchaser's representative with all requisite facilities / equipment for carrying out satisfactory testing.
2. The diesel engines shall be tested in the presence of purchaser's representative accordance with latest edition of B.S. 5514 or any other equipment standard as agreed to with the purchaser before the finalization of order.
3. The routine load and fuel consumption test shall be of the 4 hours.
4. Unless otherwise specified, 10% overload provision shall be kept while setting the fuel limit for the site running.
5. The engine control panel/s after assembly and wiring, shall be functionally tested in the presence of the client's / consultant's representative.

9) ALTERNATOR:

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1. This specification define the requirements of design, manufacture, testing and supply of self excited emergency generator complete with automatic voltage regulator, control panel, isolator and other accessories as specified in the material requisition.
2. Unless otherwise specified the emergency generator shall be supplied complete with :
 - 2.1 Brush less excitation system complete with AVR.
 - 2.2 Electric panel including control cubicle and associated auxiliary devices, relay panel and generator breaker / isolator, battery and battery charger.
 - 2.3 Air inlet and outlet for generator cooling (inlet shall be oriented to suit total plant layout).
 - 2.4 Lifting arrangement for the machine.
 - 2.5 Foundation frame complete with foundation bolts to install alongwith engine on common base frame.
 - 2.6 Lub. Oil system integral with the prime mover lub. Oil system.
 - 2.7 Spares for commissioning.
 - 2.8 Spares for two years of operation and maintenance.
 - 2.9 Any other part / accessories not specifically mentioned above but considered necessary for safe and reliable operation.

10) DESIGN AND CONSTRUCTION:

1. The alternator design shall meet the requirement specified in data sheet and shall be suitable for the site conditions specified therein.
 - 1.1 The alternator shall be mounted on a common base frame together with the rime mover unless otherwise agreed. The generator shall be provided with necessary lifting hooks and two earth terminals for connection to main earth grid.
 - 1.2 The alternator winding shall be class "F" insulation with temperature limitation to Class "B".
 - 1.3 The stator windings shall be brought out to six insulated terminals in two separate terminal boxes. The alternator shall, therefore, be provided with three separate terminal boxes i.e. for the line and neutral stator connection and for control connection. The terminal box for the line terminal shall have 40 % free space and each segregated for easy cable end connection of cable size specified in data sheet. The neutral box shall in addition to the space for neutral earthing cable shall have sufficient room for the current transformers used for the protection of the generator. Star connection shall be formed in the neutral side of terminal box. The terminal box for control cable shall contain properly marked terminals for all internal equipments e.g. embedded temp. detectors etc. All terminals shall be stud type. The terminal boxes shall be complete with lugs and double compression type cable glands. Current transformers shall be as specified in data sheet.
 - 1.4 All parts and accessories shall be suitable to withstand stresses due to over speed / overload / short circuit conditions specified.
 - 1.5 Bearings shall be double shielded and prelubricated. Grease in the bearing enclosure shall provide additional lubrication to bearings as well as provide sealing against dust

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and moisture. On line greasing facility with excess grease expulsion system shall also be provided.

- 1.6 The alternator shall be air cooled unless otherwise agreed, alternator enclosure shall be as specified in data sheet.
- 1.7 The direction of rotation of the rotor of the machine shall be compatible with that of the prime mover. A clear indication of the direction of rotation shall be given on either end of the machine.
- 1.8 Field winding shall have class "H" insulation with excellent electrical and mechanical properties. The field winding shall be capable of operating at a field voltage with Excitation capacity $E_{max} / E_n = 1.6$ for at least two minute to meet improved stability requirements.
- 1.9 A rating plate of S.S material shall be fixed on the generator frame and shall give the following information :

- 1.9.1 Manufacturer's name.
- 1.9.2 Serial Number, Type and frame reference
- 1.9.3 Rated output in KVA & KW
- 1.9.4 Rated power factor, frequency and voltage
- 1.9.5 Rated stator current and speed in Rev. / Min.
- 1.9.6 Class of insulation
- 1.9.7 Phase rotation (CW or CCW)
- 1.9.8 Customer's indent no.
- 1.9.9 Year of manufacture
- 1.9.10 Weight of rotor and stator in Kg.

11) EXCITATION SYSTEM:

1. The generator shall be provided with brush less type solid state excitation system. The field of the exciter shall be either permanent magnet type or externally excited through external power, transformer and AVR. AC voltage generated in the exciter shall be rectified by the rotary rectifier assembly and feed power to the main field circuits of the generator.
 - 1.1 The exciter capacity shall be at least 20% more than the maximum requirement at any time. The exciter winding shall be insulated with class "F" insulation.
 - 1.2 Automatic solid state voltage shall be provided with the following features as a minimum.
 - Short circuit protection.
 - Manual voltage control switch with adjuster.
 - Cross current compensation for parallel operation.
 - Voltage build up circuitry.
 - Stator current limiter.
 - Field current limiter.

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The current and potential transformers required to feed the AVR from the generator terminal shall be adequately rated.

12) SYSTEM OPERATION:

1. The emergency generator set shall normally be in an unattended area. The control system shall operate in fail safe mode and shall include all controls and protection necessary for the safe operation of the package. The generator set shall function as per one of the following schemes :
 - Manual start in service mode.
 - Manual test mode.

13) PAINTING, PACKING AND TRANSPORT:

1. All metal surfaces shall be thoroughly cleaned of scale, rust and grease etc. Prior to painting. Cleaned surfaces shall be given two coats of primer and prepared for final painting. Final finish shall be free from all sorts of blemishes.
2. The equipment shall be shipped to site suitably packed to prevent any damage. Each package shall have labels to show purchaser's name, purchase order and equipment no. suitable lifting lugs etc. shall be provided and lifting points shall be clearly marked on the package. Packing shall be suitable for storage at site for a minimum period of 6 months.

14) TESTS AND INSPECTION:

1. The owner or his authorised 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. He shall be given all assistance to carry out the inspection.
2. Detailed test procedure alongwith the facilities available at vendors works shall be furnished along with the bid Owner's representative shall be given minimum four weeks advance notice for witnessing the final testing. Test certificates including test records and performance curves etc. shall be furnished for the complete D.G., individual test certificates of engine / alternator / common panel should be submitted, only thereafter complete D.G. would be tested.

15) TESTS:

1. Equipment shall be tested to conform to the appropriate standards and the following tests shall be conducted in the presence of purchaser's :
 2. Functional tests, continuity tests and high voltage test on control panel to establish the performance called for in the specification.
 3. Power frequency voltage test on switch gear and mechanical / electrical operational check.
 4. Routine tests for alternator as per IS : 4721.
 5. Over speed test (1.2 times the rated speed for 2 minutes.)
 6. Transient response tests for sudden application and rejection of loads of 25% , 50%, 75% and 100% of rated capacity.
 7. Phase sequence test.
 8. Vibration test.
 9. Noise level test.
 10. Dimensional and alignment test.
 11. Wave from test.

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DATA SHEET FOR DIESEL GENERATOR SET

SR. NO.	PARTICULARS	REQUIRED DATA
1.0	Prime mover	Diesel Engine
1.0	Quantity required	AS PER TENDER
1.0	Service	Prime mover for generating set
4.0	Rating	AS PER TENDER
5.0	RPM	AS PER TENDER
6.0	Voltage	AS PER TENDER
7.0	Voltage variation / regulation Steady state – slow variation In load (0.0% to 100% at P.F. 0.8)	1% or less
8.0	Voltage deep (sudden load application 0.0% to 100% at P.F. 0.8)	-5%, recovery time – 0.25 sec.
9.0	Frequency	50 Hz.
10.0	Frequency variation / regulation	0.5 Hz.
11.0	Temperature rise	Class 'F' used as Class 'B'
11.0	Alternator Insulation Material	VPI Insulation preferred
11.0	Flywheel	Required
14.0	Vibration damper	Required (fluid type only)
15.0	Fuel pump air cleaner	Required
16.0	Fuel pump	Required
17.0	Oil filter, fuel filter etc.	Required
18.0	Lub oil pump	Required
19.0	24 V DC electrical system consisting of SMF lead acid battery set and suitable charger	Required
20.0	Safety controls	Required
21.0	Residential type Silencer	Required
21.0	Acoustic Hood	Required
21.0	AMF panel with MCCB	Required
24.0	Coupling	Required
25.0	Instrument panel consist of a) Starter switch with key b) Lub oil temp. gauge c) Water temp. gauge d) Lub oil pressure gauge e) Tacho cum Hour meter	Required Required Required Required Required Required
26.0	Fuel tank	Required (Capacity -990 Litres Max.)
27.0	Battery charger	Required (Electronics float & boost type)
28.0	Engine testing a) At shop b) At site	Required
28.0	Tool kits	Required
29.0	Literature (Two sets each) a) Operation & maintenance manual b) Parts catalogue / list	Required Required

Construction of Multi-Storey Building Vadodara

30.	GPCB Norms	As per Latest Ammendment.
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16) Note:

1. The engine H.P. should be selected so as to achieve required KW rating to be generated at site condition and derated considering temperature inside acoustic enclosure..
2. D.G. set should be able to start by push button AMF relay, or remote command.
3. The engine test shall be witnessed by the OWNER's representative.
4. The engine should have automatic belt tensioning arrangement for battery charging alternator system.
5. The engine should have facility for the indication of oil level in oil sump during running of the engine.
6. The noise level should not be more than 75 db at 1 Mtr. distance and engine exhaust smoke emission level should be less than 1 bosch.
7. Engine should be preferably from the engine manufacturers who maintain quality - assurance to international standard of ISO 9001.
8. Engine should be fitted with electronic governor only.
9. The engine water circular pump should be directly driven by engine gear system. V-belt driven system should not be adopted / accepted.

17) MODE OF MEASUREMENT

Supply of the DG SET including transport to site, loading and unloading , exhaust etc. as specified will be treated as one unit for measurement and payment.

6 TECHNICAL SPECIFICATION FOR PCC,MCC,LT PANELS

5) SCOPE OF WORK

2. Main Distribution Panels, Sub-Distribution Panels and Final Distribution shall be covered under this section. Panels/Boards shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, 4 wire system with neutral grounded at transformer. All Distribution panels shall be CPRI tested design and manufactured by an approved manufacturer. CPRI certificate shall be made available.
3. Distribution panels shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1991.

6) CONSTRUCTION FEATURES:

Construction of Multi-Storey Building Vadodara

1. Distribution panels shall be 2 mm thick sheet steel cabinet for indoor installation, dead front, floor mounting/wall mounting type and shall be form as per site construction requirements.
2. The Distribution panels shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors and folded covers, Neoprene gasket, padlocking arrangement and bolted back.
3. All removable/ hinged doors and covers shall be grounded by flexible standard connectors.
4. Distribution panel shall be suitable for the climatic conditions as specified in Special Conditions. Steel sheets used in the construction of Distribution panels shall be 2 mm thick and shall be folded and braced as necessary to provide a rigid support for all components.
5. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal.
6. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage up to and including 1100 V AC.
7. All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned.
8. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts.
9. Self threading screws shall not be used in the construction of Distribution panels.
10. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels.
11. Minimum operating clearance of 300 mm shall be provided between the floor of Distribution panels and the lowest feeder compartment.
12. Distribution panels shall be of adequate size with a provision of spare switchgear as indicated on the Single Line Diagram. Feeders shall be arranged in multi-tier.
13. Knockout holes of appropriate size and number shall be provided in the Distribution panels in conformity with the location of cable/conduit connections.
14. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.
15. Every cabinet shall be provided with Trifoliate or engraved metal name plates.
16. All panels shall be provided with circuit diagram engraved on PVC sheet.
17. All live accessible connections shall be shrouded and shall be finger touch proof and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm.

7) BUSBAR CONNECTIONS:

2. Bus bar and interconnections shall be of high conductivity electrolytic grade aluminium / copper as indicated in the bill of quantities complying with requirement of IS :

Construction of Multi-Storey Building Vadodara

5082 – 1981 and of rectangular cross section suitable for carrying the rated full load current and short circuit current and shall be extendable on either side.

3. Bus bars and interconnections shall be insulated with heat shrinkable sleeve of 1.1 KV grade and shall be colour coded.
4. Bus bars shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system.
5. All bus bars shall be provided in a separate chamber and all connections shall be done by bolting.
6. Additional cross sectional area to be added to the bus bar to compensate for the holes.
7. All connections between bus bars and breakers shall be through solid copper / aluminium strips of proper size to carry full rated current and insulated with insulating sleeves.
8. Maximum current density for the bus bars shall be 0.8-1A/sq.mm for aluminium and 1.4 A/sq.mm for copper bus bars.
9. The busbar shall be housed in a separate compartment. The busbar shall be isolated with 3 mm. thick bakelite sheet to avoid any accidental contact. The busbar shall be arranged such that minimum clearance between the busbar are maintained as below :

Between phases	:	25 mm. minimum
Between phases and neutral	:	25 mm.
Between phases and earth	:	25 mm.
Between neutral and earth	:	20 mm. minimum

Maximum allowable temperature for the Bus bar to be restricted to 85 deg C

8) TEMPERATURE - RISE LIMIT

6. Unless otherwise specified, in the case of external surface of enclosures of bus bar compartment which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces as per IS 8623(Part-2) 1991.
7. All main distribution panels and sub distribution panels shall be provided with MCCB of appropriate capacity as per Single Line Diagram.
8. All final Distribution boards shall be provided with Miniature Circuit Breakers.
9. Final Single Phase Distribution boards shall be connected to the incoming supply through double pole MCB units & earth leakage circuit breakers.
10. All wiring for final distribution boards shall be concealed behind 5 mm thick bakelite sheet or M S sheet cover.
11. All Distribution boards shall be completely factory wired, ready for connection.
12. All the terminals shall be of proper current rating and sized to suit individual feeder requirements.

Construction of Multi-Storey Building Vadodara

13. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram.
14. All the switches and circuits shall be distinctly marked with a small description of the service installed.
15. Continuous earth bus sized for prospective fault current shall be provided with arrangement for connecting to station earth at two points. Hinged doors/ frames shall be connected to earth through adequately sized flexible braids.

9) CABLE COMPARTMENTS

2. Cable compartment of adequate size shall be provided in the Distribution panels for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables.

10) SWITCHGEARS

8.1 MOULDED CASE CIRCUIT BREAKER (MCCB)

- 8.1.1 The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2/IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA or any accredited international lab.
- 8.1.2 MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses
- 8.1.3 The breaking capacity of MCCB shall be as specified in the schedule of quantities.
- 8.1.4 The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu).
- 8.1.5 MCCBs for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/IS 13947-1.
- 8.1.6 The breaker as supplied with ROM should meet IP54 degree of protection.

8.2 CURRENT LIMITING & COORDINATION

- 8.2.1 The MCCB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables and let-through energy curves for all.

Protection Functions

Construction of Multi-Storey Building Vadodara

- 8.2.2 MCCBs with ratings up to 200 A shall be equipped with Thermal-magnetic (thermal for overload and magnetic for short-circuit protection) trip units (as per Single line diagram).
- 8.2.3 Microprocessor MCCBs with ratings 250A and above shall be equipped with microprocessor based trip units (as per Single line diagram).
- 8.2.4 Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorised access to the settings
- 8.2.5 Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of rms current values, electromagnetic compatibility, etc.)
- 8.2.6 Protection settings shall apply to all poles of circuit breaker.
- 8.2.7 All Microprocessor components shall withstand temperatures up to 125 °C.
- 8.2.8 Rotary handles to be provided for operation where ever required as indicated in Single line diagram.

8.3 TESTING

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

8.4 INTERLOCKING

- 8.4.1 Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.
- Handle interlock to prevent unnecessary manipulations of the breaker.
 - Door interlock to prevent the door being opened when the breaker is in ON position.
 - Defeat-interlocking device to open the door even if the breaker is in ON position.
 - PLC controller to operate the Motorised Breakers in sequence as indicated logic diagram in SLD.
- 8.4.2 The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable over load & short circuit pick-up both in Thermal magnetic and Microprocessor Trip Units.
- 8.4.3 All MCCB with microprocessor based release unit, the protection shall be adjustable Overload, Short circuit and earth fault protection with time delay.
- 8.4.4 The trip command shall override all other commands.

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8.5 MINIATURE CIRCUIT BREAKER (MCB)

- 8.5.1 Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection.
- 8.5.2 The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B, C, D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer.
- 8.5.3 The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.
- 8.5.4 The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

8.6 RESIDUAL CURRENT CIRCUIT BREAKER CURRENT OPERATED TYPE (RCCB)

System of Operation

- 8.6.1 Residual Current Circuit Breaker shall conform to IEC 61008. RCCB shall work on the principle of core balance transformer.
- 8.6.2 The incoming shall pass through the toroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer.
- 8.6.3 In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB shall be current operated independent of the line voltage, current sensitivity shall be of 30 mA at 240/415 volts AC and shall have a minimum of 20,000 electrical operations.

Mechanical Operation

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

Neutral Advance Feature

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

Testing Provision

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

8.7 AIR CIRCUIT BREAKER

6.7.1 Construction:

The ACBs shall have following features:

- a) Motorised with 230 V A.C. motor.
- b) 230 V A.C closing and shunt trip coil
- c) Draw out type with "service", "test", "isolated" and "maintenance" position.
- d) Safety shutter of Fibre glass/polycarbonate sheet of 2mm thickness shall be provided
- e) Mechanically trip free plus anti-pumping feature is to be provided.
- f) Electrical trip free plus anti pumping shall be provided with relay ONLY and not by contactors.
- g) Electrical/Mechanical operation counter shall be provided.
- h) Door interlock with defeat features to be provided & shall be electrically draw out type
- i) ACB shall be lockable in isolation position.

6.7.2 Release:

- j) Thermal Magnetic release shall be direct acting type, tripping ACB mechanically.
- k) Short circuit, overload and earth fault protection shall be provided.
- l) Vendor to suggest release type for feeders of supply range characteristic and accuracy.

6.7.3 ACB Performance:

- m) ACB performance inside panels at ambient 50 Degree.
- n) Ith Symmetrical breaking, 50KA
- o) Making capacity peak 87.5 KA
- p) Short time rating, 1sec. 50KA

11) ELECTRICAL POWER AND CONTROL WIRING CONNECTION :

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2. Terminal for both incoming and outgoing cable connections shall be suitable for 1100 V grade, aluminium / copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solderless sockets for the cable size as indicated on the appended drawings for the Panels.
3. Power connections for incoming feeders of the main Panels shall be suitable for 11000 V grade aluminium conductor (XLPE) cables.
4. Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.
5. Both control and power terminals shall be properly shrouded.
6. 10% spare terminals shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block, so that not more than one outgoing wire is connected to per terminal.
7. Terminal strips for power and control shall preferably be separated from each other by suitable barriers of enclosures.
8. Wiring inside the modules for power, control, protection and instruments etc. shall be done with use of 660 / 1100 V grade, PVC insulated copper conductor cables conforming to IS : 694 and IS : 8130. Power wiring inside the starter module shall be rated for full current rating of respective contactor, but not less than 4.0 sq.mm. cross-section area. For current transformer circuits, 2.5 sq.mm. copper conductor wire shall be used. Other control wiring shall be done with 1.5 sq.mm. copper conductor wires. Wires for connections to the door shall be flexible. All conductors shall be crimped with solderless sockets at the ends before connections are made to the terminals. All wires shall be FRLS grade.
9. Control power for the Motor starter module shall be taken from the respective module switchgear outgoing. Control power wiring shall have control fuses, (HRC fuse type) for circuit protection. All indicating lamps shall be protected by HRC fuses.
10. Particular care shall be taken to ensure that the layout of wiring is neat and orderly. Identification ferrules shall be fitted to all the wire termination for ease of identification and to facilitate checking and testing.
11. "CUPAL" washers shall be used for all copper and aluminium connections.
12. Final wiring diagram of the Panels power and control circuit with ferrules numbers shall be submitted alongwith the Panels as one of the documents against the contracts.

12) TERMINALS :

1. The outgoing terminals and neutral link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformers for instruments metering shall be mounted on the disconnecting type terminal blocks. No direct connection of incoming or outgoing cables to internal components of the distribution board is permitted, only one conductor may be connected in one terminal.

13) WIREWAYS :

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

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14) LABELS :

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

15) NAME PLATE :

1. A name plate with the Panels designation in bold letters shall be fixed at top of the central panel. A separate name plate giving feeder details shall be provided for each feeder module door.
2. Inside the feeder compartments, the electrical components, equipments, accessories like switchgear, control gear, lamps, relays etc. shall suitably be identified by providing stickers.
3. Engraved name plates shall preferably be of 3 ply,(Red-White-Red or Black-White-Black) lamicald sheet. However, black engraved perspex sheet name plates shall also be acceptable. Engraving shall be done with square groove cutters.
4. Name plate shall be fastened by counter sund screws and not by adhesives.

16) DANGER NOTICE PLATES :

1. The danger notice plate shall be affixed in a permanent manner on operating side of the Panels.
2. The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.
3. The danger notice plate, in general, meet the requirements of local inspecting authorities.
4. Overall dimensions of the danger notice plate shall be 200 mm. wide x 150 mm. high.
5. The danger notice plate shall be made from minimum 1.6 mm. thick mild steel sheet and after due pre-treatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.
6. The letters, the figures, the conventional skull and bones etc. shall be positioned on plate as per recommendation of IS : 2551-1982.
7. The said letters, the figures and the sign of skull and bones shall be painted in signal red colour as per IS : 5-1978.
8. The danger plate shall have rounded corners. Location of fixing holes for the plate shall be decided to suit design of the Panels.
9. The danger notice plate, if possible, be of ISI certification mark.

17) EARTHING

2. Earthing shall be provided as per IS: 3043-1987.

18) PAINTING

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13. All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating).
14. The shade of colour of panel inside/outside shall be as per BOQ confirming to IS Code No.5.

19) LABELS

2. Engraved PVC labels shall be provided on all incoming and outgoing feeder.
3. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

20) METERS

1. All voltmeters and indicating lamps shall be through MCB's.
2. Meters and indicating instruments shall be flush type.
3. All CT's connection for meters shall be through Test Terminal Block (TTB).
4. CT ratio and burdens shall be as specified on the Single line diagram/BOQ.

21) CURRENT TRANSFORMERS

8. Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps.
9. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondaries for operation of associated metering.
10. The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits.
11. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing

and terminal connections.

12. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

22) POTENTIAL FREE CONTACTS

5. Potential free contacts shall be provided for connection to Building Automation System in panels indicated in Schedule of Quantities.

23) INDICATING PANEL

20. All meters and indicating instruments shall be in accordance with relevant Indian Standards. Meters shall be flush mounted type. Indicating lamps shall be of low burden, and shall be backed up with 2 amps MCB/MPCB as per relevant fault level and toggle switch.

24) TESTING

5. Testing of panels shall be as per following codes:
- IV. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages upto and including 1000 VAC.
 - V. IS: 13947 : 1993 Degree of protection
 - VI. IS: 5578 & 11353:1985 Arrangement of bus bars.

25) WIRING

14. In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

26) INSTALLATION

- vi) Installation of all LT panels shall include but not limited to the following to complete the installation, testing and commissioning:

15. Transporting materials from stores to exact location of installation.
16. Supply and installation of required base frame made of MS angle or channel sections and duly painted with black paint.
17. Positioning, aligning, fixing, assembling, and installation of LT panel issued free of cost by Client after carrying out proper cleaning and inspection.
18. Site supervision, testing for proper functioning / operation, and pre-commissioning tests.

27) COMMISSIONING & ONSITE TESTING

7. All switchboards shall be tested for dielectric test with 1000V megger.

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8. All earth connections shall be checked for continuity.
9. All busbar connections shall be checked and tightened properly.
10. All cable terminations and terminal shrouding shall be checked if they are properly done.
11. The operation of protective devices shall be tested by secondary injection test.
12. The operation of circuit breaker shall be tested for all interlocks.
13. Functional test shall be done for all ACBs, MCCBs and other components.
14. Indicating lamps and meters shall be checked for proper working.

28) WORKMANSHIP:

5. The contractor shall erect the panel at site in co-ordination with the supplier if required.
6. He should check for loose ends on the part of the supplier and shall inform client and consultant for the same.
7. Physical and continuity tests shall be carried out by contractor.
8. Also the field tests carried out by the supplier shall be recorded by the contractor.

29) MODE OF MEASUREMENT:

4. Contractor shall be paid for one panel erection as per BOQ Quantities part.

7 TECHNICAL SPECIFICATION FOR THYRISTOR BASED APFCR PANEL

1) SCOPE

This specification covers design, manufacture, and supply, testing of capacitor bank and automatic power factor correction panel with capacitor banks suitable for continuous duty.

2) CODES AND STANDARDS

1. The design manufacture and performance of power factor improvement capacitor / capacitor banks shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable Indian/British/IEC standards. In particular the equipment shall conform to the latest revisions of the following:
2. When the above standards are in conflict with the stipulation of this specification, this specification supercedes them.

3) CONSTRUCTION

3.1 Capacitor Bank

Capacitor banks shall comprise of identical delta connected three phase units. The individual capacitor unit shall be manufactured out of mixed dielectric design comprising of bi axially oriented polypropylene film and capacitor tissue paper.

Each individual element of the capacitor tissue unit shall be provided with silver fuse wire.

The capacitor unit shall consist of many such elements in series / parallel combinations for getting the desired KVAR output.

The capacitor shall be thermal stability & MPP/APP TYPE AS SPECIFIED IN SINGLE LINE DIAGRAM.

The dielectric losses of the capacitor shall be restricted to 2 watts per KVAR.

The phase terminal connections of the capacitor unit shall be brought out at the top through metal insulators, which should be soldered to the fabricated top cover.

The capacitor shall be provided with suitably rated discharge resistors.

The capacitor shall be designed to withstand the electrodynamic and thermal stresses caused by transient over current during switching.

3.2 Busbar Chamber

Capacitor bank shall be provided with a bus - bar chamber. The chamber shall be dust and vermin proof in construction, fabricated from 2-mm. thick sheet steel. Continuous neoprene rubber gaskets shall be copper on all mating surfaces. TPN Bus - bars shall be of copper supported on epoxy insulators of adequate rating and strips.

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The bus - bar sizes and clearance shall be suitable for connection of cables through crimping type cable lugs. Bus- bar chamber shall be extended suitably on one side to cable and box at the end of bus - bar chamber undrilled removable gland plate and access covers to be provided for cable entry as required.

4) EARTHING

The enclosure of individual capacitor unit shall be provided with 2 nos. 10 mm dia. earth terminals, each complete with two plain and one spring washer, nuts etc. These terminals shall be effectively bonded to the common sheet steel framework. Each bank will have two external earth terminals in the bus-bar chambers complete with hardware.

5) PAINTING

All sheet steel shall be thoroughly cleaned, degreased and phosphated, painted with two coats of paint. The type and shade of paint be as specified in Data Sheet.

6) DRAWINGS

The following drawings shall be submitted along with the bid :

- a. General arrangement drawing showing overall dimensions, weight, internal arrangement and mounting details.
- b. Terminal chamber, showing bus-bar arrangement with all dimensions.

7) TEST & TEST CERTIFICATES :

- 7.1. Vendor shall carry out all routine tests as specified in IS : 2834 and shall furnish the test certificates.
- 7.2. The vendor shall also carry out the thermal stability test on the units in the presence of purchaser representatives.
- 7.3. The capacitor units shall be tested from electric supply authorities like G. E. Board / A. E. Co. and the test certificates in duplicate shall be furnished to client and also the copy shall be submitted to the electric supply authority while getting the power supply released from them.

8) CAPACITOR PANEL

Capacitor control panel shall be automatic if specified in the Data sheet.

The panel for capacitor shall be fabricated from 2.0 mm thick sheet steel and shall be finished as per clause no.5.0. Earthing terminals shall be provided as per clause no. 4.0. The panel shall be provided suitably rated TPN copper bus-bar supported on epoxy insulators and with heat shrinkable type sleeves. Each capacitor unit shall be connected to main bus bar through contactors of suitable rating (9 Nos. of double the rating of capacitor current) with safety margin. Each unit shall be of 10/15/20/25/50 KVAR – ALL PP- (APP) as specified.

Protective MCCB of suitable rating shall be provided with base/holders. Connections shall be made with PVC insulated flexible copper cables having crimped copper lugs.

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Continuous earthing conductor/ strip of G.I. shall run through and all capacitor units shall be earthed.

Sufficient ventilation shall be provided in the capacitor compartment to limit the temperature rise. Cooling fans shall be provided with ON-OFF switches as per requirements.

The main bus-bar shall be terminated on suitably rated MCCB as per data sheet. vertical compartment with detachable gland plate shall be kept for incoming cable connections from bottom or top as specified.

Capacitors units shall be mounted on angle frame of strong construction.

The panel shall be mounted on M.S. channel section at bottom for easy installation.

The panel shall be provided with lifting hooks / Eye bolts for handling.

Automatic power factor correction sensing relays (APFCR) shall be provided with all related circuits and contactors for controlling the power factor to max. 0.98 by energising the contactor and related capacitor bank "ON" or "OFF" as per load conditions.

The controller shall be set for time lag of 45 seconds so that on sensing the low or high power factor it energises or deenergises the contactor after 45 seconds.

The Dust and vermin proof switching compartment shall be isolated from capacitor mounting compartment.

The panel shall be provided with :

- a. MCCB of adequate capacity as specified.
- b. 100 x 100 mm. flush type 0-500 V digital voltmeter with selector switch.
- c. 100 x 100 mm. flush type digital Ammeter with suitable rated C.T. and selector switch.
- d. Supply "ON" indication lamp (R-Y-B).
- e. Power factor meter 0.5 lag to 0.5 lead.
- f. KVAR meter of suitable rating.
- g. "ON" - "OFF" push button with suitable thyristor based size contactor.
- h. By - pass switch for each capacitor unit for manual operation.
- i. Automatic Power Factor correction relay unit with ON-OFF mode selector switch.
- j. Capacitor Heavy Duty Contactors (Thyristor based).

The capacitor panel shall be installed away from wall with sufficient distance for better cooling and ease of maintenance.

The following drawings shall be submitted before procurement for approval from the Consultants..

1. General arrangement and Fabrication details.
2. Power wiring diagram of capacitor panel.
3. Control wiring diagram of capacitor panel/
4. C.T. connection.

9) MODE OF MEASUREMENT:

1. The APFCR Panel shall be measured in Nos as per BOQ Quantities.

8 TECHNICAL SPECIFICATION FOR LDB & PDB

1) SCOPE OF WORK

3. Distribution Boards (DBs) shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, neutral grounded at transformer. The DB shall be minimum di-electric strength of 1.5 KV / Sec. All Distribution Boards shall manufactured by a manufacturer listed in Appendix-I.
4. LDB's shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1991.

2) CONSTRUCTION FEATURES

5. DB's shall be made out of 1.6 mm thick high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of LDB shall be folded and braced as necessary to provide a rigid support for all component.
6. DB shall be suitable for indoor / outdoor installation, wall mounting free standing type, in double door construction.
7. The Final Distribution Boards shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement.
8. All removable/ hinged doors and covers shall be grounded by 1.0 sqm tinned stranded copper connectors.
9. Final Distribution Boards shall be suitable for the climatic conditions. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal.
10. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage upto and including 1100 V AC.
11. All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of LDBs.

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12. Knockout holes of appropriate size and number shall be provided in the LDB's in conformity with the location of cable/conduit connections. Detachable sheet steel gland plates shall be provided at the top / bottom to make holes for additional cable entry at site if required.

3) DISTRIBUTION BOARDS SHALL COMPRISE OF THE FOLLOWING:

6.1 A panel for mounting where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.

6.2 Installations accessories shall be part of the DB for fixing conductor and rails for mounting MCB's and RCCB's etc. Neutral bus bars & earthing bus bars required in the circuit. All busbars in the LDB shall be insulated type.

6.3 Service cable /interconnection shall be part of the Distribution Boards.

6.4 The board shall be installed at a height such that the operating is within reach of the normal human height i.e. 1.2 to 1.8 meters from finish floor level.

6.5 Degree of protection shall be IP-52 for indoor application, IP-54 for kitchen & laundry and IP-55 for outdoor application.

6.6 All three phase distribution boards shall have 4 rows and single phase distribution boards shall have single rows for housing of MCB's and RCCB's unless noted otherwise.

6.7 Phase segregation to be maintained in all three phase distribution boards.

6.8 Earthing shall be provided in each LDB's.

6.9 MINIATURE CIRCUIT BREAKER (MCB)

6.9.1 MCB's shall have quick make and break no welding self-wiping silver alloy contacts for 10 KA short circuit both on the manual and automatic operation.

6.9.2 Each pole of the breaker shall be provided with inverse time thermal over load and instantaneous over current tripping elements, with trip free mechanism.

6.9.3 In case of multi-pole breakers, the tripping must be on all the poles and operating handle shall be common. Breakers must conform to BS 3871 with facility for locking in OFF position.

6.9.4 Pressure clamp terminals for stranded/solid conductor insertion are acceptable up to 4 sq.mm. Aluminium or 1.5 sq.mm.

6.9.5 Copper and for higher ratings, the terminals shall be suitably shrouded. Wherever MCB isolators are specified they are without the tripping elements.

6.10 RESIDUAL CURRENT CIRCUIT BREAKER CURRENT OPERATED TYPE (RCCB)

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

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6.10.2 The RCCB should ensure mainly the following functions:

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

4) EARTHING

2. Earthing shall be provided as per IS:3043-1987.

5) PAINTING

2. All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be of Siemens gray paint shade no. RAL-7032 of IS Code No.5.

6) LABELS

1. Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

7) TESTING

1. Testing of panels shall be as per following codes:

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- i. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages upto and including 1000 VAC.
- ii. IS: 13947 : 1993 Degree of protection

8) WIRING

1. In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

9) WORKMANSHIP:

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

10) MODE OF MEASUREMENT:

2. The distribution boards shall be measured in Nos as per BOQ Quantities.

9 TECHNICAL SPECIFICATION FOR LT CABLES & CABLE TRAY.

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1) SCOPE OF WORK

8. The Medium voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian Standards specifications, manufacturer's instructions. The cables shall be delivered at site in the original drums with manufacturer's name, size and type clearly written on the drums.
9. All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.
10. The cable shall be supplied in single length i.e. without any intermediate joint or cut unless specifically approved by the client.
11. The cable ends shall be suitably sealed against entry of moisture, dust, water etc. with cable compound as per standard practise.

2) MATERIAL

7. The MV cables shall be cross linked polyethylene (XLPE) insulated PVC sheathed of 1100 volts grade as asked for in the schedule of quantities. Cables upto 10 sq.mm shall be with copper conductor and 16 sq.mm and above shall be with aluminium conductor.

3) Technical Requirements:

6. All XLPE Aluminium/Copper Power cables shall be 1100 Volts grade, multi core constructed as per IS : 7098 Part-I of 1988 as follows :
 - 4.1 Stranded Aluminium /Copper conductor in case of 10 sq.mm. and above whereas solid conductor in case of 10 sq.mm. and below.
 - 4.2 Cores laid up.
 - 4.3 The inner sheath should be bonded over with thermo-plastic material for protection against mechanical and electrical damage.
 - 4.4 Armoring should be provided over the inner sheath to guard against mechanical damage. Armoring should be Galvanised steel wires or galvanised steel strips. (In single core cables used in A.C. system armoring should be non-magnetic hard aluminium Wires/Strips. Round steel wires should be used where diameter over the inner sheath does not exceed 13 mm; above 13 mm flat steel armour should be used. Round wire of different sizes should be provided against specific request.)
 - 4.5 The outer sheath should be specially formulated heat resistant black PVC compound conforming to the requirement of type ST2 of IS : 5831-1984 extruded to form the outer sheath.
7. Conductor shall be of electrolytic Aluminium/Copper conforming to IS : 8130 and are compact circular or compact shaped.
8. Insulation shall be of XLPE type as per latest IS general purpose insulation for maximum rated conductor temperature 70 degree centigrade.

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9. In Inner sheath laid up cores shall be bonded over with thermoplastic material for protection against mechanical and electrical damage.
10. Insulation, inner sheath and outer sheath shall be applied by extrusion and lapping up process only.
11. Uncoated, annealed copper / aluminium, of high conductivity, upto 4 mm² size the conductor shall be solid and above 4 mm² the conductors shall be concentrically stranded as per IEC: 228.
12. Repaired cables shall not be used.
13. Current ratings of the cables shall be as per IS: 3961.
14. The XLPE insulated cables shall conform to latest revision of IS and shall be read along with this specifications. The Conductor shall be stranded Aluminium/Copper circular/ sector shaped and compacted. In multi core cables the core shall be identified by red, yellow, blue and black coloring of insulation.
15. The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.
16. Progressive automatic in line sequential marking of the length of cables in meters at every one meter shall be provided on the outer sheath of all cables.
17. Cables shall be supplied in non returnable wooden drums as per IS: 10418.
18. Both ends of the cables shall be properly sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation, storage and erection.
19. The product should be coded as per IS: - 7098 Part-I as follows:-

	Aluminium Conductor	
A	XLPE Insulation	
	2X	
	Steel round wire armour	
W	Steel strip armour	
	F	
	Steel Double round wire armour	WW
	Steel Double strip armour	
FF		
	Non-magnetic (Al.) round wire armour	Wa
	Non-magnetic (Al.) strip armour	Fa
	PVC outer sheath	
Y		

4) Core Identifications:

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

Black shall always be used for neutral.

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5) Inspection

6. All cables shall be inspected by the contractor upon receipt at site and checked for any damage during transit.

6) Joints in Cables

4. The Contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoid cable jointing.
5. This apportioning shall be got approved by the Owner's site representative before the cables are cut to lengths.
6. Where joints are unavoidable heat shrinkable type joints shall be made.
7. The location of such joints shall be got approved from the Owner's site representative and shall be identified through a marker.

7) Jointing Boxes for Cables

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

8) Jointing of Cables

12. All cable joints shall be made in suitable, approved cable joint boxes and the filling in of compound shall be done in accordance with manufactures' instructions and in an approved manner. All straight through joints shall be done in epoxy mould boxes with epoxy resin.
13. All cables shall be joined colour to colour and tested for continuity and insulation resistance before jointing commence.
14. The seals of cables must not be removed until preparations for jointing are completed.
15. Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged.
16. The conductors shall be efficiently insulated with high voltage insulating tape and by using of spreaders of approved size and pattern.
17. The joints shall be completely topped up with epoxy compound so as to ensure that the box is properly filled.

9) Cable End Terminations

8. Cable end termination shall be done in cable terminal box using crimping sockets and proper size of glands of double compression type.
9. Solderless crimping type Aluminium/Cu lugs conforming to IS suitable for cable size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner.

10) Bonding of Cables

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4. Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armour clamp and gland.
5. The clamps must grip the armouring firmly to the gland or casing, so that no undue stress is passed on to the cable conductors.

11) Cable Installation in Cable Trays and Cable Trenches.

15. Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable.
16. The cable drums shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks.

12) Laying of Cables on Cable Trays

9. The relative position of the cables, laid on the cable tray shall be preserved and the cables shall not cross each other.
10. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius as recommended by the manufacturers.
11. All cables shall be laid with minimum one diameter gap and shall be clamped at every meter to the cable tray.
12. Cables shall be tagged for identification with aluminium tag and clamped properly at every 20M.
13. Tags shall be provided at both ends and all changes in directions both sides of wall and floor crossings.
14. All cable shall be identified by embossing on the tag the size of the cable, place of origin and termination.
15. All cables passing through holes in floor or walls shall be sealed with fire retardant Sealant and shall be painted with fire retardant paint upto one meter on all joints, terminations and both sides of the wall crossings by "VIPER CABLE RETARD".
16. This method may be adopted in places like indoor substations, air-conditioning plantrooms, generator rooms etc. or where long horizontal runs of cables are required within the building and where it is not convenient to carry the cable in open ducts.
17. This method is preferred where heavy sized cables or a number of cables are required to be laid. The cable trays may be either of perforated sheet type or of ladder type.

PERFORATED TYPE CABLE TRAY

18. The cable tray shall be fabricated out of slotted/perforated MS sheets as channel sections, single or double bended. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanised or painted as specified. Alternatively, where specified, the cable tray may be fabricated by two angle irons of 50mmX50mmX6mm as two longitudinal members, with cross bracings between them by 50mmX5mm flats welded/bolted to the angles at 1 m spacing. 2mm thick MS perforated sheet shall be suitably welded/bolted to the base as well as on the two sides.

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19. Typically, the dimensions details to be considered as per BOQ.
20. The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler plates and cable tray shall be scraped and removed before the installation.
21. The width of the cable tray shall be chosen so as to accommodate all the cables in one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 800mm.
22. Factory fabricated bends, reducers, tee/cross junctions, etc. shall be provided as per good engineering practice. (Details are typically shown in figure 3). The radius of bends, junctions etc. shall not be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.
23. The cable tray shall be suspended from the ceiling slab with the help of 10mm dia MS rounds or 25mmX5mm flats at a span spacing of 1mtr.
24. Flat type suspenders may be used for channels upto 450mm width bolted to cable trays.
25. Round suspenders shall be threaded and bolted to the cable trays or to independent support angles 50mmX50mmX5mm at the bottom end as specified. These shall be grouted to the ceiling slab at the other end through an effective means, as approved by the Engineer-in-Charge, to take the weight of the cable tray with the cables.
26. The entire tray (except in the case of galvanized type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.
27. The cable tray shall be bonded to the earth Terminal of the switch bonds at both ends.
28. The cable trays shall be measured on unit length basis, along the center line of the cable tray, including bends, reducers, tees, cross joints, etc. and paid for accordingly

LADDER TYPE CABLE TRAY

29. The ladder type of cable tray shall be fabricated of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a center to center spacing of 250cm.
30. Alternatively, where specified, ladder type cable trays may be fabricated out of 50mmX50mmX6mm (minimum) angle iron for longitudinal members, and 30mmX6mm flat for rungs.
31. Typical details of fabrication and dimensions of both the types of trays are shown in figure 4A,B,C and D.
32. The maximum permissible loading, jointing of channel sections, width of the cable tray, provision of elbows, bends, reducers, horizontal tee/ cross junctions etc. suspension of cable tray from the ceiling slab; painting and measurement of the cable tray shall be as per sub-clauses (ii) to (x) below clause 2.6.11.2, except that the overall width of one cable tray may be limited to 800mm.

13) Laying of Cables in Ground

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17. Cable trench shall be dug to the minimum depth of 1 mtr and the width shall dependent on the no of cables to be kept with the layer of brick in between two cables.

EXCAVATION OF TRENCHES :

18. The trenches shall be excavated in reasonably straight lines.
19. Wherever there is a change in direction, suitable curvature shall be provided.
20. Where gradients and changes in depth are unavoidable, these shall be gradual.
21. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.
22. The bottom of the trench shall be levelled and shall be made free from stone, brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 100 mm in depth.
23. Prior to laying of cables, the cores shall be tested for continuity and insulation resistance. The cable drum shall be properly mounted on jacks, at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum and the spindle is horizontal.
24. Cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains. The entire drum length shall be laid in one stretch.
25. However, where this is not possible the remainder of the cable shall be removed by 'Flaking' i.e. by making one long loop in the reverse direction.
26. After the cable has been uncoiled and laid into the trench over the rollers, the cable shall be lifted off the rollers beginning from one end by helpers standing about 10 meters apart and laid in a reasonably straight line.
27. Cable laid in trenches in a single tier formation shall have a cover of clean, dry sand of not less than 150 mm. above the base cushion of sand before the protective cover is laid.
28. In the case of vertical multi-tier formation after the first cable has been laid, a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid.
29. Finally the cables shall be protected by second class bricks before back filling the trench. The buried depth of uppermost layer of cable shall not be less than 750mm.
30. **Back Filling** : The trenches shall be back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 300 mm. Unless otherwise specified, a crown of earth not less than 50 mm in the centre and tapering towards the sides of the trench shall be left to allow for subsidence.

14) Route Marker

8. Route marker shall be provided along straight runs of the cables not exceeding 30 meters also for change in the direction of the cable route and underground joints.
9. Route marker shall be of cast iron painted with aluminium paint.
10. The size of marker shall be 100 mm dia with "Cable" and voltage grade inscribed on it.

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15) Testing of Cables

3. Cables shall be tested at works for all routine tests as per IS including the following tests before being dispatched to site by the project team.
 - g) Insulation Resistance Test.
 - h) Continuity resistance test.
 - i) Sheathing continuity test.
 - j) Earth test.(in armoured cables)
 - k) Hi Pot Test.
4. Test shall also be conducted at site for insulation between phases and between phase and earth for each length of cable, before and after jointing.
5. On completion of cable laying work, the following tests shall be conducted in the presence of the Owner's site representative.
 - l) Insulation Resistance Test(Sectional and overall)
 - m) Continuity resistance test.
 - n) Sheathing continuity test.
 - o) Earth test.
6. All tests shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules.
7. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests.
8. All tests shall be carried out in the presence of the Owner's site representative, results will be noted and signed by all present and record be maintained.

16) WORKMANSHIP

16. Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the Contractor shall mark it out on the drawings and also on the site and obtain the approval of the CLIENT AND/OR ITS ARCHITECT before laying the cable.
17. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only.
18. Cables shall be laid on walls, cable trays, inside shafts or trenches.
19. Saddling or support for the cable shall not be more than 500 mm apart. Plastic identification tags shall be provided at every 30 m.
20. Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or in accordance with the manufacturer's recommendations whichever is higher.
21. In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc unless marked on drawing by architect / consultant.

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22. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion.
23. Cables shall be protected with brick or cement tiles on all the three sides as shown on drawings. Width of excavated trenches shall be as per drawings.
24. Back fill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall be provided with cables markers at every 10 meters and at all loop points.
25. All cables shall be full runs from panel to panel without any joints or splices.
26. Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid.
27. Cable termination for conductors up to 4 sq.mm. may be insertion type and all higher sizes shall have compression type lugs.
28. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armouring shall be earthed at both ends.
29. In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall be laid in slant position, so that no rainwater may enter the building.
30. After the cables are tested the pipes shall be sealed with M. seal & then tarpaulin, shall be wrapped around the cable for making the entry watertight.
31. Testing : MV cables shall be tested upon installation with a 500 V Meggar and the following readings established:
 - 16.1 Continuity on all phases.
 - 16.2 Insulation Resistance.
 - 16.3 between conductors.
 - 16.4 all conductors and ground.
 - 16.5 All test readings shall be recorded and shall form part of the completion documentation.
 - 16.6 Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool. Proper insulation tape shall be applied at the cable and lug joint.
32. Format for cable testing certificate :
 - a. Drum no. from which cable is taken :
 - b. Cable from _____ to _____
 - c. Length of run of this cable ____ mtr
 - d. Insulation resistance test
 - between core 1 to earth ____mega-ohm
 - between core 2 to earth ____mega-ohm
 - between core 3 to earth ____mega-ohm
 - between core 1 to core 2 ____mega-ohm
 - between core 2 to core 3 ____mega-ohm
 - between core 1 to core 3 ____mega-ohmduration used:
 - e. High voltage test: Voltage Duration
 - between core and earth
 - between individual cores

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33. The cable shall be laid side by side in trench with brick covering on all the three sides.
34. The trench shall be such that sharp bends shall be avoided while laying the cable.
35. The bedding of fine sand under the cable shall be not less than 6 mm. The trench shall be terminated in Manholes with specified size of R.C.C. hume pipes as shown in drawing. Cable markers shall be provided through out the route of cable at 10 mtrs distance.
36. The trenches shall be refilled after the cable are laid and the Ground level shall be done as per original after pressing the same. The cables shall be checked for insulation resistance and continuity tests shall be carried out.

17) MODE OF MEASUREMENT:

17.1 Mode of Measurement for Cable Trench & Cable Tray.

The cable laying shall be measured in rmt. The trenches dug and refilled shall be measured in cu. Mtr. The bricks and sand bedding shall be measured in rmt. The cable trays shall be measured in rmt.

17.2 Mode of Measurement for Cable and Cable End Terminations.

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

10 TECHNICAL SPECIFICATION FOR INTERNAL WIRING.

1) SYSTEM OF WIRING

1. The system of wiring shall consist of PVC insulated copper stranded conductor flexible FRLS wires in metallic / non metallic (Rigid heavy/Medium Duty ISI -marked fire retarded PVC Conduits of minimum 2mm Wall thickness and Sizes of conduits shall be 25 mmdia. conduits for both mains and point wiring and shall be concealed or surface mounted above false ceiling as called for.

2) GENERAL DESCRIPTION

1. Prior to laying and fixing of conduits, the contractor shall mark the conduit route, carefully examine the working drawings prepared by him and approved by the Consultant indicating the layout, satisfy himself about the non interference in the route, sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details.
2. Any discrepancy found shall be brought to the notice of the Owner's site representative.

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3. Any modifications suggested by the contractor should get written approval before the actual laying of conduits is commenced.
4. In laying of conduits it is important that not more than two right angle bends are provided for each circuit without a pull box.
5. No junction box shall be provided in the entire length of conduit run for drawing of wires.
6. Only switch outlets, lighting fixture outlets, equipment power outlets and socket outlets shall be considered for drawing of wires.

3) LIGHTING & POWER WIRING

1. All final branch circuits for lighting and appliances shall be single conductor/ stranded/ flexible wires run inside conduits.
2. The conduit shall be properly connected or jointed into sockets, bends, and junction boxes.
3. Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.
4. All circuits shall preferably be kept in a separate conduit up to the Distribution Board. No other wiring shall be bunched in the same conduit except those belonging to the same phase.
5. Each lighting branch circuit shall not have more than ten outlets or 800 watts whichever is lower. Each conduit shall not hold more than three branch circuits.
6. Flexible cords for connection to appliances, fans and pendants shall be 650/1100 V grade (three or four cores i.e. with insulated neutral wire of same size) with tinned stranded copper wires, insulated, twisted and sheathed with strengthening cord. Colour of sheath shall be subject to the CLIENT AND/OR ITS ARCHITECT'S approval.
7. Looping system of wiring shall be used. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors.
8. No such joints shall be made unless the length of the sub-circuit, sub-main or main is more than the length of the standard coil.
9. Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in 3 mm. thick painted or galvanized steel boxes with cover plates as specified. Cadmium plated brass screws shall be used.
10. Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 25 mm. and wires not less than 1.0 sq.mm. copper shall be used.
11. Every conductor shall be provided with identification ferrules at both ends matching the drawings.

4) TESTING

1. The entire installation shall be tested for:

Insulation resistance.
Earth continuity.
Polarity of single pole switches.

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2. All the wiring switch board, outlet points shall be done in a concealed manner in wall & slab in PVC conduit of minimum 25 mm dia. (medium gauge) & with 650v / 1100v grade PVC insulated flexible copper conductor wire.
3. The switches should be modular with moulded cover plates, blank plates for outlet boxes.
4. The accessories, connectors, sockets, should be fixed with brass chrome / cadmium plated machine screw. For fan points the rates should be with hum -free type 300 W regulators as required to complete the point wiring.
5. The wiring shall be as per IS: 732 and IS: 4648. The wiring shall be done in a looping manner so as to avoid junction boxes at any place.
6. All the looping shall be done only in the switchboard and outlet points. The size of the wire shall be as per the specification. Colour code shall be strictly followed.
7. The size of wires shall as follow as per BOQ and as per clients requirements:
8. Light, fans, exhaust fan, 5 Amp. On board plug point, two way light points, bell point etc from switch to outlet.

Phase / Neutral	1.5 m m ²
Earth	1.5 m m ²

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

Phase / Neutral	2.5 m m ²
Earth	1.5 m m ²

10. From D.B. to 16A power point etc – i.e. circuit mains part of point wiring

Phase / Neutral	4.0 m m ²
Earth	1.5 m m ²

11. Separate pipes shall be laid for off wires and circuit mains.
12. Circuit mains of same phase shall be drawn in one pipe with prior permission/discussion with the consultant.
13. Separate phase, neutral and earthing wire of sizes recommended by consultant shall be drawn for each and every circuit mains.
14. Mains for lighting and on board plug points shall be of one-size higher wires than those used in off.

5) COMPUTER WIRING :

1. Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc., shall be installed in flexible conduits. Otherwise rigid conduits shall be used. No flexible extension shall exceed 1.25 m.
2. Conduits run on surfaces shall be supported on metal 12 mm. thick G.I. pressure saddles which in turn are properly screwed to the wall or ceiling. Saddles shall be at intervals of not more than 500 mm.
3. Fixing screws shall be with round or cheese head and of rust-proof materials. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building.

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4. Unseemly conduit bends and offsets shall be avoided by using fabricated mild steel junction/pull through boxes for better appearances.
5. No cross-over of conduits shall be allowed unless it is necessary and entire conduit installation shall be clean and neat in appearance.
6. Conduits embedded into the walls shall be fixed by means of staples at not more than 500 mm. intervals. Chases in the walls shall be neatly made and refilled after laying the conduit and brought to the finish of the wall but the building Contractor will do final finish.
7. Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the CLIENT AND/OR ITS ARCHITECT, before the concrete is poured.
8. Proper care shall be taken to ensure that the conduits are neither dislocated nor choked at the time of pouring the concrete suitable fish wires shall be drawn in all conduits before they are embedded.
9. Where conduit passes through expansion joints in the building, adequate expansion fittings shall be used to take care of any relative movement.
10. Inspection boxes shall be provided for periodical inspection to facilitate withdrawal and removal of wires. Such inspection boxes shall be flush with the wall or ceiling in the case of concealed conduits. Inspection boxes shall be spaced at not more than 12 meters apart or two 90° solid bends or equal.
11. All junction and switch boxes shall be covered by 6 mm clear plate. These junction boxes shall form part of point wiring or conduit wiring as the case may be including the cost of removing the cover for painting and re-fixing. No separate charges shall be allowed except where specially mentioned.
12. Conduits shall be free from sharp edges and burrs and the threading free from grease or oil. The entire system of conduits must be completely installed and rendered electrically continuous before the conductors are pulled in. Conduits should terminate in junction boxes of not less than 32 mm. deep.
13. An insulated earth wire of copper rated capacity shall be run in each conduit.

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

6) CONDUCTORS

1. All PVC insulated copper conductor flexible FRLS wires shall conform in all respects to Standards as listed under sub-head Indian Standards and shall be IS approved and ISI marked.

7) BUNCHING OF WIRES

1. Wires carrying current shall be so bunched that the outgoing and return wires are drawn into the same conduit.
2. Wires originating from two different phases shall not run in the same conduit. All wires shall have ferrules for identification.
3. Lighting and power circuits shall be separate. Each Power/ Light Circuit's Neutral shall be individual per Circuit and shall not be looped from any other Circuit.

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8) LOAD BALANCING

1. Balancing of circuits in three phase installation shall be as planned by the Consultants in the tender drawings and shall be checked by the contractor before the commencement of wiring and shall be strictly adhered to.

9) COLOUR CODE OF CONDUCTORS

1. Colour code shall be maintained as indicated by the Consultant for the entire wiring installations. Red, yellow, blue shall be for three phases, black for neutral and green with yellow band shall be for earthing.

10) WORKMANSHIP

Drawing Conductors

1. The drawing and jointing of PVC insulated copper conductor wires shall be executed with due regard to the following precautions.
2. While drawing wires through conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors.
3. There shall be no sharp bends. Wire reel stands to be used for pulling of wires to avoid kinks.
4. Care shall be exercised while drawing the wires from reels, by taking appropriate measures to ensure that wires are not spread on ground, causing dust and dirt accumulation on the new wires.
5. Maximum permissible number of 1100 volt grade PVC insulated wires that may be drawn into rigid non metallic or PVC Conduits are given below:

Size of wires Nominal Cross Section Area (Sq. mm.)	Maximum number of wires within conduit size(mm)				
	20	25	32	40	50
1.5	7	12	16	--	--
1.5	5	10	14	--	--
4	4	8	12	--	--
6	3	6	8	--	--
10	--	4	5	6	--
16	--	3	3	6	6
25	--	--	2	4	6
35	--	--	--	3	5

6. Insulation shall be removed by insulation stripper only. Few Strands of wires shall not be cut/reduced for convenience in connecting into terminals.
7. The terminals shall have sufficient cross sectional area to take all strands and it's connecting brass screws shall have flats ends.
8. All looped joints shall be connected through terminal block/connectors. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. All light points shall be terminated through a connector.

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9. Only licensed wiremen (Before doing the work or before appointing him on site contractor has to submit his wiring licence to Owner) and cable jointers shall be employed to do jointing work.
10. Before entrusting cable jointing work to any technician, or before appointing Cable Jointers or Wiremen on Site, Contractor has to submit such Technicians' / Wireman's / Cable Joints' licence to Owner.
11. All wires and cables shall be embossed with the manufacturer's label with ISI mark and shall be brought to site in original packing. For all internal wiring. PVC insulated wires of 1100 volts grade (FRLS) shall be used.
12. The sub-circuit wiring for point shall be carried out in loop system and no joints shall be allowed in the length of the conductors.
13. No wire shall be drawn into any conduit until all defective work of conduit installation of any nature that may cause injury to wire is completed.
14. Care shall be taken while pulling out the wires so that no damage occurs to conduits/wire itself, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction.
15. The minimum size of PVC insulated copper conductor wires for all sub-circuit wiring for light points shall be minimum 1.0 sq.mm copper. Separate neutral to be pulled for each circuit.
16. Conduits shall be kept at a minimum distance of 100 mm. from the pipes of other non-electrical services. And maintain minimum 300 mm distance between telephones, TV & Computer piping.
17. Separate conduits/raceways shall be used for following points as applicable and as requirements of site conditions:
 - 17.1 Normal lights and 5 A 3 pin sockets on lighting circuit.
 - 17.2 Separate conduit shall be laid from D.B. to switch board.
 - 17.3 Power outlets - 15 A 3 pin 20 A/30 A, 2 pin scraping earth metal clad sockets.
 - 17.4 Emergency lighting.
 - 17.5 Telephones.
 - 17.6 Fire alarm system.
 - 17.7 Public address system & Music system.
 - 17.8 For all other voltages higher or lower than 230 V.
 - 17.9 T.V. Antenna.
 - 17.10 Water level guard.

11) FISH WIRE

1. To facilitate subsequent drawing of wires in the conduit, GI fish wires of 1.0 mm (14 SWG) shall be provided along with the laying of recessed conduit.

12) MODE OF MEASUREMENT

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

11. TECHNICAL SPECIFICATION FOR LIGHT FIXTURES & ACCESSORIES.

1) SCOPE :

- 1 The scope of work shall cover the supply, installation and testing of various types of light fixtures. The scope also includes the supply of heavy duty exhaust fan and ceiling fan.

2) STANDARDS :

The following standards and rules shall be applicable :

- (a) IS 3646 - 1960 Code of practice for interior illuminator.
 - (b) IS 1913 - 1969 General and Safety requirements for electric lighting fittings.
 - (c) Indian Electricity Act and Rules issued thereunder.
- 1 All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the relevant British Standard Code of Practice in the absence of Indian Standard.

3) GENERAL REQUIREMENTS :

Supplying and erecting LED indoor fittings with LEDs of wattage 0.2 Watt to 0.5 Watt assembled on single MCPCB, with housing used as a heat sink shall be made of thick sheet Steel conforming to IS: 513/CRCA polyester powder coated and high U.V. & corrosion resistance with diffuser and/or Polycarbonate optics with company mark/name 120 to 300 V, Power Factor more than 0.9, THD < 10 %, CCT 4000 K to 6500K, Uniformity ratio >0.7, Luminaire efficacy > 85 lumens/watt , LED driver efficiency > 85 % CREE / OSRAM / PHILIPS Lumileds / NICHIA / SEOUL/Bridgelux(U.S.A.) make LED used for luminaire. (Each fitting required LM-79 & LM-80 Certificates)

36W T-5 LED TUBE LIGHT Wall/Ceiling Type Led Light Fixture with integral/non integral driver complete with Mounting Accessories

22W Surface / Recessed Mounted Light with integral/non integral driver complete with Mounting Accessories

12W Surface / Recessed Mounted Light with integral/non integral driver complete with Mounting Accessories

36W 600x600MM Surface / Recessed Mounted Light with integral/non integral driver complete with Mounting Accessories

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4) TEST :

- 1 The following routine tests shall be conducted as per the relevant Indian Standards :
 - a) Each fixture shall be tested at 1500 volts r.m.s. 50 Hz for one minute and no flashover or breakdown shall occur between current carrying parts and ground.
 - b) Insulation resistance of each fixture shall be tested at 500 V.D.C. and the insulation resistances so measured shall not be less than 2 mega ohms between all current carrying parts and ground.
 - c) Each fixture complete with its proper lamp/lamps shall be shown to operate satisfactorily at its normal voltage and frequency.
 - d) Each fixture shall be examined visually to ensure that it is complete in all respects and satisfactorily finished.
 - e) Type and routine test certificates shall be submitted for tests conducted as per relevant IS/BS for the fixture and accessories.

5) DRAWINGS AND DATA:

As per of the proposal the bidder furnish relevant descriptive and illustrative literature on lighting fixtures and accessories and following drawings/ data for the respective lighting fixtures :-

- i) Dimensional Drawings.
- ii) Mounting details cable entry facilities and weights.
- iii) Light distribution diagrams (Zonal & Isokandora)
- iv) Light absorption and utilisation factors.
- v) Lamp output V/S temp. curves.

6) WORKMANSHIP:

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

7) MODE OF MEASUREMENT:

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

- 1 All fixing accessories, mounting bracket, ballast condensers and control gear wherever applicable.
- 2 Supplying and fixing Ball and socket joints wherever required.
- 3 Earthing of fittings.
- 4 Electrical connections to fittings/fans from the junction box/ceiling rose.

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- 5 Installation and interconnection of Electronic regulators for ceiling fans.
- 6 Supplying and fixing 300 mm. GI down rod for ceiling fans.

12. TECHNICAL SPECIFICATION FOR EARTHING SYSTEM.

1) GENERAL DESCRIPTION

1. All the non-current carrying metal parts of the electrical installation and mechanical equipments shall be earthed properly.
2. The metal conduits, trunking, cables armour and sheath, electric panels' boards, lighting fixtures, ceiling and exhaust fan and all other parts made of metal shall be bonded together and connected by means of specified earthing system.
3. An earth continuity conductor shall be installed with all the feeders and circuits and shall be connected from the earth bar of the panel boards to the conduit system, earth stud of the switch box, lighting fixture, earth pin of the socket outlets and to any metallic wall plates used.
4. All the enclosures of motors shall be also connected to the earthing system.

2) SCOPE OF WORK

1. The scope of work shall cover supply, laying, installation, connecting, testing and commissioning of:
 - 1.1 Earthing station.
 - 1.2 Earthing Aluminium/copper strips from earthing station to equipotential bar.
 - 1.3 Earthing Aluminum / copper strips / wires from equipotential bar to lay feeder mains and circuit to connect power panels, DBs, switchboards etc.
 - 1.4 Bonding of Non-current carrying parts, and metallic parts of the electrical installation.

3) STANDARDS

1. The following standards and rules shall be applicable:
 - 1) IS: 3043 - 1966 Code of practice for Earthing.
 - 2) Indian Electricity Act and Rules

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the British Standard Codes of Practice in absence of Indian standard.

4) TYPE OF EARTHING STATION

PLATE EARTHING STATIONS

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1. The equipment neutral earthing shall be with Cast Iron plate earthing station, Cast Iron Earth plate shall be 30 x 30 x 0.35 mm for earthing.
2. The earth resistance shall be maintained with suitable soil treatment.
3. The resistance of each earth station should not exceed 1 ohm.
4. The earth lead shall be connected to the earth plate through Hot Dip G.I. bolts.
5. The earthing conductors shall be of copper strip in case of GI earthing.
6. G.I. pipe with funnel of approved quality shall be used for watering the earthing electrodes / stations.
7. The block masonry chamber with chequered plate shall be provided for housing the funnel and the pipe for watering the earthing electrodes / stations.
8. The hardware and other consumables for earthing installation shall be of copper/bras in case of copper earth plate and shall be hot dip galvanised iron material in case of G.I. earth plate,.
9. Test link / test pit cover through chequered plate.

PIPE ELECTRODE EARTH STATION

1. The earth station shall be as shown on the drawing and shall be used for equipment earth grid and/or street light pole earthing.
2. The earth electrode shall be 150 cms long 1.5 cms dia class "A", Galvanised iron pipe.
3. The earth resistance shall be maintained with a suitable soil treatment as shown on the drawing.
4. The resistance of each earth station should not exceed 1 ohm.
5. The earth lead shall be fixed to the pipe with a nut and safety set screws. The clamp shall be permanently accessible.
6. The earthing grid and the earthing conductor shall be hot dip Galvanised iron strips of the size as shown in the drawing.
7. G.I. pipe with funnel of approved quality shall be used for watering the earth electrode \ station.
8. The block masonry chamber with chequered plate shall be provided for housing the above referred funnel and pipe.
9. The hardware and other consumables for earthing installation shall be hot dip Galvanised iron material as shown on the drawing.

CHEMICAL PIPE-IN-PIPE EARTHING

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1. The substation earthing shall be with copper plate earthing station unless otherwise specified & earthpit of minimum bore dia. 225mm size ASH or approved make Safe Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free G.I.Pipes.
2. The earthing station shall be as shown on the drawing. The two earth electrodes shall be 80mm & 40 mm dia GI pipes plate. The earth resistance shall be maintained with a suitable crystalline conductive materials and back fill compound.
3. The resistance of each earth station should not exceed 1 ohms.
4. The earth lead shall be connected to the earth pipe through copper/brass bolts.
5. The pipe-in -pipe earth station shall be as shown on the drawing and shall be used for equipment protective earth grid.
6. The earth electrodes shall be galvanized pipes 3.0 long with outer pipe 80 mm dia & inner pipe 40 mm dia. The outer pipe shall be plated with 80-200 microns & inner pipe shall be plated with 200-250 microns with connection terminal dia of 14 mm.
7. Crystalline Conductive material-Mixture of nature minerals and a chemical compound, highly conductive and non corrosive, which prevents the inner pipe from corrosion and dissipates the current evenly.
8. Back fill compound - Moisture retaining compound having 13 times more (Hygroscopic) water retaining capacity than its dry volume & shall be 2 bags of 25 kgs.
9. The earth lead shall be fixed to the pipe with a clamp and safety set screws. The clamps shall be permanently accessible.

5) WORKMANSHIP

INSTALLATION AND CONNECTION

1. The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case less than 3 M below finished ground level.
2. The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column.
3. The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.
4. 20 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber.
5. Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe.
6. The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing.

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7. The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.
8. Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS : 3043, Code of Practice for Earthing Installation.
9. The earth conductors (Strips / Wires, Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanised Iron clamps and Hot Dip GI screws / bolts. The conductors outside the building shall be laid atleast 600 mm. below the finished ground level.
10. The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.
11. Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.
12. The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

EARTH LEADS AND CONNECTIONS

1. Earth lead shall be bare copper or Galvanised steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. Galvanised steel buried in the ground shall be protected with bitumen and hessian wrap or polythene faced hessian and bitumen coating. At road crossing necessary hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is atleast 8 mm away from the wall surface.
2. The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.
3. Wherever crossing is required, earthing jumper shall be of insulated wires.

EQUIPMENT EARTHING

1. All apparatus and equipment transmitting or utilising power shall be earthed in the following manner. Copper /G.I. earth strips/wires shall be used unless other-wise indicated in the Schedule.

6) TEST

1. The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS: 3041.
2. The following earth resistance values shall be measured with an approved earth megger and recorded.
 - 2.1 Each earthing station
 - 2.2 Earthing system as a whole
 - 2.3 Earth continuity conductors

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3. Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 ohm in each case.
4. Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.
5. All tests shall be carried out in presence of the consultant / client.

7) MODE OF MEASUREMENT

1. Provision of earthing station complete with excavation, electrode, watering pipe, soil treatment, masonry chamber with cast iron cover etc. shall be treated as one unit of measurement.
2. The following items of work shall be measured and paid per unit length covering the cost of the earth wires / strips, clamps, labour etc.
 - a) Main equipment earthing grid and connection to the earthing station.
 - b) Connection to the switch board, power panels, DB etc.
3. The cost of earthing the boq items shall become part of the cost of the item itself and no separate payment for earthing shall be made.

13. TECHNICAL SPECIFICATION FOR LIGHTNING PROTECTION SYSTEM.

1) SCOPE

1. This specification covers the requirement of supply, installation, testing and commissioning of lightning protection system.

2) GENERAL

1. The Advanced Lightning Protection system shall include components as follow: air-termination(s), mechanical support(s), down-conductor(s), performance recording equipment(s) (optional) and a low impedance grounding system.
2. Installation procedures of the entire lightning protection system shall be governed by the IS: 2309, the IEC 61024, NFC17-102, UNE-21186 and UNE-EN-50164-1 standard. The manufacturer of the air-termination shall provide designs and instructions for the installation as per the former standards.

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3. Prior to the installation of the system, a risk assessment survey shall be conducted to determine: the level of protection required for the structure (according to standards) and the adapted solution and design to be chosen.
4. The Advanced lightning protection system shall be mounted adequately rated for wind shear loading. Guying kits shall be provided as appropriate to local environmental conditions, or based on mast arrangement selected.
5. Each air terminal must be connected to the earth termination system by at least one-down-conductor. Two down-conductors are required when a) The horizontal projection of the conductor is larger than its vertical projection, b) When the structure is higher than 28m.

3) AIR TERMINATION

1. Manufacturing process of the air-terminal shall be ISO: 9001 certified.
2. The air terminal shall have been tested in a High-Voltage laboratory with a standardized waveform: 8/20 μ s or 10/350 μ s.
3. The protection area of the air-terminal shall be determined using an acceptable method given in the following standards IS: 2309, IEC62-305 (Rolling Sphere Method), and NFC17-102 (Early Strimer Emission).
4. The air terminal shall be made of non-corrosive materials. It shall be equipped with a central rod made of copper, copper alloy or stainless steel.
5. The rod and the air-terminal tip shall have a conductive cross-sectional area larger than 120mm².
6. Lightning Air Terminal - Configured as a Spheroid which is comprised of separate electrically isolated 4panels surrounding an Earthened Central Finial. The upper section of the central finial shall be rated to withstand 200KA. The Insulation material used to electrically isolate the panels shall be comprised of base polymer which provides high Ozone & UV resistance with a di-electric strength of 24-38KV/mm & ESE terminal shall withstand a minimum Switching Impulse Voltage of 500KV tested as per NFC 17-102 & IEC Test Standard - IEC60-1:1989.The air-terminal shall guarantee a full electrical continuity between the tip and the down-conductor.
7. The air-terminal shall be able to support a 200kA current or more.No external power supply shall be required.
8. The air-terminal shall be active only during a storm.
9. The air-terminal shall ensure the emission of a streamer (ionisation of the air around the tip) when a lightning strike is occurring in the protection area claimed.
10. The intensity and potential of the streamer shall be controlled by the air-terminal to ensure sufficient values (above 10A and 2000V) so it can develop properly and intercept the lightning.
11. The air terminal shall emit a streamer only when a lightning strike is occurring (provoking lightning strikes can induce surges).
12. Performances of the air-terminal shall not be affected by extreme climatic conditions.

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4) AIR TERMINATION SUPPORT

1. The air terminal support shall consist of a minimal 5 meters Galvanized steel (GI), Powder Coated or steel elevation pole with a minimal diameter of 50 mm. The mast having arrangement for fixing of air terminal on the top.
2. The air termination support shall be fixed securely on the structure to enable the air termination and mast system to withstand maximum locally recorded wind velocities. Guy wires might be necessary to secure the system properly.

5) DOWN-CONDUCTOR

1. Down-conductors consist of strips, braided cables or round sections.
2. Materials to be used: insulated multi-strand copper (recommended) suitable for 1.1KV insulation.
3. Minimal cross-sectional area must be 70mm^2 .
4. Down conductors shall be routed to the earth termination as direct as possible. Sharp bends and upward sections (40cm max with a 45° slope max are acceptable) are to be avoided.
5. Down conductors shall be attached on the basis of three fixing per metre.
6. Down conductors shall eventually be protected against the risk of impact by installing sleeves up to height of 2m above ground level.
7. The down conductors shall be directly connected to the base of the air terminal and to the earth termination system by the mean of a test clamp.

6) EARTH TERMINATION

1. One earth termination system is to be provided for each down-conductor.
2. Resistance value should be 10 ohms or less (5 ohms or less when the structure contents sensitive materials). Minimum Resistance should be achieved by using earth enhancing compound and these compound should hold and absorb the moisture for long life and does not required regular recharging of earthing system.
3. Material to be used: Bare or tin-plated copper (recommended), or stainless steel.
4. Bonding of the earth termination to the electrical earth of the building, to metallic parts of the building, to the structural reinforcing steel of the building and to arriving services is strongly recommended.

7) PERFORMANCE RECORDING EQUIPMENT (OPTIONAL)

1. Each protection system shall be supplied with a lightning strike recorder.
2. The lightning flash counter shall register a strike for every discharge where the peak current exceeds 1500A.
3. The lightning flash counter shall have been tested and certified in a high-voltage laboratory with a $8/20\mu\text{s}$ or $10/350\mu\text{s}$ waveform.

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4. The lightning flash counter shall be installed directly on the down-conductor and as per the manufacturer instructions .

8) EARTHING OF AIR TERMINAL :-

1. Air terminal shall be connected to Maintenance free earthing.
2. Maintenance free Earthing shall be based on copper bonded earth rod minimum copper bonding of 150 micron.
3. Suitable quantity shall be used of Back fill compound (Moisture Holder) as recommended by manufacturer and these earth enhancing compound should hold and absorb the moisture for long life and does not required regular recharging of earthing system.
4. Each earth pit shall be covered with using CI Cover of 12" X 12' of GI with 6/7 mm thick.

9) TEST JOINT

1. Each Down conductor shall be incorporated a Test Joint, which allows disconnecting the earth electrode and thus allows to measuring its resistivity. The test joint shall be mounted 2 meter above the ground.

10) MAINTENANCE

1. As per the standards (IS: 2309, IEC 62-305 and NFC 17-102), the lightning protection system shall be inspected at least every 2 years.
2. A visual inspection shall be performed to make sure that: a) No extension or modification of the protected structure calls for the installation of additional lightning protective measures, b) the electrical continuity of visible conductors is correct, c) all components fasteners and mechanical protectors are in good condition, d) no parts have been weakened by corrosion
3. Measure of the earth termination resistance shall be realized to ensure it is still below 10 ohms (or 5 ohms)
4. Air termination system shall be checked to ensure a) It is still properly connected to the down conductor(s), b) The tip has not melt, c) The system is still in operating conditions d) It is still properly installed on the support and it can withstand high wind velocities (relatively to the local conditions).

11) METHOD OF MEASUREMENT

1. The complete earth conductor shall be measured and paid per unit length, including Air termination network, down conductor, test joints and earthing termination network as per BOQ mentioned items.

14. TECHNICAL SPECIFICATION FOR EXTERNAL LIGHTING.

1) SCOPE :

1. The scope of work covers the supply, installation and testing of lighting poles, weather proof light fixtures, wiring to the fixtures, cable laying, earthing as specified and shown on drawings.

2) STANDARDS :

1. As per BOQ standard

3) LIGHT FIXTURES :

1. The light fixture construction shall be of IP 65 die cast aluminium with a separate compartment for integral ballast equipment. The reflector shall be anodized polished aluminium. The glass refractor shall be heat-resistant.
2. Lamp holder shall be of porcelain and shall comprise of a terminal block of non-hygroscopic material. The luminaries shall have integral ballast housed in water tight and dust tight metal cases. Ballast shall be pre-wired to the Lamp socket and terminal block, requiring only power supply leads to the ballast primary terminals.
3. The Lamp & Laminar shall generally follow the specification under section 'LIGHT FIXTURES'.

4) LIGHTING POLES : LIGHTING POLES FOR STREET LIGHTS /FLOOD LIGHTS SHALL BE SWAGED TYPE GI POLE CONSTRUCTION

1. The lighting poles shall be fabricated from heavy duty cold-rolled steel tubes to IS:1239-1958 and hot dip galvanized or painted as specified. The pole shall have a base plate, a large access panel, and necessary fixture mounting bracket at top. The access panel shall provide easy access to a multi-way porcelain connector and fuse board, to be mounted inside the pole. The access shall be specially fabricated with adequate reinforcement and weather gasket to prevent ingress of moisture and vandal proof. Poles shall have large diameter entries for incoming and outgoing cable and two earth studs. The pole fabrication shall conform to the drawings and where such drawing is not available, the contractor shall make such drawing and have it approved before fabrication.
2. The pole shall house a multi-way porcelain terminal block and re-wirable fuse as shown on the drawings. Pole shall have a concrete coping.

5) HIGH MAST

A)MAST STRUCTURE

1. The high Mast shall be of continuously tapered, polygonal cross section polygon type (Minimum 16 - Sides) of 30 Mtrs. in height presenting good visual appearance and shall be based on proven design to given assured performance, reliability and service. The Mast shall have an approximate top diameter of say 180 mm to 200 mm and bottom diameter of 580 mm to 600 mm. The weight of the Mast shall not exceed more than 1600 kgs. excluding weight of Luminaire, to maintain good elasticity of slender structure.

B)MAST CONSTRUCTION:

1. The Mast shall be fabricated from special steel plates of BS EN 10025 grade, cut and folded to form polygonal section and shall be telescopically jointed and fillet welded. The welding

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shall be in accordance with BS : 5135. The procedural weld geometry and the workmanship shall be exhaustively tested by the radiography on the completed welded and certificates submitted.

2. The Mast shall be delivered in only 3 sections without any circumferential welding at site, which shall be joined together by slip-stressed-fit method. The joining shall be with stressing equipment, thus forming the sleeve joint. No site welding or bolted joint will be accepted. The overlap distance shall have full penetration of longitudinal welds. The base plate of the mast shall be atleast 45 mm. thick. An adequate door opening of min. 1400 mm x 300 mm shall be provided at the base of each Mast. The opening shall be such as to permit clear access to equipment like winches, cable pug and socket, etc. The opening shall be complete with a close fitting vandal resistant, weather- proof door provided with a heavy duty lock. For metal protection of the Mast, the entire fabricated Mast shall be not dip galvanised internally and externally, having minimum average thickness of 65 microns.

C) DYNAMIC LOADING:

1. The Mast structure shall be designed for an assumed maximum reaction arising from the maximum win speed (3 seconds gust), likely to be exceeded only once in 50 years (180 km per hour) and measured at a height of 10 Mtrs. above ground level as per IS 875, Part III, 1987. The design life of the Mast shall be min. 25 years. Wind excited oscillation shall be damped by the method of constructions and adequate allowance made for the related stresses. The offered High Mast shall be a tested design

D) FOUNDATION:

1. The tenderer shall see the site closely and minutely with regard to the nature of the soil, average depth of decomposed garbage and debris at proposed Mast locations and the other site conditions before working out the type of foundation and specifications for the proposed High Mast.
2. The tenderer shall be responsible for the design of the foundation and safe erection and installation of the High Mast in mechanically and structurally safe working condition for the design life of the Mast. The load bearing (safe) capacity of the soil shall be indicted by purchaser to decide the type of foundation and its specifications. The holding down bolts shall be atleast 20 nos. of high tensile strength (EN - 19 grade) and shall be supplied complete with anchor plate of 6 mm thick for casting into the foundation. The precision made steel template with tube holes shall be provided to ensure correct verticality and horizontality of bolt alignment.

E) LANTERN CARRIAGE:

1. The fabricated lantern carriages shall be provided for holding the floodlight fittings and control gear provided on each High Mast. The lantern carriage shall be of special design and of durable steel tube construction designed to act as electric conduit with cable holes fully protected by grummets. The diameter of the lantern Carriage shall be suitable so as to hold designed number of floodlight fittings, as specified in the tender design along with the control gear boxes and lantern.
2. The lantern carriage shall be fabricated in three parts joined by bolted flanges with SS bolts with nuts to enable easy removal from the erected mast for replacement/ maintenance purpose. The carriage shall be supported / suspended by three wire ropes for better stability. The lantern carriage Assembly shall not touch the lower surface of the Mast. The

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carriage design and fabrication shall be such that the lantern carriage will suit the lanterns and their control gear boxes to be used in the work.

3. The Lantern Carriage shall be so installed that it does not cause any damage to the surface of the Mast and is provided with protective buffer arrangement. The complete Lantern Carriage shall be hot dip galvanised after fabrication.
4. The weather – proof cast aluminum junction boxes (IP-55) shall be provided on the Lantern Carriage assembly from which the inter – connections will be made to the designed number of floodlight fittings and lanterns on the carriage.

MECHANICAL ARRANGMENT:

1. For installation and maintenance purpose, it will become necessary to raise or lower the lantern carriage assembly. To enable this, a suitable winch arrangement shall be provided in the base of the Mast, complete with top pulley, winch stainless steel wire ropes and winch driving power tool.

A: WINCH:

1. The winch shall be of completely self – sustaining type. The winches shall be of self – sustaining type by means of an oil bath and the lubrication shall be of recommended quality. Termination of the ropes of the winch shall be in such a way, that it does not involve distortion or twisting of the rope configuration. At least 6 turns of rope shall remain in tension on the drum even when the lantern carriage is fully lowered. The winch shall be designed to be installed or removed from the door opening at the base of the mast. The winch drums shall be grooved to ensure mechanically strong, stable and tidy rope lay with no chances of rope slippage or skippage. The winch shall be capable of operation by hand or by means of external power tool. Integrated power tool with worm is not acceptable.
2. A test certificate shall be supplied along with each winch in support of the maximum load operated by the winch and for the safety of operation at the full load rotation. A handle shall also be provided for hand operation of the winches.

B :TOP PULLEY ASSEMBLY :

1. The top pulleys shall be of a diameter, appropriately large enough to accommodate the steel wire ropes and the multicore electric cable. The material of construction of the pulley blocks shall be non – corrosive and made of dia cast (LM - 6) aluminum alloy. The pulley assembly shall be complete with self lubricating bearing and stainless steel spindle.

C :STAINLESS STEEL WIRE ROPES :

1. Stainless steel wire ropes shall be of 7 / 19 construction of 6 mm diameter, having a breaking load of not less than 2400 kgs. Complete with stainless steel thimbles. The end for connection to the winch drum shall be fitted with thimbles and the thimbles shall be secured by copper compression splices.

CABLE AND CABLE CONNECTIONS:

1. The connections shall be made with flat core flexible round sheath power cables of appropriate rating as per the schedule. The base compartment of the High Mast shall have one terminal box for terminating the incoming cable. The maintenance cables equal to that within the Mast and fitted with a 5 core plug socket shall be provided to energise lanterns while in lowering position by hooking up at the base compartment socket supply.

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2. Similarly, the provision shall be made for electric supply at the base compartment to enable operation of the external power tool for lowering or rising of the lantern carriage assembly. The trailing cables of the lantern carriage rings shall be terminated by means of metal cased plug and socket provided in the base compartment to enable flexibility.

WINCH DRIVING POWER TOOL :

1. The external electric driven tool shall be single speed, (1.2 Mt./min.) reversible three phase & hand operated motor. The power tool shall be complete with very robust remote control switch such that the tool can be operated from safe distance of 5 Mtrs. There shall be an arrangement for self alignment of power tool which can be self supported during operation. Manual handle shall be provided for hand operation of the winches. The capacity rating and speed of the electric motor used in the power tool shall be specified by the tenderers.

LIGHTNING FINIAL & AVIATION OBSTRUCTION LIGHTS:

1. One number heavy duty hot dip galvanized lighting finial shall be provided for each mast. Suitable Aviation Obstruction Lights of reliable design and reputed manufacturer shall be provided on top of each mast.

6) CABLE LAYING :

1. Cabling shall be generally as specified in the section 'CABLING'.
2. Cables shall be terminated in a 4-way terminal block inside the pole or attached therewith as shown on drawings.
3. Cable route shall be as shown on the drawings or the contractor shall mark out the route and lay the cables only upon approval of the route.

7) EARTHING :

4. All street lights fixtures and poles shall be earthed as specified under section 'EARTHING'.

8) MODE OF MEASUREMENT :

5. Each light fitting with lamp, control gear, earthing etc. shall be considered as one unit for measurement and payment.
6. Each lighting pole, concrete coping, base plate earthing etc. shall be considered as one unit for measurement and payment.
7. All cabling work shall be measured on the basis of unit length and the cost shall include, cost of cable, cable termination in junction boxes or pole terminal box etc.

15. TECHNICAL SPECIFICATION FOR LIFT.

[1] GEAR LESS LIFT DRIVE (MRL) comprising of High Starting torque Lift 3 phase 440 V A. C. Permanent Magnet Synchronous motor of proper rating with high efficiency shall be used. [2] Micro processor based / PLC, ACVVVF, vector control drive with encoder feedback closed loop system shall be used for lift car and door operation which shall be full collective selective operation hall call demand response, UP/DOWN hall stops, Main, Up/ Down Contactor with overload and phase reversal relay and safety controls. [3] Car with M S platform with bracings of adequate size and to sustain the impact load cabin + passenger with safety factor of fire for steel and side panels of Stainless steel of sheet of grade 304 duty. Car ceiling will be S.S. finishes with aesthetic appearance with LED ceiling lights. Car flooring shall be of anti skid PVC with choice of colour of engineer in charge. Car doors shall be of stainless steel grade 304, hairline finish with centre opening / telescopic automatic doors. Car panel will also be S.S. 304 finished with emergency stop device, mechanical door safety device, facility of auto/ attended mode. All car panel buttons and all floor switches must be with brail language as per lift act. [4] All landing doors must be fire rated for 2 hour shall be fully automatic centre opening/ telescopic opening made of hairline finish steel grade of 304 with key holes and infrared curtains with Unlocking facility from outside [5] Appropriate battery operated emergency light in the car along with alarm switch shall be provided. Also, Emergency Light & Fan should start immediately without any Time Delay as soon as power fails. [6] Digital scrolling indicator system for up-down arrow along with floor position indicator shall be provided inside the car and at all floors. [7] Full height infra red curtain with multiple cross / crossing light beams shall be provided.[8] Automatic Rescue Device (ARD) shall be provided accordingly of passenger capacity with Manual Rescue Operation (Manual Cranking Facility). [9] Audio visual indication in the lift car showing over loading shall be provided such that doors kept open till excess load is removed.

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[10] Spring buffers/PU Buffers shall be provided. [11] Car fan as per passenger capacity with automatic sleep timer shall be provided. [12] Voice annunciator with suitable music shall be provided in lift car. [13] Self diagnostics system for operational and safety parameters shall be provided in control panel. [14] Mechanical over speed governor with governor calibration as per actual site parameters and submission of calibration certificate submission, door key holes in the floor doors, fireman switch shall be provided. [15] Lift machine hoisting arrangement in the lift machine room and monkey ladder for lift pit should be provided by the lift agency, along with the other steel structure works, foundations for the machine etc... [16] In the hoist way fascia plate shall be provided without any extra cost, where ever required as / if directed by engineer in charge. [17] Permanent wiring with necessary safety devices like RCCB in all circuit, Over Voltage Under Voltage protection and THD eliminator in circuit for lift machine room and lift well with proper numbers of light points, with fixtures, exhaust fan and plug points shall be provided by the agency. Only 3 phase Power Supply shall be made available by department in lift machine room. Necessary Earthing as per Lift Act/Rules shall be arranged by Lift Agency. [18] Any civil/ electrical works for additional and alteration in lift shaft and machine room related to erection of lift shall be made by lift agency without any extra cost. (granite/marble fixing around all landing door openings are not in lift agency's scope.) [19] Agency has to provide all working drawings and documents and liaison services for obtaining all necessary permission from lift inspector and other authorities. [20] acrylic transparent licence/display A4 size holder in lift car

[20A] As per statutory requirement of Govt. Of Gujarat lift & escalator act 2000, lift agency has to provide

1. Car top safety barricade
2. Push & talk communication system.
3. Fireman's switch operation at Ground Floor.
4. carrying out third party lift inspection during/after lift erection and provide report by third party authorized by concern licensing authority
5. agency has to provide third party insurance upto completion of free maintenance period and submit the document for the same.

[21] Car Panel Operating Buttons with floor position indicator/buttons must be of Auto Glow type clearly visible when view from inside cabin. [22] For Physically Handicapped person Full Length Handrails of hairline finish steel grade of 304 should be provided at appropriate height on the Rear & Side Wall Panels in Lift Car.

(B) SPECIAL FEATURES DESCRIPTION OF LIFTS for PREMIUM category

1. Advanced control system dual 64 bit embedded microprocessor with CANBUS Serial Communication mode including Regenerative power efficient operation, on site programming facility, Anti nuisance, Pte-opening, BMS/RMS with necessary online real time monitoring system having necessary connectivity for remote monitoring & other suitable supporting hardware & software devices to fulfil the purpose. 2. Floor Indication LCD Display with call registration & brail mark with arrival gong and hall lantern & TFT Screen in the car with MP3 Voice Announcer. 3. CAR Panel should be Scratch resistive SS Moonrock finish / Hair Line / Honeycomb for car and all Doors, All landing doors must have fire rating up to 2 hours and car door must have multi-level crisscross beam door protection. 4. To & fro communication system & wiring (i.e. car, control room & guard room) and Each elevator are equipped with remote monitoring system. agency has to provide mobile app and user id and password for monitoring

8 Passengers, Ground plus 6 upper floors with Rated Speed of 1.5 m/sec.,
(B) With General PLUS ADDITIONAL SPECIAL FEATURES attached herewith. Prem. Cat.

16. TECHNICAL SPECIFICATION FOR SOLAR PANELS

Supply, Installation, Testing & Commissioning of following size of Grid Tied Solar Power Plant with

Solar Panels (ALMM approved): Frame Material : Anodized Aluminum alloy Frame With Twin Wall Profile, Front Cover : High Transmission Low-Iron Tempered Glass (AR Coated), High efficiency and positive power tolerance Pmax: 0/+5, Module Efficiency should be approx. 18%-21%, Normal operating temperature 45'C, Junction Box with Waterproof IP67 & MC4 Compatible and Enclosed with Bypass diodes, 100% Electroluminescence test to ensure error free Modules, Thep. temp. co-efficient of the PV module shall equal or better than - 0.45%/degree C. Solar PV modules of minimum fill factor 75% to be used. Unit Production:- 4 to 5 Unit /kw /day (Actual)(1Year Avg) With 10 year Product warranty and 25 year Linear Power Warranty., Solar Inverter: MPPT Range: 80-1000 V, Max efficiency: 97.5% - 98.9%, O/p Frequency: 50/60Hz, Operating Altitude (m) ≤4000, O/p Power Factor: ~1, O/P THDi: <3%, Operating Temperature Range: -25~60°C, Anti-islanding Protection: Integrated, Input Reverse Polarity Protection Integrated, Insulation Resistor Detection Integrated, Residual Current Monitoring Unit Integrated, Output Over Current Protection Integrated, Output Short Circuit Protection Integrated, Output Over Voltage Protection Integrated, Protection Degree: IP65, User Interface LCD & APP,Datalogger & Communication: GPRS / Wi-Fi, Module Mounting Structure: Seamless Box Pipe / 'C' Channel of suitable size for rooftop solar installations with good stability against wind & weight load., Hot Dipped Galvanized steel coils. suitable arrangement for base plate for foundation , solar panel mounting, the structure should be suitable for carry the load of solar panel,wiring, sprinkler system etc. with necessary foundation work/wall mount, j bolt, anchor fastner etc. the nut bolt used for installtion of stucture should be (SS 304) quality. and Balane of System with necessary Swithgears (Suitabel size and protection of ACDB & DCDB), inter connecting wiring, earthing system, lightning arrester system, all liasoning work with various gov. dipartment like state nodal agency,DISCOM & CEIG is included in agency scope. (Excluding GEDA Application fees, Solar connectivity Charges, Meter connectivity Charges, Meter testing Charges.) (D) Grid Tied Solar Power System: 30 kW (3 - phase)

17. TECHNICAL SPECIFICATION FOR PUMPS & ACCESSORIES.

DOMESTIC WATER PUMPS

GENERAL

-) The pump heads in the Schedules or Drawings are given for tendering guidance only and the Contractor shall be responsible for checking the total final resistance of each system, based on the actual pipe runs and equipment offered, prior to ordering. Any modifications to the system or any of the components, i.e. pumps, pipe work, motors etc., which may be required to meet the scheduled duties and space limitations shall be carried out at the Contractor's expenses.
- a) All pumps shall be constructed to meet the required working conditions and test pressure of the system concerned.
- b) All pumps shall be self primed and mounted on a common bed-plate together with the motor and directly driven through a flexible coupling and shall be aligned in the manufacturer's factory. Locally fabricated bed-plates will not be accepted. Base plate shall incorporate a drain pan and is to be provided with a screwed socket outlet for drain connection.
- c) Unless otherwise specified, pumps shall be selected for an impeller speed of 1450/1500 rpm. All pumps shall be as commercially silent in operation. A unit which is considered to be noisy shall be removed from the site and replaced by silent unit at the Contractor's expense.
- d) The Contractor shall submit for the approval the characteristic curves of the pump offered. The operating conditions shall be indicated and curves of pumps having excessive shut-off head will not be accepted.
- e) All pumps shall be fitted with an air-cock and drain plug. Each pump shall be provided with connection for pressure gauges at the suction and delivery connections, the gauges for all pumps shall be mounted on common hardwood gauge board on the wall inside the pump room. Gauges shall have 100mm diameter dial. Pressure gauge piping shall be copper comprising a loop siphon at the junction to the gauge and each gauge shall be supplied through 12mm diameter brass pig tail and pet cock. Drains shall be piped to floor drains/waste pit.
- f) The Contractor shall supply and install flexible pipe connectors at the pump suction and discharge sides for each pump.
- g) All flexible connectors shall have flanges joints to the table specified for the connecting pipe work and must be suitable for the working conditions and test pressure of the system concerned.
- h) Gland drains shall be provided in each pump packing gland with suitable nipple/outlet for copper/PVC pipes to be connected. All drains shall have a minimum internal bore of 15mm diameter and arranged in a proper pattern for piping the same to the channels or floor outlets provided inside the pump room.

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- i) Where necessary, an automatic air relief valve shall be fitted in the pump to purge any air likely to be trapped inside the pump casing. Suitable fittings shall be used for such connection and the relief valve shall not discharge at a location directly over or near to the pump motor or any other electrical equipment.
- j) Each pump shall be fitted with valves to enable it to be isolated, and in addition, where shown on the Drawings, a check/non-return valve shall be fitted in each pump discharge.
- k) Transfer pump set shall be mounted on an inertia block. Holding down bolts shall be set in position during the manufacture of the structural base. Filtered pump set shall be mounted on base plate. Generally all pump sets shall be mounted on the reinforced concrete plinth 150mm high or as instructed by the Engineer.
- l) Inertia block shall be concreted. Anchor bolts of base shall be provided.
- m) Pump inertia bases shall be provided and shall be twice the operating weight of the pumps and the associated pipe work as mounted thereon.
- n) The base plates shall be of approved make with pads machined for correct alignment of the pump and motor. At least two locating dowels shall be fitted to each component after alignment.
- o) All exposed shafts, couplings and moving parts of pumps shall be provided with suitable galvanized angle iron wire mesh guards which shall be stoutly constructed and easily removable; and shall be provided with lifting handles. Care shall be taken that these guards do not cause "Ringing" sound and/or vibrate so causing noise.
- p) An identification plate of metal shall be fixed to each pump unit. This plate shall include full details and diameter of the impeller installed, pump size, model and serial number, r.p.m., amps, etc. pump head and delivery for the duty specified, and lubricant required.
- q) All pumps shall bear the manufacturer's designation plate which shall indicate the type of services and serial number of the unit.

PUMP ARRANGEMENT

Pumps for plumbing services are single stage or multi-stage centrifugal vertical, horizontal split case or end suction type as shown in Schedule of quantity/ Drawing.

De watering / Sewage pumps shall be submersible type, or centrifugal self priming.

Each pump shall be directly coupled with the electric motor and aligned in the manufacturer's factory.

PUMP SPEED AND NOISE

Pumps shall be selected for an impeller speed as indicated in the Schedule/Drawing. All pumps shall be as commercially silent in operation.

The noise level shall be not more than NC 70 in pump room, NC 50 in the same floor and NC 35 for other floors.

PUMP BASES

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Except for submersible sump pumps, each pump set shall be mounted on an anti-vibration pump base. Details shall be submitted by the Contractor well before the manufacture of the structural base. All holding down bolts shall be provided by the Contractor.

SAFETY GUARDS

All exposed shafts, couplings and moving parts of pumps shall be provided with suitable galvanized angle iron wire mesh guards which shall be stoutly constructed and easily removable; and shall be provided with lifting handles. Care shall be taken that these guards do not cause "ringing" sound and/or vibrate so causing noise.

IDENTIFICATION

An identification plate of metal shall be fixed to each pump unit. This plate shall include full details and diameter of the impeller installed, pump size, model and serial number, r.p.m., sumps, etc pump head and delivery for the duty specified, and lubricant required.

All pumps shall bear the manufacturer's designation plate which shall indicate the type of services and serial number of the unit.

ELECTRICAL WORKS FOR PUMPS

All electrical works associated with the pumps shall comply with the NBC regulations (the latest edition) code of practice, supply rules and regulations and described in the relevant section of this Specification.

Anti-vibration mountings shall be inertia base, springs, neoprene pads or rubber-in-shear isolators, with the specified static deflection and selected to provide isolating efficiency of not less than 95%.

- r) The control panel shall be of the pressure switch/microprocessor. The complete control panel assembly and all the internal devices shall be UL508. The panel shall be complete with IP54/NEMA1 enclosure and include door interlocked main disconnect and magnetic motor starters with fused motor protectors, adjustable time delays, Hand-off auto selector switch and for each pump, power on light, minimum run timers, low suction pressure switch and pilot light. The control circuit shall include fault relay circuit to turn on the next pump should the lead pump fail.
- s) Should the duty pump fail to start and the pressure of the system shall continue to fall, the standby pump shall be initiated to cut into operation.
- t) Either pump shall be able to be selected as duty/standby/jockey. The operating pump shall also be able to select as automatic or manual and interlock devices shall be provided to isolated the system for maintenance
- u) Automatic changeover shall be provided to alternate between the duty/standby pumps on each cycle.
- v) A time delay (0 to 10 seconds) switch shall be installed in the control of each pump set to provide a time lag between the initiation of signals by the pressure switches (both pump on and off) and the actual start and stop of the pump set to avoid excessively frequent on/off cycles of the pumps due to surges in the long pipe runs.

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- w) The pump set together with the required control panel and fitted with hoot shall be mounted on a common bedplate, factory assembled in the manufacturer's workshop prior to delivery. Control panel for all pump sets shall be as per Indian standard.

RAW WATER PUMPS

Where required transfer water pumps shall conform to the following Specification:

Pump efficiency shall not be less than 70%,

Materials shall be as follows:

. Casing	-	Cast iron and minimum working pressure not less than 250 PSI or 150% of maximum discharge pressure.
. Impellers	-	Bronze and hydraulic balancing.
. Wearing Rings	-	Bronze
. Shaft Sleeve	-	Bronze
. Shaft	-	Stainless steel
. Seal	-	Mechanical seal/gland packing (asbestos-free)
. Couplings	-	Flexible metallic coupling, complete with coupling guards
. Bearings	-	Ball thrust type, grease lubricated, rated bearing life not less than 100,000 Hr

SUBMERSIBLE SEWAGE AND DRAINAGE PUMPS

Submersible sewage and drainage pumps shall be installed in sump pits consisting of discharge connection, galvanized steel guide rail, galvanized chain and lifting handle as per detail. Pump efficiency shall not be less than 40%. Can be handle solid particle upto 50mm.

Materials shall be as follows:

Casing	-	High grade grey cast iron with internal sea water corrosion resistant coating
Impellers	-	Cutter type for sewage pumps or non-clog type for drainage pumps, chromium-alloyed cast iron material of abrasion resistant.
Shaft	-	Stainless steel.
Seal	-	Double mechanical seal.
Bearings	-	Ball thrust type, grease lubricated
Maximum	-	As shown on the Equipment Schedule/Drawing speed

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Bolt & Nut - Stainless Steel

Level switches (high/low levels alarm and indications) shall be supplied and installed in the sump pits for the proper operation of the pumps as indicated on Drawings. The switches shall be of mercury float switch type. The lead-lag selection of pumps shall be changed automatically after each cycle.

Attention shall be paid to the internal dimensions of the sump pits and covers when selecting pumps.

Motor shall be class F insulation and inside the casing to prevent water ingress.

18. TECHNICAL SPECIFICATION FOR ERECTION, TESTING & COMMISSIONING.

SCOPE

- The intent of this specification is to define the requirements for the installation, testing and commissioning of the electrical system like H.T VCB panel, transformer, L.T. panels, Cables, earthing network, Internal and External lighting, Light fixtures etc.. Requirement of this project shall be as specified in bill of quantities / approved drawings / general specifications or as per the battery limits fixed by the owner / consultant.

STANDARDS

- The work shall be carried out in the best workman like manner in conformity with this specification, the relevant specification / codes of practice of the Indian Standards Institution, approved drawings and the instructions issued by the authorised representative, from time to time. Some of the relevant Indian Standards are listed elsewhere in this tender document.
- In addition to the standards mentioned in 1.1, all works shall also conform to the requirement of the following :
 - Indian Electricity Act and Rules framed thereunder.
 - Fire Insurance Regulations.
 - Regulations laid down by the Chief Electrical Inspector of the State / State Electricity Board / Union Territory.
 - Regulations laid down by the Factory Inspector of the State / Union Territory.
 - Any other regulations laid down by the local authorities.
 - Installation & operation manuals of original manufacturers of equipment.

ERECTION

- The contractor shall make his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading / unloading during transportation. Equipment shall not be removed from packing cases unless the floor has been made ready for installing them. The cases shall be opened in presence of the client / consultant or his authorised representative. The empty packing cases shall be returned to the stores and any document if found with the equipment shall be handed over to the client's representative. Any damage or shortage noticed shall be reported to the client / consultant in writing immediately after opening of packing cases.

ONAN TYPE TRANSFORMER

ERECTION

- Transformer complete with radiators, bushings, conservator and miscellaneous accessories shall be thoroughly inspected and any damage noticed shall be reported to

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the client / consultant. Before erection of transformer, the level of rails on foundation shall be checked and minor corrections if necessary shall be carried out. After the completion of erection, necessary stoppers shall be provided at the wheels. All loosely supplied fittings / accessories shall be cleaned and mounted on the transformer and connections made. After completely assembling & installation, the transformer shall be cleaned and touched up with a paint supplied by the manufacturer applied wherever necessary. All cover bolts shall be checked for proper tightness. (The foundation of transformer and rail fixing will be made by some other agency).

TESTING

- Winding insulation resistance shall be measured from primary and secondary to ground and between primary and secondary.
- Test the operation of thermister type sensor relay in accordance with the manufacturer's instructions.
- Check the polarity of terminals and the phase sequence.

Proforma for transformer tests :

- Transformer name plate.
- Insulation resistance test with 1000 V meagre.
 - a) between primary to earth
 - b) between secondary to earth
 - c) between primary and secondary
- Operation of the tap changer.
 - Operation of the tap at tap No. 1
 - Operation of the tap at tap No. 2
 - Operation of the tap at tap No. 3
 - Operation of the tap at tap No. 4
 - Operation of the tap at tap No. 5
- Polarity marking and phase sequence.

Earth resistance : Body & Neutral tank.

[This proforma shall be jointly signed by the CLIENT / CONSULTANT and the contractor in duplicate].

POWER CONTROL CENTER / MOTOR CONTROL CENTER, DISTRIBUTION BOARDS

ERECTION

- Electrical panels and bus duct shall be delivered in convenient shipping section by the manufacturer. The contractor shall make his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading / unloading during transportation. The contractor shall be responsible for final assembly and interconnection of busbars / wiring. Foundation channel shall be grouted in the flooring by the contractor. Switchgear shall be aligned and levelled on their base channels and bolted to them as per the instructions of the client / consultant. The earth bus shall be made continuous throughout the length. Loosely supplied relays and instruments shall

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be mounted and connected on the switchgear. The contacts of the drawout circuit breaker shall be checked for proper alignment and interchangeability.

- After erection, the switchboard shall be inspected for dust and vermin proof. Any hole which might allow dust or vermin etc. to enter the panel shall be plugged suitably at no extra cost. If the instrument transformers are supplied separately, they shall be erected as per the direction of the client / consultant. The contractor shall fix the cable glands after drilling the bottom / top plates of all switchboards with suitable holes at no extra cost.
- Range of overload relays / timers etc. shall be checked with requirement of motor actually to be connected at site and if the same is undersized / oversized, it shall be brought to the notice of the client / consultant, who shall arrange procurement of corrected components. However, the contractor shall not charge anything extra for labour for such replacements.
- The busduct shall be suitably supported between switchgear and transformer. The opening in the wall where the duct enters, the switchgear room shall be sealed to avoid rain water entry. The foundation of the switchgear shall be raised suitably for minor adjustment to ensure proper alignment and connection of the busduct at no extra cost. Expansion joints, flexible connection, etc. supplied by the manufacturer / contractor of the busduct shall be properly connected.

TESTING

- Before electrical panel is energised, the insulation resistance of each bus shall be measured from phase to ground. Measurement shall be repeated with circuit breakers in operating positions and contacts open.
- Before switchgear is energised, the insulation resistance of all control circuits shall be measured from line to ground.
- The following tests shall be performed on all circuit breakers during erection.
- Contact alignment and wipe shall be checked and adjustment where necessary in accordance with the breaker manufacturer's instructions.
- Each circuit breaker shall be drawn out of its cubicles, closed manually and its insulation resistance measured from phase to phase and phase to ground.
- All adjustable direct acting trip devices shall be set using values given by the consultant/ manufacturer.
- The dielectric strength of insulating oil wherever applicable, shall be checked. Before switchgear is energised, the following tests shall be performed on each circuit breaker in its test position.
- Close and trip the circuit breaker from its local control switch push button or operating handle. Switchgear control bus may be energised to permit test operation of circuit breaker with A.C. closing with prior permission of the client / consultant.
- Test tripping of the electrically operated circuit breaker by operating mechanical trip device.

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- Test proper operation of circuit breakers latch, check carriage limit switch if provided.
Test proper operation of lockout device in the closing circuit. Wherever provided by simulating conditions which would cause a lockout to occur.
- Trip breaker either manually or by applying current or voltage to each of its associated protective release.
- Before switchgear is energised, the tests covered above shall be repeated with each breaker in its normal operating position.
- Capacitor banks shall be tested as per manufacturer's instructions. In addition, test for output and/or capacitance, insulation resistance test and test for efficiency of discharge device shall be carried out.
- All electrical equipment alarms shall be tested for proper operation by causing alarms to sound under simulated abnormal conditions.

PROFORMA FOR PCC, MCC, DB, CONTROL PANEL TEST

- Circuit breaker or contactor module designation / bus no.

Insulation resistance test (contacts open, breaker racked in position)

a)	between each phase of bus	:	Mega ohm
b)	between each phase and earth	:	Mega ohm
c)	DC and AC control and auxiliary circuits	:	Mega ohm
d)	between each phase of CT / PT and between CT & PT circuit if any	:	Mega ohm

CT checks :

- a) CT ratio
 - b) CT secondary resistance
 - c) CT polarity check
- Check for contact alignment and wipe.
 - Check / test all releases / relays.
 - Check mechanical interlocks.
 - Check electrical interlocks.
 - Check switchgear / control panel wiring.
 - Check breaker / contactor circuit for :
 - a) Closing - local & remote (wherever applicable)
 - b) Tripping - local & remote (wherever applicable)
 - Opening time of breaker / contactor.
 - Closing time of breaker / contactor.

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INSTALLATION OF CABLE NETWORK

- Cable network shall include power, control and lighting cables which shall be laid in underground trenches, hume pipe open trenches, cable trays, G.I. pipes, or on building structures as detailed in the relevant drawings, cable schedules or as per the client / consultant's instructions. Supply & installation of cable trays, G.I. pipes / conduits, cable glands and sockets of both end isolators, junction boxes, remote push button stations, etc. shall be under the scope of the contractor.
- General requirements for handling cables :
- Before laying cables, this shall be tested for physical damage, continuity, absence of cross phasing, insulation resistance to earth and between conductors. Insulation resistance tests shall be carried out with 500 / 1000 V megger.
- The cables shall be supplied at site, wound on wooden drums as far as possible. For smaller length and sizes, cables in properly coiled form can be accepted. The cables shall be laid by mounting the drum of the cable on drum carriage. Where the carriage is not available, the drum shall be mounted on a properly supported axle, and the cable laid out from the top of the drum. In no case the cable will be rolled on as it produces kinks which may damage the conductor.
- Sharp bending of cable shall be avoided. The bending radius for PVC insulated and sheathed, armoured cable shall not be less than 10 D, where "D" is overall diameter of the cable.
- While drawing cables through G.I. pipes, conduits, RCC pipes, ensure that size of pipe is such that, after drawing cables, 40% area is free. After drawing cables, the end of pipe shall be sealed with cotton / bituminous compound.
- High voltage (11 KV and above), medium voltage (240 V and above) and other control cables shall be separated from each other by adequate spacing or running through independent pipes / trays.
- Armoured cables shall never be concealed in walls / floors / roads without G.I. pipes, conduits or RCC pipes.
- Joints in the cable throughout its length of laying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed, proper straight through epoxy resin tight joint shall be made, without any additional cost.
- A minimum loop of 3 mtr. shall be provided on both ends of the cable, and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying.
- Cable shall be neatly arranged in the trenches / trays in such manner so that criss-crossing is avoided and final take off to the motor / switchgear is facilitated. Arrangement of cable within the trenches / trays shall be the responsibility of the contractor.
- All cable routes shall be carefully measured and cable cut to the required lengths and undue wastage of cables to be avoided. The routes indicated in the drawings is

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indicative only and the same may be rechecked with the client / consultant before cutting of cables. While selecting cable routes interference with structures, foundations, pipelines, future expansion of buildings etc. should be avoided.

- All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all PVC insulated cables shall be taped with an approved PVC or rubber insulating tapes. Use of friction type or other fabric type tape is not permitted. Lead sheathed cables shall be plumbed with lead alloy.
- Wherever cable rises from underground / concrete / masonry trenches to motors / switchgears / push buttons, these shall be taken in G.I. pipes of suitable size, for mechanical protection upto 300 mm. distance of concerned cable gland or as instructed by the client / consultant.
- The cable pass through foundation / walls of other underground structures, the necessary ducts for opening will be provided in advance for the same. However, should it become necessary to cut holes in existing foundation of structures the electrical contractor shall determine the location and obtain approval of the client / consultant before cutting is done.

LAYING OF CABLES (UNDERGROUND SYSTEM)

- Cables shall be so laid in trench that this will not interfere with other underground structure. 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 / diverted as directed by the owner / consultant.
- Cable shall be laid at minimum depth of 750 mm. in case of L.T. and 1200 mm. in case of H.T. from ground level. Excavation will be generally in ordinary alluvial soil. The width of trench shall be sufficient for laying of required no. of cables.
- Sand bedding 75 mm. thick shall be made below and above the cables. Layer of bricks (full size) shall be laid above sand bedding on the sides and above the of cables to cover cable completely. More than one cable can be laid in the same trench by providing a brick on edge between two cables. However, the relative location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction of the client / consultant.
- For all underground cables, route markers should be used :
 - x) Separate route markers should be used for LT, HT and telephone cables.
 - y) Route markers should be grounded in ground with 1:2:4 cement concrete pedestal size 230 x 230 x 300 mm..
 - z) Cable markers should be installed at an interval not exceeding 30 mtr. along the straight routes of cables at a distance of 0.5 mtr. away from centre of cable with the arrow marked on the cable markers plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.
- RCC hume pipe for crossing road in cable laying shall be provided by employer. No deduction shall be made for cable laying in hume pipe for not providing bricks, sand and

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excavation. RCC hump pipe at the ends shall be sealed by bituminous compound after laying and testing of cables by electrical contractor without any extra charge.

LAYING OF CABLE IN MASONRY TRENCHES

- Masonry / concrete trenches for laying of cables shall be provided by employer. However, steel members such as M.S. angles / flats etc. shall be provided and grouted by electrical contractor to support the cables without any extra charge. Cables shall be clamped to these supports with minimum saddles / clamps. More than one tier of cables can be provided in the same trench if the no. of cables are more.
- Entry of cables in trenches shall be sealed with bituminous MASTIC compound to stop entry of water in trenches.

LAYING OF CABLES IN CABLE TRAYS

- Cable trays and steel members such as M.S. angle / channel / flats etc. shall be provided and fixed by the erector.
- Cable shall be fixed in cable trays in single tier formation and cables shall be clamped with aluminium flat clamps and galvanised bolts / nuts.
- Earthing flat / wire can also be laid in cable tray alongwith cables.
- After laying of cables, minimum 20% area shall be spare.

TERMINATION AND JOINTING OF CABLES

- a) For HT cables suitable size of Reychem termination kit shall be used.
- b) Use of glands :
- All PVC cables upto 1.1 KV grade, armoured or unarmoured shall be terminated at the equipment / junction box / isolators / push buttons / control accessories, etc. by means of suitable size double compression type cable glands. Armour of cable shall be connected to earth point. The contractor shall drill holes for fixing glands wherever necessary. Wherever threaded cable gland is to be screwed into threaded opening of different size, suitable galvanised threaded reducing bushing shall be used of approved type.
- In case of termination of cables at the bottom of the panel over a cable trench having no access from the bottom, a close fit holes should be drilled in the bottom plate for all the cables in one line, then bottom plate should be split in two parts along the centre line of holes. After installation of bottom plate and cables with glands, it shall be sealed with cold sealing compound.

USE OF LUGS / SOCKETS

- All cable leads shall be terminated at the equipment terminals, by means of crimped type solderless connectors unless the terminals at the equipment ends are suitable for direct jointing without lugs / sockets.
- The following is the recommended procedure for crimped joints and the same shall be followed :
 - a) Strip off the insulation of the cable and with every precaution, not in severe or damage any strand. All insulation's to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.

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- b) The cable should be kept clean as far as possible before assembling it with the terminal / socket. For preventing the ingress of moisture and possibility of re-oxidation after crimping of the aluminium conductors, the socket should be filled with corrosion inhibiting compound. This compound should also be applied over the stripped portion of the conductor and the palm surface of socket.
- c) Correct size and type of socket / ferrule / lug should be selected depending on size of conductor, and type of connection to be made.
- d) Make the crimped joint by suitable crimping tool.
- e) If after crimping the conductor in socket / lug, some portion of the conductor remains without insulation the same should be covered sufficiently with PVC tape.
- f) For HT cable upto 11 KV the manufacturer's recommendation should be followed.

DRESSING OF CABLE INSIDE THE EQUIPMENT

- After fixing of cable glands, the individual cores of cable shall be dressed and taken along the cable ways (if provided) or shall be fixed to the panels with polyethylene straps. Cable shall be dressed in such a manner that small loop of each core is available inside the panel.
- For motors of 20 HP and above, terminal box if found not suitable for proper dressing of aluminium cables, the erector shall modify the same without any additional cost.
- Cables inside the equipment shall be measured and paid for.

IDENTIFICATION OF CABLES / WIRES / CORES

- Power cables shall be identified with red, yellow and blue PVC tapes. For trip circuits identification, additional red ferrules shall be used only in the particular cores of control cable at the termination points in the switchgear / control panels and control switches.
- In case of control cables all cores shall be identified at both ends by their wire numbers by mean of PVC ferrules or self sticking cable markers, wire numbers shall be as per schematic / connection drawing. For power circuit also, wire numbers shall be provided if required as per the drawings of switchgear manufacturer / supplier.

TESTING OF CABLES

- Before energising, the insulation resistance of every circuit shall be measured from phase to ground. This requires 3 measurements if one side is grounded and 6 measurements for 3 phase circuits.
- Where splices or terminations are required in circuits rated above 650 volts, measure insulation resistance of each length of cable before splicing and/or terminating. Repeat measurements after splices and/or terminations are complete.

DC high voltage test shall be made after installation on the following :

- a) All 1100 volts grade cables in which straight through joints have been made.
- b) All cables above 1100 V grade.

For record purpose test data shall include the measured values of leakage current versus time.

The DC high voltage test shall be performed as detailed below :

- Cables shall be installed in final position with all the straight through joints complete. Terminations shall be kept unfinished so that motors, switchgear, transformer etc. are not subjected to test voltage.

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- The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution.

PROFORMA FOR TESTING CABLES

		<u>DATE OF TEST</u>	
a)	Drum No. from which cable taken.		
b)	Cable from to		
c)	Length of run of this cable	meter	
d)	Insulation resistance test		
i)	between core-1 to earth		mega-ohm
ii)	between core-2 to earth		mega-ohm
iii)	between core-3 to earth		mega-ohm
iv)	between core-1 to core-2		mega-ohm
v)	between core-2 to core-3		mega-ohm
vi)	between core-3 to core-1		mega-ohm
vii)	duration used : 1 KV		
e)	High voltage test	Voltage	Duration
i)	between core an earth.		
ii)	between individual cores		

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EARTHING NETWORK

INSTALLATION AND CONNECTION

- The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 3 M below finished ground level.
- The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column.
- The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.
- 19 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber.
- Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe.
- The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber.
- The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.
- Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS : 3043, Code of Practice for Earthing Installation.

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- The earth conductors (Strips / Wires copper / Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanised Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conductors outside the building shall be laid atleast 600 mm. below the finished ground level.
- The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.
- Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.
- The earth conductors shall be in one length between the earthing grid and the equipment to be earthed

EARTH LEADS AND CONNECTIONS

- Earth lead shall be bare copper or Galvanised steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. G.I. strip buried in the ground shall be protected with bitumen and hessian wrap or polythene faced hessian and bitumen coating. At road crossing necessary hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is atleast 8 mm away from the wall surface.
- The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

TEST

- The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS : 3041.
- The following earth resistance values shall be measured with an approved earth megger and recorded.
 - 1) Each earthing station
 - 2) earthing system as a whole
 - 3) Earth continuity conductors
- Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 5 ohm in each case.
- Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.
- All tests shall be carried out in presence of the Pmc

CONCEALED / SURFACE CONDUIT WORKS

LAYING OF CONDUITS

- Conduits shall be laid before casting in the upper portion of a slab / in PCC if below flooring or otherwise, as may be instructed in accordance with approved drawings, so as to conceal the entire run of conduits and ceiling outlet boxes. Conduits shall be so laid that they are interconnected. This is required to facilitate pulling of wires from different

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openings in case of any of the outlet is outlet is blocked during slab casting. Vertical drops shall be cut by the contractor to sufficient depth to allow full thickness of plaster over conduits. The width of the chases will be made to accommodate the required number of conduits. The chases will be filled with cement, coarse

- When the conduit is to be embedded in a concrete member it shall be adequately tied to the reinforcement to prevent displacement during casting. Tie wire to be supplied by the contractor.
- Cutting of chases in any RCC member / finished floor / already finished surface is not allowed unless prior approval of Site Engineer is taken in site instruction book. If a chase is cut in an already finished surface, the contractor shall fill the chases and finish it to match the existing finish including painting at his cost to Site Engineer's satisfaction.
- Contractor shall not cut any iron bars to fix the conduits. Puncher of wooden / steel shuttering for RCC slab / beams / column etc. for conduit work is also not allowed, unless Site Engineer permits in site instruction book under special conditions.
- Run of conduit pipe through expansion joints in RCC members should be avoided as far as possible and if unavoidable, flexible conduit pipe should be used with ceiling outlet box on both sides of expansion joints.
- Conduit on surface of RCC walls / RCC members shall be avoided as far as possible and if unavoidable prior approval of Site Engineer on sample saddles, clamps screws and a minimum 5 mtr. conduit laid on surface shall be taken, to achieve best possible workmanship. Distance between 2 consecutive clamps for fixing conduit on surface shall not exceed 900 mm. wooden patties for fixing saddles / clamps shall be used. Use of roll plug / steel fastener with hard setting / sealing compound is recommended.
- In case of stone masonry, necessary conduits with M.S. boxes should be placed as the masonry is in progress, since after completing masonry, it is very difficult to cut chases in walls. Special location of cement concrete shaft is also recommended to conceal conduit in stone masonry and the same shall be provided by client / consultant.
- In ground floor conduiting below the flooring should be avoided. Wherever it is unavoidable G.I. pipe should be used with prior approval of Site Engineer.

CEILING / WALL OUTLET BOXES FOR LIGHTS / FANS

- Outlet boxes shall be of steel with aluminium cover and so installed as to maintain continuity throughout. These shall be protected at the time of laying by filling with jute / earth / cotton etc. so that no cement mortar finds its way inside during concreting or plastering etc. Typical sketches for such outlet boxes shall be supplied alongwith other working drawings. In beams conduit socket shall be provided in place of outlet boxes. The same shall be used for installation of luminaire.
- For fixing light fixtures / brackets, outlet boxes complete with check nut for holding conduits shall be used. For lighting fixture suitable for 20 watts fluorescent tubes / incandescent lamps / mercury vapour lamps, only one outlet box is required. For fixing lighting suitable for 40 watts fluorescent lamps, two numbers outlet boxes should be provided at a distance of 300 mm. away from the centre in the longitudinal direction of the fixture, so that the use of patties / roll plug etc. may be avoided, as well as wiring from outlet box to the light fitting is to be installed in RCC beam and due to heavy reinforcement at the bottom of beam it is not possible to provide outlet boxes simple

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conduit should be provided. However alternative fixing arrangement shall be made in consultation with client / consultant.

- For fixing ceiling fans, circular outlet boxes, 100 mm. diameter, complete with 12 mm. dia. Mild Steel rod 300 mm. long, for holding 12 mm. dia. Mild Steel cover 125 mm. dia. at bottom shall be used.

DRAW OUT JUNCTION BOXES

- Steel drawout boxes at angle dimensions shall be provided at a convenient points on walls / ceilings to facilitate pulling of long runs of cables / wires. These shall be completely concealed with Anodised Aluminium, flush with plaster works. These draw boxes should be five sided. The location of these boxes is to be decided prior to fixing, as per site requirement and following should be treated as general guidance for deciding the location of these :
- These should be provided at a place where these are not in direct view. Recommended place is 400 / 450 mm. below ceiling, if conduits are running vertically.
- Junction box in the offset of bottom of RCC beam and vertical wall should not be provided.
- If junction boxes are coming side by side for two or more conduits, one common M.S. box of proper size can be used to act as junction box.
- If junction box is to be provided in ceiling, its position should be so located that it is in line with other light / fan points.
- Junction boxes should never be used for splitting one conduit into two or more. Junction box for such functions is avoidable and for this, number of conduits to be connected to one switch board should be calculated correctly as per drawing before laying conduits in ceiling.
- Locating junction boxes on outer surface of exterior walls of building should be avoided as these are in direct view and are also exposed to weather.
- Junction boxes should never be closed permanently by plaster. Removable covering of aluminium should be provided for conduit junction boxes for M.S. junction boxes removable hylem plate should be provided. This cover may be painted with wall colour.
- Junction boxes in important areas should be avoided and can be located in toilets / corridors / service shafts and stores etc.

SWITCH BOXES

- Steel boxes of required sizes, shall be provided to house speed regulators of fans, switches for lights, fans, plug sockets etc. as per requirement of drawings. These should be so designed that accessories on Anodised aluminium sheet could be mounted with tapped holes and brass machine screws, leaving ample space at the back and on the sides for accommodating wires and check nuts at conduit entries. These shall be attached to conduits by means of check nuts on all walls of the boxes through which the conduits are entering. These shall be completely connected leaving edges flush with finished wall surfaces. Anodised aluminium cover should be fixed to these switch boxes by means of brass chrome plated machine screws and cup washers. Utmost care shall be taken by contractor to ensure that all switch boxes are in line and level.

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- Inside each switch box, one bolt shall be welded to receive earthing wire.

SWITCH AND SOCKET

- Switches shall be installed at 900 mm above finished floor level unless otherwise indicated on the drawings.
- The switch controlling the light point or fan shall be connect on to the phase wire of the circuit and neutral shall be continuous, having no fuse or switch installed in the line except at the D.B. All fan regulators shall be fixed inside the switch boxes on adjustable flat M.S. strips / plates with tapped holes and brass machine screws, leaving ample space at the back and side for accommodating wires.
- The cover plates to the switch box shall be fixed by means of sunk head brass cadmium screws.
- Where two or more switches and fan regulators are installed together, they shall be provided with one gang cover plate with knockouts to accommodate required number of switches, sockets and regulators.
- The switch controlling the socket outlet shall be on the phase wire of the circuit. The third pin of the socket shall be connected to the earth continuity conductor of the circuit
- The switch boxes, installed back-to-back in the same wall shall be offset from each other, 150 mm horizontally, to preclude noise transmission.

CLEANING AND PROTECTION OF CONDUIT SYSTEM

- The entire conduit system including outlet boxes, junction boxes and switch boxes shall be thoroughly cleaned after completion of erection and tested for not blockage by air / sound or steel wire prior to finishing of building by air / sound or steel wire prior to finishing of building and before drawing in of cables / wires to safeguard conduit system against filling up with the plaster / cement slurry / water etc. all the outlet and switch boxes will have to be provided with temporary jute / cotton filling, covers and plugs etc.. Within tendered cost which shall be replaced later on by hylem / sheet cover after wiring as required.

TESTING OF INSTALLATION

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

INSULATION RESISTANCE

- The insulation resistance shall be measured by applying 500 volt megger with all fuses in places, circuit breaker and all switches closed.
- The insulation resistance in Mega ohms of an installation, measured shall not be less than 50 mega ohms divided by the number of points on the circuit.
- The insulation resistance shall be measured between
EARTH TO PHASE
EARTH TO NEUTRAL
PHASE TO NEURAL
PHASE TO PHASE

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EARTH CONTINUITY PATH

- The earth continuity conductors shall be tested for electrical continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit-breaker measured from the connection, with the earth electrode to any point in the earth continuity conductor in the completed installation and shall not exceed one ohm.

POLARITY OF SINGLE POLE SWITCHES

- A test shall be made to verify that every no-linked, single pole switch is connected to one of the phase of the supply system.

COMPLETION CERTIFICATES

- All the above tests shall be carried out in presence of client and the results shall be recorded in a prescribed form. Any default during the testing shall be immediately rectified and that section of the installation shall be re tested. The completed test result from shall be submitted to the client for approval.
- On completion of an electric installation a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form as required by the local electric supply authority.

INSTALLATION OF LIGHTING FIXTURES / FANS

INSTALLATION OF LIGHTING FIXTURES

- Scope of work under this item shall start from light point, with a 5 A Bakelite connector, 2 core 1.5 mm.² PVC insulated wires from this connector to the connector inside the lighting fixture, connections, fixing of lighting fixture complete with all accessories, lamps on wall / roof / steel truss etc. testing the lighting fixture and commissioning. If wire length of light point is enough to reach connector of light fitting, connector in light point can be deleted.

INSTALLATION OF EXHAUST FANS

- Scope of work under this system shall start from exhaust fan point, with a ceiling rose, 2 core 1.5 mm.² PVC insulated wire from ceiling rose to connector of exhaust fan, connections, making fan opening in walls including repair / finishing fixing of exhaust fan complete with accessories and louvers on walls with hold-fasts, testing the exhaust fans and commissioning.

INSTALLATION OF EXTERNAL LIGHT FIXTURES

BRACKET FOR STREET LIGHT FITTINGS

- The brackets shall be made of 38 mm. NB MS class "B" pipe approx. 1.8 mtr. long bent at the centre at an angle 120° C. with necessary holding brackets, hold fasts etc. with special reducer at the end to accommodate type of street light fitting to be fixed. Bracket shall have 1 coat of anti-corrosion paint before despatch to site and 2 coats of approved make and shade of aluminium paint. This bracket shall also be provided with one M.S. water tight box complete with the connector, neutral link, rewirable fuse etc.. See enclosed drawings of street light poles.

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INSTALLATION OF POLES

- Installation of poles shall be done as per enclosed drawings of street light poles. The depth of pole to be buried in ground shall be $\frac{1}{5}$ th of the total pole length or as specified in drawing, whichever is more. Special care shall be taken in erecting poles so that these are not strained or damaged during erection and are firmly stayed till the foundation are secured. The pole shall be grouted inside ground pit (cross-section 600 x 600 mm.) with cement concrete 1:2:4. Before the placement of concrete around pole in the pit, necessary conduit pipes (not less than 25 mm. dia.) shall be placed for facilitating drawing of cables. Separate conduit shall be provided for incoming and outgoing cables. The cement concrete shall be protected from premature drying by curing for at least 7 days after pouring. All concrete surface from 150 mm. below ground level to top shall be finished smooth with cement mortar 1:4.

INSTALLATION OF STREET LIGHT FIXTURES

- This includes fixing of street light fittings complete with accessories and lamps at the end of the pole / bracket, connecting it with 3 x 1.5 mm.² aluminium conductor, PVC insulated cable from water tight M.S. box, testing, commissioning. Third core shall be connected with earthing point of light fitting at one end and earthing point of marshalling box at the other end.

GENERAL NOTES FOR STREET LIGHTING

- For supplying and laying of cables, technical specification (wiring) shall be applicable reference shall be made under heading Cable Work elsewhere in the tender.
- For street light poles along roads, nearest finished road level shall be taken as ground level and for poles along compound wall / away from roads, existing ground / finished ground shall be taken as ground level.
- Distance of 1 mtr. shall be maintained between centre of pole and centre of curb of road. For compound wall poles, distance between compound wall and poles shall be 3 mtrs.
- A loop of 1.5 mtr. of cable shall be provided near each street light pole for all incoming and outgoing cable.

COMPLETION TESTS

- After supply and installation of complete project or a particular building / area, following tests shall be carried out by the contractor before switching on the power to installation and the results shall be recorded and submitted to the Site-Engineer. If results are not satisfactory / as per standards set herewith, the contractor shall identify the defects / short coming and shall rectify the same. Nothing extra shall be paid for carrying out these tests and contractor has to arrange all necessary instruments.

INSULATION RESISTANCE TO EARTH

- This is to be measured with all fuse links in place, all switches ON, all lamps and appliances in position by applying a voltage not less than twice the working voltage (subject to a limit of 500 V). Insulation resistance of the whole or any part of the installation to earth must not be less than 50 mega-ohms divided by the number of outlets (points and switch positions) except that it need not exceed one mega-ohm for the whole installation.

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INSULATION RESISTANCE BETWEEN CONDUCTORS

- Tests to be made between all the conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or neutral or the other pole or phase conductors of the supply. For this test, all lamps shall be removed and all switches put ON. The result of the test must be 50 mega-ohms divided by the number of outlets (points and switch positions) but need not exceed 1 mega-ohm for the whole installation.

POLARITY OF SINGLE POLE SWITCHES

- Tests shall be made to verify that all non-linked single pole switches are on phase conductor (live) and not on neutral or earth conductor. This can be done by connecting test lamps between two terminals of switch and earth. If the lamp lights up when switch is ON and either terminal is touched, the switch is correctly installed.

RESISTANCE OF METAL CONDUITS / SHEETS (EARTH CONTINUITY TEST)

- In case of cables encased in metal whether conduit or metallic sheathing, the total resistance of the conduit or sheathing from the earthing point any other position in the completed installation shall not exceed 2 ohms. This can be carried out by following circuit :
- One end of the lead is connected to the ECC and its connection with the electrode and the other to the farthest point of the ECC. First, current through the circuit is measured with the resistance of 2 ohms short circuited by the link. Next, current is measured through the two ohms resistance by disconnecting the two leads from the ECC and joining them together. If current is more in the first case, the resistance of ECC is less than 2 ohms.

HANDING OVER / TAKING OVER

- After completion of works and tests specified above, the building of the project can be taken over by the employer as and when these are ready in all respects. However, the defect liability period of 12 months would start from the date, when the building of the project have been completed and handed over.

TOOLS AND TEST EQUIPMENT

- The Tenderer shall indicate the makes of tools, test equipment and other item listed below:

TOOLS

- a) Set of spanners of sizes 6 mm to 32 mm width across flat
- i) Adjustable wrench of 36 mm jaw width
- ii) Adjustable wrench of 23 mm jaw width
- b) Heavy duty screw driver with full size insulated handle and blade length of
 - i) 100 mm
 - ii) 50 mm
 - iii) 200 mm

TEST EQUIPMENT

- a) 2500 V megger motor operated
- b) 500 V megger hand operated
- c) Multimeter (Battery operated) satisfying the following

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- i) With 0-1 mA, 0-100 mA, 0-1A and 0-5A, AC & DC current ranges
- ii) With 0-100 mV, 0-3V, 0-30 V, 0-300 V and 0-1000V AC & DC voltage ranges
- iii) The resistance ranges shall be atleast five (0-100) m ohm, (0-1) Ohm, (0-10) Ohm, (0-100) Ohm, (0-100) mega ohm
- iv) The Input impedance shall not be less than one mega Ohms for voltage ranges

LADDERS

- Ladder shall be made out of light aluminium alloy of good strength. They shall be of step ladder, foldable, self supporting type with spreader of metallic angles or high strength nylon straps. The ladder shall be provided with shoes on bottom of legs. Rugs shall be flat type having thickness of 30 mm in case of 3 metres long ladders and 60 mm for 6 metres long ladder.
 - i) 3 metres long
 - ii) 6 metres long
- Tong tester - ammeter range 0 to 30, 150 & 300 Amps AC and voltmeter (0-600) V, class 1.0 with leads and leather case.

C.TECHNICAL SPECIFICATIONS FOR FIRE FIGHTING WORKS

1.0 SCOPE OF WORK

The scope includes fire protection system only; the detection is covered under separate tender

1.1 Fire Hydrant system

1.2 Fire Sprinkler System

1.3 Fire Extinguishers

The detailed scope is described in the chapter "Extent of Work. "

2.0 FIRE EXTINGUISHERS

2.1 GENERAL:

The scope of work under this part of the specification covers supply and installation of internal appliances as per requirements specified in schedule & marked on drawings and instructions of engineer-in-charge.

Makes of all the appliances supplied and installed shall be as per the 'List of Approved Make ' or as approved by LFA and shall be of identical design for the entire premises.

Mounting accessories, indicator boards etc are part of the scope of supply of internal appliances.

2.2 SPECIFICATIONS:

Internal appliances with various fire extinguishing medium shall conform to the following specifications and shall be installed and maintained as per IS: 2190 / NFPA 10

IS: 15683 Fire extinguisher, portable CO2

IS: 15683 Fire extinguisher, portable, dry powder type.

IS: 15683 Fire extinguishers, water type

Portable Extinguishers of the following types shall be installed.

1. Dry chemical Powder type
2. Co2 type
3. Water type

2.2.1 DRY CHEMICAL POWDER TYPE:

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The Dry chemical powder type shall be of 5 Kg. Capacity and shall have the IS mark 2171 complete with powder and charged including with fixing bracket, fitted with gunmetal cap, and discharge hose and open grip nozzle.

2.2.2 CO2 TYPE:

The Co2 Extinguisher shall be ISI mark, with initial charge with high pressure cylinder, complete with wheel type valve, internal discharge tube, with high pressure discharge hose with horn and suspension brackets. The extinguisher shall have ISI mark of 2878 and capacity shall be 4.5 Kgs.

The Co2 Extinguisher of 22.5 kg. Capacity shall have ISI mark 2878 and necessary wheel valve, discharge hose and shall be mounted on light weight rubber tyre wheels.

ABC type extinguisher is not applicable for this tender.

3.0 PIPE WORK

3.1 GENERAL REQUIREMENTS:

All the materials shall be of TAC/LFA approved, best quality conforming to the specifications and subject to the approval of the Client or his representative. If so directed, materials shall be tested in an approved testing laboratory & the contractor shall produce the test certificate in original to the Engineer-in-charge & the entire charges for original as well as repeated tests shall be borne by the Contractor.

Before welding, the pipe faces shall be cleared & then shall be welded conforming to IS : 9595 – 1980. The electrodes used for welding shall comply with IS: 814. The laying of welded pipe shall also comply to IS 5822 – 1986. The welding joints shall be tested in accordance to IS:3600, Part 1973.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps or supported at every 3 mtr. & at change of direction as required. Only approved type of anchor fasteners shall be used for RCC ceiling and walls.

Valve and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

3.2 PIPING

Pipes of the following types are to be used:

MS/ G.I. pipes as per IS: 1239, heavy duty (for pipes of sizes 150 mm N.B. and below) suitably lagged on the outside to prevent soil corrosion. M.S. pipes buried below ground shall be lagged as per IS: 10211.

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MS/GI pipelines upto 150 mm dia. shall have all fittings as per IS: 1239, Part-II (heavy grade) while pipelines above 150 mm dia shall be fabricated from IS: 3589 Gr.320 pipes as applicable or from steel plates.

For MS/GI pipelines upto 50 mm dia screwed jointing shall be adopted, while for pipelines above 50 mm dia welded or flanged construction is to be carried out or as specified in Schedule of quantities.

Hangers and supports shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. All guides, anchor, braces, dampener, expansion joint and structural steel to be attached to the building structure trenches etc. shall be provided. Hangers and components for all piping shall be approved by the Consultant / Client / Architect.

The piping system shall be capable of withstanding 150% of the working pressure including water hammer effects.

Flanged joints shall be used for connections to vessels, equipment, flanged valves and also on suitable straight lengths of pipeline of strategic points (@ at every 15-20 mtr.) to facilitate erection and subsequent maintenance work.

Excavation for pipe line shall be in open trenches. Pipes shall be buried at least one meter below ground level and shall have 230 mm x 230 mm masonry supports at least 300mm high at 3m intervals. Masonry work to have plain cement concrete foundation (1 cement: 4 coarse sand: 8 stone aggregate) of size 380 x 380 x 75 thick resting on firm soil.

Wherever required Contractor shall support all trenches or adjoining structures with adequate supports to prevent land slides.

On completion of testing and painting trenches shall be refilled with excavated earth in 15 cm layers and compacted.

Contractor shall dispose off all surplus earth within the site.

Contractor shall provide suitable cement concrete anchor blocks for overcoming pressure trusts in underground / external pipes. Anchor blocks shall be of cement concrete 1:2:4 mix.

4.0 VALVES

Valves shall be used to start, stop or control flow. Non-return valves shall be provided unidirectional flow.

Butterfly valve conforming to BS 5155 or as indicated in BOQ will be used for isolation of flow in pipelines. Optionally, gate valves having outside screw rising spindle shall be used and shall be as per IS: 780 / 14846 PN 1.0/1.6, as applicable. For sizes 50mm to 200mm, Butterfly valve shall be as per IS: PN = 1.6 or as specified in Schedule of quantities. Non-return valves shall be swing check/spring operated type. An arrow mark in the direction of flow shall be marked on the body of the valve. These valves shall conform to IS:5312 for swing type or API 596/598 for spring type check valves

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Valves below 50 mm size shall have screwed ends while those of 50 mm and higher sizes shall have flanged connections. Drain lines will have locks for draining.

5.0 INTERNAL HYDRANT:

Internal hydrant shall be provided at each landing or at suitable location consisting of single / twin headed gunmetal landing valve as indicated in BOQ with 63 mm dia oblique female instantaneous pattern with caps & chains. Outlet and 80 mm inlet (IS: 5290-1969) with separate shut off valve. Landing valves shall be 63 mm dia. oblique female instantaneous pattern with caps and chains. Landing valves shall be of gunmetal and fitted with instantaneous coupling conforming to IS: 901. The valve body, stop valve, checks valve, nut, instantaneous female outlet and blank cap shall be of leaded-tin bronze conforming to Grade-II of IS: 318-1962. The valve spindle shall be of brass rod conforming to IS: 320 - 1962. The hand wheel shall be mild steel or cast iron washers gaskets shall be of rubber conforming to IS:638 - 1965 or leather conforming to IS:581 : 1969. The coupling shall be fitted with an internal plug secured by chain landing valves shall be installed on hydrant riser at a height of 1.0 to 1.2 meter from the floor level.

Each internal hydrant shall be provided with two nos. 63 mm. Diameter 15 mtr. Long hose pipe with gunmetal male and female instantaneous type coupling, machined wound with G.I. wire hose of IS 636 type A and couplings to IS:903 with IS certification, gunmetal branch pipe with nozzle conforming to IS:903.

6.0 HOSES

Hoses pipes shall be of fabric reinforced rubber lines as per IS:636 Type II or canvas hose as per IS:4927, with nominal size of 63 mm and lengths of 15 meter or 7.5 meter, as per quantities specified for in schedule or bill of quantity.

All hose pipes shall carry ISI marking on the body of the hose.

The hose shall have instantaneous spring lock-type coupling on ends. The instantaneous coupling shall be as per IS:901. It shall be fixed to each other by copper rivets and galvanized M.S. wires and leather bands. All coupling shall be interchangeable with each other, and shall bear ISI markings.

7.0 HOSE CABINETS (HOSE BOX)

Each hydrant shall be housed in a Hose cabinet of suitable size. The hydrant cabinet shall hold double / single headed hydrant as specified, 2 hoses and one branch pipe as required. Internal hydrants shall normally fit the size of the niche made for it. The cabinet shall be of minimum 16 SWG M.S. sheet with centre opening, double glass front doors (cleat glass of 4mm thickness). The glass shall be firmly fixed by means of steel clips and screw with rubber beading. Hinges shall also be screwed and not welded. The corner members (frame) shall be of 25 x 25 x 3 mm thick angle. The hose box shall be firmly fixed to the wall/support by means of brackets and dash fasteners. The steel work shall have one coat of primer and two coats of red paint. The words "Yard Hydrant", "Hydrant" etc. should be painted in white or red on the glass in 75 mm high letters. The hose box shall be lockable for internal hydrant installation.

8.0 HOSE REEL

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The hose reel shall be directly tapped from the riser through a 25 / 32 mm dia pipe, the drum and the reel being firmly held against the wall by use of dash fasteners. The hose reel shall be swinging type (180degrees) and the entire drum, reel etc. shall be as per IS:3876 and IS:884. The rubber tubing shall be of best quality and the nozzle shall be shut off type.

9.0 BRANCH PIPES

Branch pipe shall be of either gun metal or aluminum and should conform to IS:903. One end of the branch pipe will receive the coupling while the other end shall have a nozzle screwed to it. It shall bear ISI marking.

10.0 YARD / EXTERNAL HYDRANT

Yard or External Hydrants shall be as per IS: 908 and the valve as per IS: 5290. The hydrant shall consist of stand post assembly and a masonry base 200 mm X 200 mm X 200 cm high and shall be made at the point where it comes out of the soil. The valve shall complete with hand wheel, quick coupling connection spring and blank cap. The hydrant shall be laid on 150 dia. or as mentioned in BOQ.

Yard or External hydrant shall be controlled by a cast iron sluice valve. Hydrant shall have oblique female instantaneous pattern 63 mm diameter outlets with caps and chains. The hydrant shall be of gunmetal and flange inlet and single outlet conforming to IS: 5290, a duck foot bends and flanged riser of required height to bring the hydrant to level above ground. The valve body, stop valve, checks valve, nut, instantaneous female outlet and blank cap shall be of leaded-tin bronze conforming to Grade-II of IS: 318-1962. The valve spindle shall be of brass rod conforming IS: 320 - 1962. The hand wheel shall be mild steel or cast iron washers gaskets shall be of rubber conforming to IS:638 - 1965 or leather conforming to IS:581 : 1969.

Each external hydrant shall be provided with two nos. 63 mm. Diameter 15 mtr. Long hose pipe with gunmetal male and female instantaneous type coupling, machined wound with G.I. wire hose of IS 636 type A and couplings to IS:903 with IS certification, gunmetal branch pipe with 20 mm nozzle conforming to IS:903.

11.0 VALVE CHAMBERS

A valve chamber shall be brick masonry chamber in cement mortar 1:5 (1 cement: 5 coarse sand) on cement concrete foundation 150 mm thick foundation 1:5:10 mix (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size), 15 mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back filling, complete. The wall shall be 230 mm thick with heavy duty ISI marked C.I. manhole covers.

12.0 FIRE BRIGADE INLET CONNECTION

A fire brigade inlet connection with a non-return valve shall be provided to facilitate the fire brigade to pump water into the installation by the use of their own equipment. Four way or 150 mm dia connection to the system shall comprise of four instantaneous pattern 63 mm dia. male inlets shall be with caps and chains complete with 150 mm dia. sluice valves, non-return valve housed in a M.S. cabinet with glass fronted door. The cabinet shall be suitable for recess mounting.

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Two way or 100 mm fire brigade inlet connection to the system shall comprise of two instantaneous pattern 63 mm dia. male inlets shall be with caps and chains complete with 100 mm dia sluice valve, non-return valve housed in a M.S. cabinet with glass fronted door. The cabinet shall be suitable for recess mounting.

13.0 SYSTEM DRAINAGE

The systems shall be provided with suitable drainage arrangements with G.I./MS piping of 50 mm dia. complete with all accessories, and provided with drain valve.

14.0 HYDRANT SYSTEM

14.1 The hydrant system shall comprise of AC motor driven pump sets. Diesel pump, Jockey pump etc. with all required accessories including valves, appurtenances, instrumentation and controls etc. complete in all respects. The system shall cover the entire area from independent pipe work from the fire water pump set. The hydrant work shall remain pressurized through the proposed Jockey pump taking care of any leakages in the system pipelines and valve glands. All pumps / motors / engines to be of makes approved by local Fire Authority.

14.2 The hydrant system shall be kept charged by pressurized water at approximately 7.5 Kg/cm² at all times. In the event of fire when any of the hydrant valves in the net work is opened, the resultant fall in header pressure should enable starting the Electric Motor driven fire water pumping set through pressure switches automatically. One Diesel Engine / DG set driven pump shall be a stand-by pump serving hydrant system & sprinkler both. In case of failure of electricity or failure of Elec. Pump to start on demand, the stand-by DG set operated pump shall automatically take over. Apart from the automatic starting of the pump sets, provision shall be kept for manual starting also. However shifting down of the pump sets shall be manual.

14.3 The hydrant system in the yard shall be furnished with external hydrants consisting of landing valves (positioned approx. one meter above ground level) fitted M.S. (Heavy) flanged single headed stand pipes installed on underground hydrant headers distributed 45 M apart approximately or as marked on the plan.

The entire system including all pumps, motors, diesel pump set and panels shall be of approved make by TAC / Local Fire Authority.

15.0 SPECIFICATION FOR PUMPS AND ANCILLARY EQUIPMENT

15.1 SCOPE OF WORK

15.1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install electrically operated pumps for fire hydrant installations as required by the drawings and specified hereinafter or given in the schedule of quantities.

15.1.2 Without restricting to generality of the foregoing the pumps and the ancillary equipment and shall include the following:

- a) Electrically operated pumps with motors base plate and accessories.
- b) Pump suction and delivery headers, valves, air vessel and connections.

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- c) Pressure gauges / pressure switch.
- d) Only single point 3 phase supply will be made available to the Contractor. From there, all provision viz. Electrical switchboard, wiring, cabling, cable tray, control panel, earthing, etc. shall be made.

15.1.3 GENERAL REQUIREMENT

- a) Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in concrete foundations.
- b) Pumps and motors shall be truly aligned with suitable instruments.
- c) All pump connections shall be standard flanged type with appropriate number of bolts.
- d) Manufacturer instructions regarding installation connections and commissioning shall be followed with respect to all pumps, switchgear and accessories.

15.1.4 FIRE AND JOCKEY PUMPS

- a) The main Fire hydrant & Sprinkler pumps shall be End Suction Back Pull Out / Split Casing type while Jockey pumps shall be of Centrifugal Mono block Pump type having following specifications.
- b) Shut off head should not exceed 140% of rated head. Pump shall not develop less than 65% of rated head at 150% of rated capacity.

M A T E R I A L S O F C O N S T R U C T I O N

Part	Material
Casing	Cast Iron
Impeller	Bronze IS: 318, Gr. LTB 2
Casing Wearing	SS
Shaft	AISI – 410 / Stainless Steel
Shaft Sleeve	S.S. 316
Stuffing Box	Gland Packed

- c) Pumps shall be provided with pressure gauge with isolation cock on the delivery side.
- d) In case of motor driven pump the motor rating should be adequate to drive the pump at 150% of rated discharge.
- e) The pump and its prime mover (Electric motor or Diesel Engine) shall comply with all the equipment of the Rules of the Traffic Advisory Committee.

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- f) All pumps shall have positive suction & shall be provided with suction strainer of SS & CI bell mouth. In case of negative suction suitable priming arrangement shall be provided.
- g) In first phase only, all pumps shall be installed. Pump head shall be considering ultimate phase.

A) JOCKEY PUMP

Starting and stopping of Jockey Pump set shall be automatic at predetermined levels through pressure switch. However, arrangements for manual start and stop of the pump shall also be made. Jockey Pump shall take care of small leakages in the piping system and pumps cushion tanks.

B) ELECTRIC DRIVEN

Electrically driven pumps shall be provided with totally enclosed fan cooled, foot mounted, squirrel cage induction motors suitable for fire pumps with IP-55 enclosure.

The motors should be rated not to draw more than 4.5 times the starting current.

Motors shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge.

The motors shall be wound for class-F insulation and windings shall be vacuum impregnated with heat and moisture resisting varnish, glass fiber insulated.

C) DIESEL ENGINE

- a) Diesel engine shall have suitable no. of cylinders with individual heat assemblies. The engine shall be water cooled and shall include heat exchanger and connecting piping strainer, isolating pressure reducing valves, bye-pass line, exhaust pipe, silencer, day tank for fuel all interconnected piping etc., complete in all respects.
- b) Engine shall be direct injection type with low noise and exhaust omission levels,
- c) The speed of engine shall match the pump speed for direct drive.
- d) The engine shall be capable of being started without the use of the wicks, cartridge heater plugs or either at engine room temperature of 4°C and shall take full load within 15 seconds from the receipt of the signal to start.
- e) The engine shall effectively operate at 46°C ambient temperature at 150 meter above mean sea level.
- f) Engine shall be suitable for running on high speed diesel oil.
- g) The system shall be provided with a control panel with push button starting arrangement also wired to operate the engine on differential pressure gauge.
- h) The entire system shall be mounted on a common structural base plate with anti-vibration mounting, Dunlop make, and flexible connections on the suction and delivery piping.

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- i) Contractor provide one fully mounted and supported Day Oil Tank fabricated from 6mm thick MS sheet electrically welded for 8 hours working load and having suitable capacity of oil. Provide level indicators – low level and full level in the Day Oil Tank on the control panel through float switches and a breather. Day Oil Tank shall also be provided with filling connection (Threaded) with cap, gauge glass indication and cocks, drain cock, inspection / cleaning cover with gasket and nuts / bolts. MS dyke to hold 150% of the Day Tank capacity to be built around the Day Tank.
- j) Contractor to provide one exhaust pipe with suitable muffler (residential type) to discharge the engine gasses to outside in open air as per site conditions (Contractor to check the site).
- k) Contractor to provide all accessories, fittings and fixtures necessary and required for a complete operating engine set. The exhaust pipe shall be taken outside the building with minimum number of bends (approx. length 30 Meters) and shall be duly heat insulated with 50mm thick glass wool covered with 24 gauge aluminum cladding.
- l) Contractor shall indicate special requirements, if any, for the ventilation of the Pump Room.

Noise & Vibration level of the pump driven by motor/engine shall be within the acceptable limits of ISO 2372, IS 11727.

15.1.5 BOOSTER PUMP

A booster pump shall be provided at terrace to pressurize the wet riser system. The pump shall be centrifugal end suction / mono block type.

15.1.6 BASE PLATE

Pumps and motors shall be mounted on a common structural base plate and installed as per manufacturer's instructions.

16.0 CUBICLE TYPE SWITCH BOARD/L.T. PANEL

Cubicle type switchboards and components shall conform to the requirements of the latest revision including amendments of the following codes and standards.

IS: 8623 gear	Specification for factory built assemblies of switchgear and control for voltage upto and including 1000V AC / 1200V DC.
IS: 4237	General requirements for switch-gear and control-gear for voltage not exceeding 1000-V.
IS: 2147 gear	Degree of protection provided by enclosure for low voltage switch-gear and control-gear.
IS: 1018	Switch-gear and control-gear selection/installation and maintenance.
IS: 6005	Code of Practice for phosphate of iron and steel.
IS: 13947-1993/ IEC 947 - 1989	Air circuit breaker / molded case circuit breaker.

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IS: 1248 and Direct acting indicating analogue electrical measuring instruments testing accessories.

IS: 2705 Part - I, Current transformers for metering and protection with classification burden and insulation. II & III 1964

17.0 AIR CUSHION TANK

Every wet riser shall be provided with an air cushion tank at its top most point. The air cushion tank shall be provided with an automatic air release cock, 20 mm dia. drain pipe, drain valve and shut off valve.

18.0 PRESSURE GAUGE

All pressure gauges shall be dial type with Borden tube element of SS 316. The dial size shall be of 150 mm diameter and scale division shall be in metric units marked clearly in black on a white dial. The range of pressure gauge shall be 0-10 kg.sq.cm or as specified in BOQ. The pressure gauges shall be complete with isolation cock, siphon tubing, etc.

19.0 PRESSURE SWITCHES

19.1 The pressure switch shall be industrial type single pole double throw electric pressure switch designed for starting or stopping of equipment when the pressure in the system drops or exceeds pre set limits. It shall comprise of a single pole change over switch, below element assembly and differential spindle.

19.2 All pressure switches shall have ¼" BSP (F) inlet connection and screwed cable entry for fixing cable gland. All control cabling shall be provided.

20.0 SPRINKLER HEADS

Sprinkler heads shall be provided at approximate spacing so as to cover 12 sq.mtr. per sprinkler head in case of ordinary hazard & 17 sq.mtr. in case of light hazard. The spacing shall however be in uniformity with the drawings and properly coordinated with electrical fixtures, ventilation ducts and grilles and other services along the ceiling. Sprinkler heads shall be gunmetal quartz bulb type with a temperature rating of 68°C. Sprinkler heads shall be of upright conventional type with fusible link for operation. Sprinkler head shall be approved by the under writers Laboratories (U.L.) or Fire Officers Committee (FOC). The finish shall be as specified in bill of quantities.

Contractor shall install cabinet (fabricated from 16 Gauge M. S. sheets with lockable glass shutters. Shelves for keeping spare sprinklers and spanner at locations approved by the Engineer-in-Charge and given in the schedule of quantities. The contractor shall also give required tools for removing and fixing of different types of sprinkler free of cost as directed by Engineer-in- Charge.

21.0 SPRINKLER SYSTEM

21.1 GENERAL:

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To supply, install, testing and commissioning of sprinkler system as per drawing and Sprinkler heads spacing shall be in conformity with the drawings and properly coordinated in reflected ceiling with electrical fixtures, ventilation ducts and grills and other services along the ceiling.

Sprinkler heads shall be brass / gunmetal with quartz bulb with temperature rating of 68 degree Celsius. Sprinkler heads shall be of type and quality approved by the local fire brigade authority/NFPA 13. The inlet shall be screwed. Sprinkler heads shall be pendent, recessed or special side type. All sprinklers shall conform to the specifications given by TAC, IS, NFPA, FOC, UL & FM.

21.2 PENDENT /UPRIGHT TYPE SPRINKLER HEAD

Sprinkler heads shall be quartzite bulb type with bulb, valve assembly, yoke and the deflector. The sprinkler shall be of approved make and type with 15 mm nominal diameter outlets.

The bulb shall be made of corrosion free material strong enough to withstand any water pressure likely to occur in the system. The bulb shall be shatter when the temperature of the surrounding air reaches at 68 c.

The nominal bore shall 15 mm diameter and color of liquid shall be as per temperature rating.

21.3 CONCEALED TYPE / WITH ROSSETE SPRINKLER HEAD

Adjustable concealed sprinklers shall be provided as specified in S.O.Q. in areas where an attractive appearance is primary concern. Concealed Sprinkler heads shall be infinitely adjustable for a full 15 mm so as to compensate for uneven ceiling heights & allow adjustment of the sprinkler cover at any timer. The sprinkler shall be of approved make and type with 15 mm nominal diameter outlets.

The bulb shall be made of corrosion free material strong enough to withstand any water pressure likely to occur in the system. The bulb shall be shatter when the temperature of the surrounding air reaches at 68 c.

The nominal bore shall 15 mm diameter and color of liquid shall be as per temperature rating.

21.4 INSATLLATION CONTROL VALVE & REALATED EQUIPMENTS FOR SPRINKLER STSTEM

The sprinkler system shall have installation control valve (Flow switch with Isolation Valve and Drain arrangement) along with assemblies at entry of main header in each floor.

21.5 FLOW SWITCH

Flow switch shall have a paddle made up of flexible material of the width to fit within the pipe bore. The terminal box shall be mounted over the paddle / pipe through a connecting socket. The switch shall be potential free in either NO or NC position as required. The switch shall be able to trip and make/ break contact on the operation of a single sprinkler head. The terminal box shall have connections for wiring to the Fire alarm panel. The seat shall be of stainless steel. The flow switch shall have IP: 55 protections.

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The flow switch shall work at a minimum flow rate of 100 LPM. Further, it shall have a retard to compensate for line leakage or intermittent flows.

21.6 BUTTERFLY VALVE

The Butterfly valve shall be suitable for waterworks and tested to minimum of 16 kg/sq cm Pressure. The valves shall fulfill the requirements of BIS (Indian Standard) BS: 5155 or AWWA C 504, API 609 and MSS-SP-67.

The body shall be of cast iron to IS: 210 in circular shape and of high strength to take the minimum water pressure of 10 kg/sq cm. The disc shall be heavy-duty cast iron with anti-Corrosive epoxy or nickel coating.

The valve seat shall be high grade elastomeric or nitrile rubber. The valve in closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure. The shaft shall be of ENB grade carbon steel.

The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages.

The valve shall be supplied with manual gear operated opening/ closing system by lever.

21.7 DRAIN VALVE

50 MM / or as specified in SOQ diameter MS/ G.I. pipe conforming to I.S.:1239 (heavy grade) with 50 mm diameter / or as specified in SOQ gunmetal full way valve shall be provided for drainage of any water in the system in low pockets.

21.8 SPRINKLER ALARM VALVE:

Apart from above, Sprinkler alarm valve shall be provided with all accessories for wet sprinkler system to ensure positive water flow. It shall have flange connection & shall have brass body & steel trims. The valve shall conform to the specifications given by NFPA/UL/LFA

22.0 TESTING OF THE HYDRANT SYSTEM:

22.1 All air shall be trapped from the pipeline through hydrants & air valves. Each section of the pipe shall be slowly filled with the water & allow to stand the water for 2 hours minimum with the ends closed. No joints / connection shall be leaked within this duration. The hydraulic test pressure shall be 1.5 times the design pressure.

22.2 Flushing of underground connections: Underground mains and lead-in connections to system risers shall be flushed before connections made to piping in order remove foreign materials which may have entered the underground during the course of installation. For hydrant system the flushing operation shall be continued until water is clear.

22.3 Underground mains and lead-in connection shall be flushed at a flow rate of not less than 480 ltrs. Per minute.

22.4 Provision shall be made for the disposal of water issuing from test outlets to avoid property damage.

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22.5 Acceptance Test

At the time of taking over, the hydrant system shall fulfill the following acceptance

tests:-

- 22.5.1 Starting up of the pressure suction (Jockey Pump) : The pressure switch shall be set at 3.5 kg/cm² at the lower limit and 7.5 kg/cm² at the upper limit. The system drain shall be opened to cause a drop in the pressure. The Jockey Pump shall start as soon as the pressure gauge needle falls down to 3.5 kg. The Jockey pump shall also stop automatically when the system has been pressurised again upto 7.5kg/cm².
- 22.5.2 The main electrical pump shall be set to start at 3.5 kg/cm². An external hydrant valve using a single length of hose and branch pipe shall be fully opened to cause a drop of pressure in the system. At first, the jockey pump shall start when the pressure drops from 7 kg. Further, drop in the pressure from 3.5 kg should be allowed to test automatic start-up of the electrical pump. The electrical pump shall continue to run at least for 5 minutes and register rise in the pressure upto 3.5 kg the Jockey Pump shall be automatically start at this. The electrical pump shall be stopped manually by pressuring the stop button.
- 22.5.3 After having the system got fully charged at 7.5 kg/cm² the external hydrant valve using hose and branch pipe at (ii) above shall be opened. When the pressure has dropped from 3.5 kg/cm², the electric main pump shall come into operation automatically. After the main pump has run for 5 minutes, the power supply in the pump house shall be switched off. The diesel pump shall automatically come into operation immediately.
- 22.5.4 All these tests mentioned above shall be repeated after one hour interval. The result of all the tests shall be identical again. After the system has satisfactorily withstood the above tests, it can be taken over from the contractor.

23.0 START-UP/SYSTEM TESTING

It will be the responsibility of the tendered to cause interim/stage inspection by the Local Fire Authority LFA/ Chief Fire Officer C.F.O during execution of the work as and when so called for by the Employer / Consultant and shall carry out any rectification / modification as may be suggested by the Local Fire Authority (LFA), Chief Fire Officer (CFO).

Soon after the work is completed, the contractor shall inform the LFA/CFO in writing with a copy to the Consultant/Employer for getting the complete system including all sub system and instrumentation, control etc. thoroughly inspected and tested for satisfactory performance. After satisfactory completion of tests of the systems by the LFA / CFO, the contractor shall be required to submit as built drawings to the Consultant / OWNER which have been so approved.

24.0 COMMISSIONING OF SYSTEM

- 24.1 Pressurized the fire hydrant system by running the main fire pump and after attain required pressure shut off the pump.
- 24.2 Open bye-pass valve and allow the pressure to drop in the system. Check that the jockey pump cuts- in and cuts-out at the pre-set pressure. If necessary adjust the pressure switch for the jockey pump. Close bye-pass valve.

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- 24.3 Open bye-pass valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the preset pressure and should not cut-out automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However, the jockey pump should cut out as soon as the main pump starts.
- 24.4 Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.
- 24.5 When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant simultaneously and allow the hose pipe to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.
- 24.6 Diesel engine / DG set driven pump should also be checked in the same manner as given in Para above by running for 8 hours.
- 24.7 Check each landing valve, male and female couplings and branch pipes for compatibility with each other. Any fitting which is found to be incompatible and does not fit into the other properly, shall be replaced by the Contractor. Landing valves shall also be checked by opening and closing under pressure.

25.0 HANDING OVER

- 25.1 All commissioning and testing shall be done by the Contractor to the complete satisfaction of the Engineer-in-Charge / Consultants, and the job handed over to the Client.
- 25.2 Contractor shall also hand over to the Client all maintenance and operation manuals and all items as per the terms of the contract.

TECHNICAL DATA SHEET

(Technical information to be furnished in following format by Bidder)

TECHNICAL DATA SHEET TO BE FURNISHED BY BIDDER

SR. NO.	SPECIFICATION	DESCRIPTION		
1.0	FIRE PUMP(S)	HYDRANT	SPRINKLER	JOCKEY
1.1	Type(s)	REQ.		
1.2	Make(s)	REQ.		
1.3	General Specifications :	REQ.		
1.3.1	Capacity (Lit/Sec)	REQ.		
1.3.2	Head in (mtr.)	REQ.		
1.3.3	Sizes of suction and delivery pipes in mm	REQ.		
1.3.4	Pump Efficiency	REQ.		
1.4	Material for Impeller	REQ.		

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TECHNICAL DATA SHEET TO BE FURNISHED BY BIDDER

SR. NO.	SPECIFICATION	DESCRIPTION		
1.5	Material for Pump Casing	REQ.		
1.6	Material for Shaft	REQ.		
1.7	Electrical Motor			
1.7.1	Type	REQ.		
1.7.2	Make	REQ.		
1.7.3	Speed in R.P.M	REQ.		
1.7.4	H.P and Voltage of driving motor, type of enclosure and class of winding insulation, Motor full load current (Remote controlled starting arrangement, if any)	REQ.		
1.7.5	Details of electric supply	REQ.		
1.7.6	Type of Starter	REQ.		
1.8	Diesel engine (if asked)			
1.8.1	Speed and Horse power of the engine driving pump(s)			
1.8.2	Method of starting the engine			
1.8.3	Fuel Consumption			
1.8.4	Details of batteries, Battery Charger and Diesel Engine control panel			
1.8.5	Make			
2.0	HYDRANT MAINS			
2.1	Material & Type of underground and / or overhead mains with method of joining			
2.2	To what pressure have the pipes been tested?			
2.3	No. & dia. Of wet riser			
3.0	HYDRANT VALVES			
3.1	Type and Make			
3.2	No. & type of Yard hydrants valve			
3.3	No. & type of floor hydrants			
4.0	HOSE			
4.1	Material and diameter			
4.2	Manufacturer's Name and Guarantee for bursting pressure.			
4.3	No. of length of 15m and 7.5m respectively			
4.4	At what pressure the hose has been tested by			

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TECHNICAL DATA SHEET TO BE FURNISHED BY BIDDER

SR. NO.	SPECIFICATION	DESCRIPTION
	the insured?	
4.5	Where is hose kept?	
4.6	No. of branch pipes and nozzles and their diameters	
5.0	SPRINKLER (IF REQUIRED)	
5.1	No. & type of isolation valves	
5.2	Type, make and fusing temperature of the sprinkler heads used.	

Note: Performance curve for pumps & catalogues for each above item shall be submitted

D. TECHNICAL SPECIFICATION FOR PLUMBING WORKS

1.0 BASIC MATERIALS AND METHODS

1.1 GENERAL

All materials shall be new and of the best of their kind and shall conform to the latest Indian Standard Specification.

All materials shall be approved quality as per samples and origins approved by the Architects/Consultants.

As and when required by the Architects/Consultants, the contractor shall arrange to test the materials and/or portions of the works at his own cost to prove their soundness and efficiency. If after tests any materials, work or portions of work are found defective or unsound by the Architects/Consultants, the contractor, shall remove the defective materials from the site, pull down and re-execute the works at his own cost to the satisfaction of the Architects/Consultants. To prove that the materials used are as specified, the contractor shall furnish to Architects/Consultants with original vouchers on demand.

All works executed shall be as directed and to the satisfaction of the Architects/Consultants.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps at interval specified.

Clamps, hangers and supports on RCC walls, columns & slabs shall be fixed only by means of approved made of expandable metal fasteners inserted by use of power drills.

All pipes clamps, supports, nuts, bolts, washers shall be galvanized MS steel throughout the building. Painted MS clamps & nuts, bolts & washers shall not be accepted.

Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

Access, doors for fittings and clean outs shall be so provided that they are easily accessible for repair and maintenance.

2.0 PLUMBING FIXTURES AND TRIM

2.1 SCOPE OF WORK

Work under this section shall consist of furnishing all materials & labor necessary and required to completely install all sanitary fixtures, chromium plated fittings and accessories as required by the drawings specified hereinafter and given in the Schedule of Quantities.

Without restricting to the generality of the foregoing the sanitary fixtures shall include the following:

Sanitary fixtures

Chromium plated fittings

Porcelain or stainless steel sinks

Accessories e.g. towel rods, toilet paper holders, soap dish, towel rack, coat hooks etc.

Connections to all kitchen, pump headers and other equipment requiring water and drainage connections.

Whether specifically mentioned or not all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, screws, hangers as required.

All exposed pipes within toilets and near fixtures shall be chromium plated brass or copper unless otherwise specified.

2.2 GENERAL REQUIREMENTS

Sanitary fixtures shall be of the best quality approved by the Architects/Consultants. Wherever particular makes are mentioned, the choice of selection shall remain with the Architects/Consultants.

All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, specifications and drawings. Accessories shall also include proper fixing arrangement, brackets, nuts, bolts, screws and required connection pieces.

Fixing screws shall be half round head chromium plated brass screws with C.P. washers where necessary.

Contractor shall furnish without cost all such accessories and fixing devices that are necessary and required but not supplied along with the Plumbing Fixtures & CP fittings by the manufacturers as a part of the original and standard supply.

All fittings and fixtures shall be fixed in a neat workmanlike manner true to level and heights shown on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good at Contractor's cost.

Contractor should seal all fixtures fixed near wall, marble and edges with an approved type of polysulphide sealant appropriate for its application.

2.3 VITREOUS CHINA SANITARYWARE

All glazed Vitreous China Sanitary ware fixtures shall conform to Indian Standard IS: 2556. The details, make and type to be provided are given in the Schedule of Quantities. The Vitreous China Sanitary ware shall be of first quality only. They shall be non-porous and fully vitreous, with all the visible portions perfectly glazed and should absolutely be free from hairline cracks pin- holes and local depressions. It shall be perfectly symmetrical, uniform and smooth and curves. All sanitary fixtures and fittings shall be stores under covered roof and handled carefully to prevent any damage.

2.4 CHROMIUM PLATED FITTINGS

All Chromium plated fittings shall be of brass/copper, heavy chromium plated, of the make and design approved by the Architects/Consultants. The fittings shall be cast fittings of screw type, machined and threaded properly for fixing to the supply pipes.

The plating shall conform to Indian Standard IS:482 (Electroplated coating of nickel and chromium of copper and copper alloys).

The fittings shall be supplied complete with chromium plated matching flanges, wall cover plates, nuts and extension pieces of required lengths. Metallic washers where required shall also be of chromium plated brass. All bib cocks and stop cocks shall conform to Indian Standard IS:781. Brass screw down pillar taps shall conform to IS:1701 and all other fittings shall match the supply fitting in construction and appearance. All fixing accessories and screws shall be similar to fittings. All washers shall conform to Indian Standard IS:4346.

All waste fittings (Waste, Chain, Overflow, Spreaders Caps etc.) shall be of brass/copper heavy chromium plated of the make and design specified and match the supply fittings. They shall conform to Indian Standard IS:2963.

Bottle traps (for wash basins, sinks, urinals etc) shall be deep seal (Min. 6cm seal) cast brass bottle traps, heavy chromium plated. All bottle traps shall be provided with suitable cleaning eye, extension piece, flare nuts of all chromium plated.

Wall flanges shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pierce through them. These wall caps shall be of chromium plated brass snugly fittings and the receiving pipes and shall be large enough to cover the punctures properly.

2.5 INSTALLATION OF SANITARY FIXTURES AND FITTINGS

General Requirement

The fixtures and fittings shall be provided with all such accessories as are required to complete the item in satisfactory working conditions, whether specifically mentioned or not in the schedule of Quantities, Specifications and drawings.

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The sanitary fixtures and fittings shall be installed at the correct assigned position as shown on the drawings and as directed by the Architects / Consultants, and shall fully meet with the aesthetic and symmetrical requirements as demanded by the Architects/Consultants.

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Architects/Consultants requirements. Wherever necessary, the fittings shall be centered to dimensions and pattern as called for.

Fixtures shall be installed by skilled workman with appropriate tools according to the best trade practice. Manufacturer's instructions shall be followed for the installation of fixtures. Fixtures in all toilets shall be standard height mounting as called for on the drawings. Fixtures shall be mounted rigid, plumb, and true to alignment.

Mock up and Trial Assembly

The installation of the sanitary fixtures and fittings shall be as per the shop drawings approved by the Consultants.

The Contractor shall have to assemble at least one set of each type of sanitary fixtures and fittings in order to determine precisely the required supply and disposal connections. Relevant instructions from manufacturers shall be followed as applicable. This trial assembly shall be developed to determine the location of puncture holes, holding devices etc. which will be required for final installation of all sanitary fixtures and fittings. The above assembly shall be subject to final approval by the Architects/Consultants.

The fixtures in the trial assembly can be re-used for final installation without any additional payments for fixing or dismantling of the fixtures.

Supporting and Fixing Devices

The contractor shall provide all the necessary supporting and fixing devices to install the sanitary fixtures and fittings securely in position. The fixing devices shall be rigidly anchored into the building structure. The devices shall be rust resistant and shall be so fixed that they do not present an unsightly appearance in the final assembly. Where the location demands, the Architects/Consultants may instruct the contractor to provide chromium plated or other similarly finished fixing devices. In such circumstances the contractor shall arrange to supply the fixing devices and shall be installed complete with appropriate vibration isolating pads, washers and gaskets.

Final Installation

The contractor shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built in piping system. All unions and flanges shall match in appearance with other exposed fittings.

Fixtures shall be mounted rigid, plumb and to alignment. The outlets of water closet pans and similar appliances shall be examined to ensure that outlet ends are butting on the receiving pipes before making the joints. It shall be ensured that the receiving pipes are clear of obstruction. When fixtures are being mounted, attention shall be paid to the possibility of movement and settlement by other causes. Overflow shall be made to ensure that necessary anchoring devices have been provided for supporting water closets, wash basins, sinks and other appliances.

Protection against damage

The contractor shall take every precaution to protect all sanitary fixtures against damage, misuse, crazing, staining, breakage and pilferage by providing proper wrapping and locking arrangement till the completion of the installation. At the time of handing over, the contractor shall clean, disinfect and polish all the fixtures and fittings. Any fixtures and fittings found damaged, cracked chipped stained or scratched shall be removed and new fixtures and fittings free from defects shall be installed at his own cost to complete the work.

2.6 MEASUREMENT

Sanitary fixtures and accessories shall be measured by numbers in the unit given in the Schedule of Quantities.

Rates for all items shall be inclusive of cutting holes and chases and making good the same, C.P Brass screws, nuts, bolts and any fixing arrangements required and recommended by manufacturers, testing and commissioning.

WATER STORAGE TANKS

3.1 GENERAL

The following provisions should be made by the plumbing contractor in the Water Storage Tank

- aa) 600 dia opening with sealed manhole cover.
- bb) Manhole with double sealed manhole cover.
- cc) Inlets, outlets over flows, drains and insect proof vent cowls as required on Drawings.

Necessary perforations (including puddle flanges where required) for the inlet and outlet pipes shall be provided. Each storage tank shall be equipped with overflow, warning pipes, and vent pipes, and drain sumps (located directly below the manhole).

With watertight hinged cover and locking device.

3.2 TANK FITTINGS

Overflow pipes shall be:

Dipped down inside tanks so as to terminate in a position maximum 150mm above bottom of pump room floor.

Provided with metal hinged flaps at outlets.

Discharge in conspicuous position.

Strainers with Anti-vortex Plate shall be:

3mm thick brass strainer

With 3mm thick galvanized mild steel anti-vortex plates

With total perforation area of 3mm maximum diameter holes not less than twice of the cross section area of pump suction pipe.

3.3 LEVEL CONTROLLERS

All level controllers, level sensors, level switches and alarms shall be provided and installed by the contractor.

Each probe shall be of the correct length for its particular application and tank location. Electrodes shall be polished stainless steel 20mm outside diameter. Electrode holders shall be weather proof in all respect.

The earthing probes shall be connected and wired to the building earth system.

Each set of electrodes shall be installed inside a 200mm-diameter PVC pipe acting as a wave barrier.

The level switch set shall be operated with a stepped down voltage at 24V maximum. Stepped down transformer shall be provided for each set of control probes and shall be installed inside centralized control cubicles inside pump room.

Provide interface unit at the pump control panel for the levels to be monitored by BMS (refer to drawing).

The BMS control panel will monitor the following outputs from the location for each Tank.

BMS Tank High Level (O/P)

Whenever the liquid level in the tank reaches a high level, a high level dry contact will be provided by the contractor at the level controller and monitored by the BMS.

BMS Tank Low Level (O/P)

Whenever the liquid level in the tank reaches a low level, a low level dry contact will be provided by the contractor at the level controller and monitored by the BMS.

BMS Level Sensing (O/P)

The BMS will monitor the level of liquid in specified tanks via a level sensor provided by the M&E contractor. All level controllers will provide a 4-20mA signal to the ELV contractor.

3.4 EXECUTION

dd) Tank Disinfection

Disinfect all potable water tanks including concrete water tanks according to the following method:

A solution of 200-mg/L available chlorine shall be applied directly to the surfaces of all parts of the storage facility that would be in contact with water when the storage facility is full to the overflow elevation.

The chlorine solution may be applied with suitable brushes or spray equipment. The solution shall thoroughly coat all surfaces to be treated, including the inlet and outlet piping, and shall be applied to any separate drain piping such that it will have available chlorine of not less than 10mg/L when filled with water. Overflow piping need not be disinfected.

The disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30-min. after that entire water should be flushed out. After which potable water shall be admitted, the drain piping shall be purged of the 10-mg/L chlorinated water, and the storage facility shall then be filled to its overflow level. Following this procedure, and subject to satisfactory bacteriological testing and acceptable aesthetic quality, water may be delivered to the distribution system.

ee) **DOMESTIC WATER PUMPS**

4.1 GENERAL

The pump heads in the Schedules or Drawings are given for tendering guidance only and the Contractor shall be responsible for checking the total final resistance of each system, based on the actual pipe runs and equipment offered, prior to ordering. Any modifications to the system or any of the components, i.e. pumps, pipe work, motors etc., which may be required to meet the scheduled duties and space limitations shall be carried out at the Contractor's expenses.

All pumps shall be constructed to meet the required working conditions and test pressure of the system concerned.

All pumps shall be self primed and mounted on a common bed-plate together with the motor and directly driven through a flexible coupling and shall be aligned in the manufacturer's factory. Locally fabricated bed-plates will not be accepted. Base plate shall incorporate a drain pan and is to be provided with a screwed socket outlet for drain connection.

Unless otherwise specified, pumps shall be selected for an impeller speed of 1450/1500 rpm. All pumps shall be as commercially silent in

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operation. A unit which is considered to be noisy shall be removed from the site and replaced by silent unit at the Contractor's expense.

The Contractor shall submit for the approval the characteristic curves of the pump offered. The operating conditions shall be indicated and curves of pumps having excessive shut-off head will not be accepted.

All pumps shall be fitted with an air-cock and drain plug. Each pump shall be provided with connection for pressure gauges at the suction and delivery connections, the gauges for all pumps shall be mounted on common hardwood gauge board on the wall inside the pump room. Gauges shall have 100mm diameter dial. Pressure gauge piping shall be copper comprising a loop siphon at the junction to the gauge and each gauge shall be supplied through 12mm diameter brass pig tail and pet cock. Drains shall be piped to floor drains/waste pit.

The Contractor shall supply and install flexible pipe connectors at the pump suction and discharge sides for each pump.

All flexible connectors shall have flanges joints to the table specified for the connecting pipe work and must be suitable for the working conditions and test pressure of the system concerned.

Gland drains shall be provided in each pump packing gland with suitable nipple/outlet for copper/PVC pipes to be connected. All drains shall have a minimum internal bore of 15mm diameter and arranged in a proper pattern for piping the same to the channels or floor outlets provided inside the pump room.

Where necessary, an automatic air relief valve shall be fitted in the pump to purge any air likely to be trapped inside the pump casing. Suitable fittings shall be use for such connection and the relief valve shall not discharge at a location directly over or near to the pump motor or any other electrical equipment.

Each pump shall be fitted with valves to enable it to be isolated, and in addition, where shown on the Drawings, a check/non-return valve shall be fitted in each pump discharge.

Transfer pump set shall be mounted on an inertia block. Holding down bolts shall be set in position during the manufacture of the structural base. Filtered pump set shall be mounted on base plate. Generally all pump sets shall be mounted on the reinforced concrete plinth 150mm high or as instructed by the Engineer.

Inertia block shall be concreted. Anchor bolts of base shall be provided.

Pump inertia bases shall be provided and shall be twice the operating weight of the pumps and the associated pipe work as mounted thereon.

The base plates shall be of approved make with pads machined for correct alignment of the pump and motor. At least two locating dowels shall be fitted to each component after alignment.

All exposed shafts, couplings and moving parts of pumps shall be provided with suitable galvanized angle iron wire mesh guards which shall be stoutly constructed and easily removable; and shall be provided with lifting handles. Care shall be taken that these guards do not cause "ringing" sound and/or vibrate so causing noise.

An identification plate of metal shall be fixed to each pump unit. This plate shall include full details and diameter of the impeller installed, pump size, model and serial number, r.p.m., amps, etc. pump head and delivery for the duty specified, and lubricant required.

All pumps shall bear the manufacturer's designation plate which shall indicate the type of services and serial number of the unit.

4.2 PUMP ARRANGEMENT

Pumps for plumbing services are single stage or multi-stage centrifugal vertical, horizontal split case or end suction type as shown in Schedule of quantity/ Drawing.

De watering / Sewage pumps shall be submersible type, or centrifugal self priming.

Each pump shall be directly coupled with the electric motor and aligned in the manufacturer's factory.

4.3 PUMP SPEED AND NOISE

Pumps shall be selected for an impeller speed as indicated in the Schedule/Drawing. All pumps shall be as commercially silent in operation.

The noise level shall be not more than NC 70 in pump room, NC 50 in the same floor and NC 35 for other floors.

4.4 PUMP BASES

Except for submersible sump pumps, each pump set shall be mounted on an anti-vibration pump base. Details shall be submitted by the Contractor well before the manufacture of the structural base. All holding down bolts shall be provided by the Contractor.

4.5 SAFETY GUARDS

All exposed shafts, couplings and moving parts of pumps shall be provided with suitable galvanized angle iron wire mesh guards which shall be stoutly constructed and easily removable; and shall be provided with lifting handles. Care shall be taken that these guards do not cause "ringing" sound and/or vibrate so causing noise.

4.6 IDENTIFICATION

An identification plate of metal shall be fixed to each pump unit. This plate shall include full details and diameter of the impeller installed, pump size, model and serial number, r.p.m., sumps, etc pump head and delivery for the duty specified, and lubricant required.

All pumps shall bear the manufacturer's designation plate which shall indicate the type of services and serial number of the unit.

4.7 ELECTRICAL WORKS FOR PUMPS

All electrical works associated with the pumps shall comply with the NBC regulations (the latest edition) code of practice, supply rules and regulations and described in the relevant section of this Specification.

Anti-vibration mountings shall be inertia base, springs, neoprene pads or rubber-in-shear isolators, with the specified static deflection and selected to provide isolating efficiency of not less than 95%.

The control panel shall be of the pressure switch/microprocessor. The complete control panel assembly and all the internal devices shall be UL508. The panel shall be complete with IP54/NEMA1 enclosure and include door interlocked main disconnect and magnetic motor starters with fused motor protectors, adjustable time delays, Hand-off auto selector switch and for each pump, power on light, minimum run timers, low suction pressure switch and pilot light. The control circuit shall include fault relay circuit to turn on the next pump should the lead pump fail.

Should the duty pump fail to start and the pressure of the system shall continue to fall, the standby pump shall be initiated to cut into operation.

Either pump shall be able to be selected as duty/standby/jockey. The operating pump shall also be able to select as automatic or manual and interlock devices shall be provided to isolated the system for maintenance

Automatic changeover shall be provided to alternate between the duty/standby pumps on each cycle.

A time delay (0 to 10 seconds) switch shall be installed in the control of each pump set to provide a time lag between the initiation of signals by the pressure switches (both pump on and off) and the actual start and stop of the pump set to avoid excessively frequent on/off cycles of the pumps due to surges in the long pipe runs.

The pump set together with the required control panel and fitted with hoot shall be mounted on a common bedplate, factory assembled in the manufacturer's workshop prior to delivery. Control panel for all pump sets shall be as per Indian standard.

4.8 RAW WATER PUMPS

Where required transfer water pumps shall conform to the following Specification:

Pump efficiency shall not be less than 70%,

Materials shall be as follows:

. Casing	-	Cast iron and minimum working pressure not less than 250 PSI or 150% of maximum discharge pressure.
. Impellers	-	Bronze and hydraulic balancing.
. Wearing Rings	-	Bronze
. Shaft Sleeve	-	Bronze
. Shaft	-	Stainless steel
. Seal	-	Mechanical seal/gland packing (asbestos-free)
. Couplings	-	Flexible metallic coupling, complete with coupling guards
. Bearings	-	Ball thrust type, grease lubricated, rated bearing life not less than 100,000 Hr

4.9 SUBMERSIBLE SEWAGE AND DRAINAGE PUMPS

Submersible sewage and drainage pumps shall be installed in sump pits consisting of discharge connection, galvanized steel guide rail, galvanized chain and lifting handle as per detail. Pump efficiency shall not be less than 40%. Can be handle solid particle upto 50mm.

Materials shall be as follows:

Casing	-	High grade grey cast iron with internal sea water corrosion resistant coating
Impellers	-	Cutter type for sewage pumps or non-clog type for drainage pumps, chromium-alloyed cast iron material of abrasion resistant.
Shaft	-	Stainless steel.
Seal	-	Double mechanical seal.
Bearings	-	Ball thrust type, grease lubricated
Maximum	-	As shown on the Equipment Schedule/Drawing speed
Bolt & Nut	-	Stainless Steel

Level switches (high/low levels alarm and indications) shall be supplied and installed in the sump pits for the proper operation of the pumps as indicated on Drawings. The switches shall be of mercury float switch type. The lead-lag selection of pumps shall be changed automatically after each cycle.

Attention shall be paid to the internal dimensions of the sump pits and covers when selecting pumps.

Motor shall be class F insulation and inside the casing to prevent water ingress.

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The Contractor shall supply and fix pump discharge pipe work, vents, control and power wiring and associated conduit. Three spare packing shall be provided for each pump.

The installations shall be complete with the following accessories:

- . Seal monitor in oil chamber for leakage checking.
- . Thermal switches to protect over heated motor.
- . Automatic control box.
- . Cable of sufficient length for connection of the control box to the pump.
- . A.C. alarm bells.
- . Cable holders.

4.10 EXECUTION

Completely align and level pumps, motors and bases. Where pumps and motor are shipped as a unit, realign them in the field.

Grout base plates completely to provide a non-deflecting support.

Install and align mechanical seals in accordance with the manufacturer's recommendation.

Pump manufacturer or his represented to set packing, adjust impellers and check alignment prior to start-up.

Pump shall be mounted according to vibration isolation section.

Repair all surface damage during shipping and installation or prior to client's acceptance of the building.

ff) INTERNAL & EXTERNAL WATER SYSTEM

GENERAL

Water supply system to cater for drinking, washing, flushing & other requirements shall be installed as called for on the drawings.

The piping system consists of medium class galvanized iron pipes and fittings, CPVC/PPR Pipes or other material as called for. The size and makes are specified in the Schedule of Quantities.

5.1 REQUIREMENTS

- A. Supply and installation of the cold water system including incoming water mains, all distribution pipe work, transfer pumps, multistage pressure booster pump sets, valves, fittings, hangers, equipment supporting frameworks, etc. as per the Drawings.

Water connections shall be provided at the plot boundary by Municipal Authority.

The incoming water mains shall be routed to water storage tanks in the vicinity. Water supply distribution system to various usage points will be through hydro-pneumatic system.

Water hose points shall be provided to the basement plant rooms, roof and other areas as required.

5.2 FERRULES

The ferrules for connection with C.I main shall generally conform to IS: 2692. It shall be of non-ferrous materials with a C.I bell mouth cover and shall be of nominal bore as specified. The ferrule shall be fitted with a screw and plug or valve capable of completely shutting off the water supply to the communication pipe, if and when required.

5.3 WATER METERS

Water meters of approved make and design shall be supplied for installation at location as shown. The water meters shall meet with the requirement and approval of local water supply authorities. Suitable valves and chambers or wall meter box to house the meters shall also be provided along with the meters.

The water meters shall be provided with straight reading, dry dial, hermetically sealed register, and magnetic drive. The rotation of the turbine is directly transmitted to the register, and magnetic drive. The meters shall have totalization of flow volume in cubic meter (cum). The meter shall conform to local municipal authority, and shall be suitable for connection to the BMS for remote monitoring/reading.

The meters shall conform to Indian Standard IS: 779 and IS: 2373. Where called for, the water meters shall be located in masonry chambers of appropriate size.

Provision shall also be made to lock the water meter. The provision shall be such that the lock is conveniently operated from the top. Where the provision is designed for use in conjunction with padlocks, the hole provided for padlocks shall be a diameter not less than 4mm.

5.4 MAKING WATER CONNECTION

A pit of suitable dimension shall be dug at the point where the connection is to be made with ring main and earth removed up to 150mm below the main. The flow of water in main shall be disconnected by operating the nearest sluice valve on the main. The main shall be drilled and sloped at 45 to the vertical and the ferrule of required size shall be screwed in. the ferrule shall be fitted in a manner so that no portion of projection of the shank shall be left projecting within the main into which it is fitted. Ferrule shall be non-ferrous material with a CI bell mouth cover and shall be of nominal bore as required.

5.5 INSTALLATION OF WATER METER AND STOP COCK

The GI lines shall be cut to the required lengths at the position where the meter and stop cock are required to be fixed. Then end of the pipe shall be

threaded. The meter and stop cock shall be fixed in a position by means of connecting pipes, GI jam nut and socket etc. The stop cock shall be fixed near the inlet of the water meter. The paper disc inserted in the ripples of the meter shall be removed. And the meter is installed exactly horizontal or vertical in the flow line in the direction shown by the arrow on the body of the meter. Care shall be taken that the factory seal of the meter is not disturbed. Wherever the meter shall be fixed to a newly fitted pipe line, the pipe line shall have to be completely washed before fitting the meter.

5.6 DISINFECTION OF PIPING SYSTEM AND STORAGE TANKS

Before commissioning the water supply system, the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph.

The water storage tanks and pipes shall first be filled with water thoroughly flushed out. The storage tanks shall be filled with water again and disinfecting chemical containing chlorine shall be added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is used, the proportions will be 150gms of powder to 1000 liters of water. The powder shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be specified by the makers. When the storage tank is full, the supply shall be stopped and all the taps on the distributing pipes are opened successively. Each tap shall be closed when the water discharged begins to smell chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flushed out before any water is used for domestic purposes.

5.7 TESTING

All water supply system shall be tested to hydrostatic pressure test of at-least two and half time the maximum pressure but not less than 7kg/sq.cm. for a period of not less than 24hours. All leaks and defects in joints revealed during the testing shall be rectified and got approved at site.

Piping required subsequent to the above pressure test shall be resettled in the same manner.

System may be tested in sections and such sections shall be entirely resettled on completion.

5.8 SHIFTING OF EXCAVATED SURPLUS MATERIAL

Contractor shall make his own arrangement to shift the surplus excavated material within the site limits as directed by Engineer-in-charge.

5.9 PROTECTION AGAINST CORROSION

All embedded piping material and accessories shall be suitably protected against corrosion. All embedded GI pipes shall be wrapped throughout with

1mm thick fiberglass RP tissue laid in bitumen with overlaps in joints and final coat of bitumen paint. Where GI pipes are laid under floors, trenches etc shall be encased with 100mm thick fine sand all-round in additions to the protective coating as stated above.

5.10 LAWN HYDRANT

Lawn hydrants shall be of 25mm size unless otherwise indicated. All hydrants shall be provided with ball valves and nipple to receive hose pipes. Lawn hydrant valves shall be of approved make and design. Where called for lawn hydrants shall be located in masonry chambers of appropriate size.

5.11 MEASUREMENT

All pipes above ground shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. coupling, tees, bends, elbows, unions, flanges and U clamps with nuts, bolts & washers fixed to tall or other standard supports.

Jointing as per procedure specified above.

Cutting holes, and chases in walls, floors, any pipe support required for pipes below ground & making good the same.

gg) PIPING AND FITTING MATERIAL 6.1 PIPING

SCHEDULE

hh) Notes on Pipe work

All PVC pipes where installed in direct contact with concrete shall be wrapped with polythene tape/fibreglass tissue for protection.

All fittings for pipe work shall conform to the relevant IS Specification.

Where purpose mode fittings are required, they shall also be generally in accordance with the relevant IS Standard.

All pipe work shall be free from burst, rust and scale and shall be thoroughly cleaned before erection. Open ends during the progress of work shall be blanked-off with purpose-made metal or plastic caps and the use of wooden plugs is forbidden. Should any stoppage in the circulation occur after the various systems have been put into operation, owing to non-compliance with this requirement, the Contractor shall rectify the matter at no extra cost to the Contract.

Pipes shall be installed with correct falls for venting and draining and attention shall be paid to neatness of installation, i.e. groups of pipes shall be accurately spaced and valves, joints, etc., symmetrically arranged. Where two or more pipes are visible and change direction together bends shall be struck from a common radius point. Adequate clearances shall be maintained in all cases, to allow for the application of the insulation materials and finishing.

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The Contractor shall note the restricted space available in certain service ducts and the absolute necessary to ensure that all pipe work is installed in the correct sequence, manner and position to ensure that operation of all valves and maintenance is possible.

All reductions in pipe sizes shall be made using approved standard reducing fittings. Reducing bushes shall not be used without approval. Connections between lengths of pipes shall be made using standard fittings. Long threads must not be used.

All pipe work in pump rooms, plant rooms, and on roof level shall be installed with flanges or unions at intervals not exceeding 6m for ease of dismantling.

Changes in direction of pipes shall be made with long radius bends or elbows, as far as practicable. Under no circumstances shall pipes be bent without the use of fittings.

All pipe runs when not installed underground or in duct shall be concealed as far as possible by careful positioning or shall be chased into walls, laid in screed etc, or as directed by the Architect/Consultant.

All pipe work within the fire protected areas must be enclosed to satisfy the local municipal/fire authority requirements and such enclosures shall be supplied and installed by the Contractor.

Where pipes and rainwater outlets pass through roof slabs, the Contractor shall leave suitable openings during casting. The Contractor shall install the pipe, rainwater outlets, etc., taking into account the water proofing installation method as detailed by the Engineer.

Floor drains shall be installed in the same manner as rain water outlets. Openings will be formed in the slabs. Detailed dimensions and locations shall be supplied by the Engineer.

The Contractor shall locate all valves, traps, cleaning eyes, and similar items where they are easily accessible for operation, inspection, and maintenance.

ii) Water Supply System

S. No.	Description	Type of Material
1.	Potable water tank drains, overflows and warning pipes up to and including 65mm diameter.	CPVC/ PPR.
2.	Incoming potable water pipe from Municipal authority.	CPVC/Galvanized Iron medium class
3.	External Potable cold water main distribution pipe	CPVC/ PPR
4.	Potable cold water branch pipe	CPVC/ PPR

jj) Soil/Waste and Rain Water System

S. No.	Description	Type of Material
1.	Rain water pipe above ground 50mm and above	Cast Iron Pipe to IS 3989 / UPVC SWR SYSTEM.
2.	Rain water pipe below ground 80mm and above.	RCC pipes NP2 class
3.	Waste water pipe above ground 50mm and above	Cast Iron Pipe to IS 3989/PVC SWR SYSTEM/UPVC Pipes.
4.	Waste water pipe below ground 50mm and above	Stoneware Pipes / UPVC Pipes/RCC Pipes NP2 class

6.2 PIPING SPECIFICATIONS**6.2.1 Galvanized Iron Pipes**

The pipes shall be galvanized mild steel welded (ERW) or (HFW) screwed and socketed conforming to the requirements of IS: 1239. The Galvanizing shall conform to IS: 4736. The Zinc coating shall be uniform, adherent, reasonably smooth and free from imperfections such as flux, ash and drops inclusions, bare patches, black spots, pimples, lumpiness, 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 pipe.

The fittings shall be malleable cast iron as per IS: 1879 and comply with all the requirements that of pipes. The sizes of pipes and fittings are specified in the schedule of quantities.

6.2.2 UPVC PIPES

UPVC Pipes and fittings shall be heavy class manufactured to Indian Standard IS: 4985(Specification for UPVC pipes & fittings). The Pipes shall be of desired working pressure as specified in the Schedule of Quantities. On delivery to site, the pipes and fittings shall be inspected for thickness, cracks etc. The pipes shall be stored in a sheltered roof as protection against direct sunlight.

6.2.3 CPVC Pipes

Chlorinate Polyvinyl Chloride (CPVC) Pipes and fittings shall be heavy class manufactured to international Standard with the CPVC compound shall conform to (NSF) certification for use in drinking /portable water. Pipes shall be of desired working pressure as specified in the Schedule of Quantities. On delivery to site, the

pipes and fittings shall be inspected for thickness, cracks etc. The pipes shall be stored in a sheltered roof as protection against direct sunlight.

6.2.4 Copper Pipes

Copper pipes shall be of 99.9 percent copper. Pipes shall be either hard or soft or temper drawn straight lengths. The pipes shall be rigid enough to hold its shape without support and yet is flexible enough to permit flaring and bending by hand bending machine. Pipes in nominal sizes from 15 to 54mm (inclusive) shall be connected with capillary fittings with integral tin-copper or silver solid ring to B.S. 864:1972 Part 2.

Pipes in nominal sizes from 67mm to 219mm (inclusive) shall be connected with gunmetal silver brazing fittings by welding to the relevant welding code B.S. 1723:1963 (brazing). All brazing fittings shall be cast in one piece. Local welded lobster fittings shall not be accepted. All welders shall be fully qualified. Welding rods shall be of not less than 50% silver content and suitable for the piping materials and atmospheric conditions to B.S. 1845:1977.

6.2.5 CAST IRON PIPES & FITTINGS

Soil, Waste, Vent, Anti-Siphonage and Rainwater Pipes shall be cast Iron Pipes. All pipes shall be straight and smooth and inside free from irregular bore, blow holes, cracks and other manufacturing defects. Pipes shall be either of sand cast to IS: 1729 or centrifugal cast to IS: 3989.

6.2.6 PPR PIPES

Polypropylene Random (PPR) pipes and fittings shall be heavy class as per DIN 8077 and fittings as per DIN: 16962. The Pipes shall be of desired working pressure as specified in the Schedule of Quantities. On delivery to site, the pipes and fittings shall be inspected for thickness, cracks etc. The pipes shall be stored in a sheltered roof as protection against direct sunlight.

6.2.7 Composite Pipes.

Composite pipes consists of aluminium and polyethylene composite pipes is combination of two materials i.e, aluminium core tube bonded by adhesive to the interior and exterior tube layers of polyethylene. The pipes and fittings as manufactured as per internal standards and meet the requirements of BS: 7291, the specifications for thermoplastic pipes and associated fittings for hot and cold water for domestic purposes.

The pipes are available in coils and easily formed into curves set by hand and only requires bending spring when forming light bends down to radius equivalent to 5 times the diameter of pipe. Inside & outside layers comprise High Density

6.2.8 STAINLESS STEEL PIPES

The stainless steel pipes shall conform to the following standards and codes.

ASTM – A 312 Seamless and Welded Austenitic Stainless Steel Pipes

ASTM – A530 Testing of Welded Austenitic Stainless Steel Pipes

The stainless steel pipes shall be seamless or welded annealed tubing with plain ends conforming to ASTM 312 – TP 304/316 as indicated in the bill of materials. The pipes shall be internally electro polished with 300 grade finish.

The fittings shall be butt /socket welded conforming to ASTM A – 182.

The pipes thickness shall be as per Schedule 10 for pipes upto 50 mm dia and schedules for pipes above 50 mm dia.

6.2.9 Fittings

Fittings shall conform to the same Indian Standard as for pipes. Contractor shall use pipes and fittings of matching specifications.

Fittings shall be of the required degree of curvature with or without access door.

Access door shall be made up with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal. Fixing shall be air and water tight.

6.2.10 PVC SWR SYSTEM

PVC SWR systems for soil, waste & rain water shall be of manufactured to Indian Standard 13592. The pipes and fittings shall be of the rubber ring joints type with in-built groove for insertion of rubber seal lubricant. The rubber ring shall conform to IS: 5382. The Pipes shall be of desired working pressure as specified in the Schedule of Quantities. On delivery to site, the pipes and fittings shall be inspected for thickness, cracks etc. The pipes shall be stored in a sheltered roof as protection against direct sunlight.

6.3 PRESSURE RATING

The pressure rating of all pipes from cistern water tanks to the elevated water tanks shall be PN12.5. For all other pipe works, pressure rating shall be PN10 unless otherwise specified.

The pressure rating of valves and fittings shall be not less than that of the pipe work.

6.4 EXECUTION

The execution of works and materials used shall be as per the latest relevant I.S. specification. Whether reference has been made to Indian Standard or any other specifications, the same shall mean to refer to the latest specification irrespective of any particular edition of such specification being mentioned in the specifications below or Schedule of Quantities.

All pipes shall be anchored as required to control the movement of pipes due to thermal changes. Generally anchors shall also be fitted at the lower end of vertical pipes. Details of all anchor points shall be submitted to the Engineer for approval.

The anchors shall securely hold the pipe in a rigid position to resist the attempted movement due to expansion and the weight of pipe and contents.

The Contractor shall submit full details to the Engineer of all expansion and anchor joints proposed for use throughout the building prior to installation.

General

In all pipe system, long radius bends and pitcher tees shall be used wherever possible and practicable. All fittings shall be suitable for a working and test pressure not lower than that specified for the pipe work system concerned elsewhere in this Specification.

Reduction in bore of pipe shall be generally made eccentric for horizontal pipes (to prevent air locking) and concentric taper fittings shall be fitted for vertical pipes unless specifically required to achieve the required space and invert levels.

The workmanship shall be best of its kind and shall conform to the specifications, as below or Indian Standard Specifications in every respect or latest trade practices and shall be subject to approval of the Architects/Consultants. All materials and/or Workmanship which in the opinion of the Engineer is defective or unsuitable shall be removed immediately from the site and shall be substituted with proper materials and/or workmanship forthwith.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps at interval specified.

Clamps, hangers and supports on RCC walls, columns & slabs shall be fixed only by means of approved made of expandable metal fasteners inserted by use of power drills.

All pipes clamps, supports, nuts, bolts, washers shall be galvanized MS steel throughout the building. Painted MS clamps & nuts, bolts & washers shall not be accepted.

Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

Tender drawings indicated schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed working drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolation and control valves, drain and air valves, and all pipe supports. He must keep in view the specific openings in buildings and other structures through which pipes are designed to pass.

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Piping shall be properly supported on, or suspended from, on stands, clamps, hangers as specified and as required. The contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability. All pipes shall be secured at every joint.

- iii) Piping supports shall be steel, adjustable for the height and primer coated with rust prevent paint and finish coated black. Where pipe and clamps are of dissimilar materials, spacing b/w the supports shall not exceed the following:

Pipe size	Spacing between supports
Up to 12mm	1.5 meters
15mm to 25mm	2.0 meters
30mm to 50mm	2.0 meters
Above 50mm	2.5 meter

Vertical risers shall be parallel to walls and columns lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars attached to pipe and with a 15mm thick rubber pad or any resilient materials. Where pipes pass through the terrace floor, suitable flashing shall be provided to prevent water leakage. Riser shall have a suitable drain out in the valve at the lowest point and air vent at the highest point.

Pipe sleeves, 50mm larger diameter than pipes, shall be provided wherever pipes pass through walls and slabs, and annular space filled with fiberglass and finished with retainer rings.

Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation 14gauge metal sheet shall be provided between the insulation and the clamp, saddle or roller, extending at-least 15cm. on both sides of the clamps saddles or roller.

All pipe work shall be carried out in a workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that area shall be carried out in one stretch.

Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings do not meet with the requirements.

The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.

All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before lying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reduces are to be made in horizontal runs, eccentric reduces shall be used for the piping to drain freely in other locations, concentric reduces may be used.

Xi) Flanged inspection pieces 1.5meters long, with bolted flanges on both ends, shall be provided not more than 30meter centers wherever shown in approved for construction shop drawings to facilitate future cleaning of all welded pipes.

Insulation

Hot water pipe lines in chase shall be insulated by wrapping 6mm thick asbestos rope around the pipe and finished with a coat of magnesia cement containing 85% magnesia.

Fixing Ferrules

For fixing ferrule, the empty main shall be drilled and tapped at 4-5 to the vertical and the ferrule screwed in. The ferrule must be so fitted that no portion of the shank shall be left projecting within the main into which it is fitted.

Cutting Chases in Masonry Walls

The chases up to 7.5x7.5cm shall be made in the walls for housing GI pipes etc. These shall be provided in correct positions as shown in the drawings or directed by the Architects/Consultants. Chases shall be made by chiseling out the masonry to proper line and depth. After GI pipes etc are fixed in chases, the chases shall be filled with cement mortar 1:2:4 or as specified may be made flush with the masonry surface. The concrete surface shall be roughened with wire brush to provide a key for plastering.

Water Fittings

Unless otherwise specified, all gunmetal fittings such as gate, globe, check & safety valves shall be fitted in pipe line in workman like manner. Necessary unions shall be provided on both ends of the valves for easy replacement. The joints between fittings and pipes shall be leak-proof when tested to a pressure. The defective fittings and joints shall be replaced or redone.

6.5 PIPE INSTALLATION

Laying and Jointing of GI Pipes

All pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable. The pipes shall be fixed to walls with standard slotted angles 'U' shape threaded bolts, nuts for clamping pipes to angles. Slotted angles shall be grouted to RCC work with dash fasteners of size so as to fit tightly on the pipes when tightened with screwed bolts. These slotted angles shall be spaced at regular intervals in straight lengths and heights.

The galvanized pipes and fittings shall run in wall chase or ceiling or as specified. The fixing shall be done by means of standard pattern holder bat clamps keeping the pipes about 1.5cm clear of the wall where to be laid on surface. Where it is specified to conceal the pipes, chasing may be adopted or pipes fixed in the shafts, ducts etc. provided there is a sufficient space to work on the pipes with usual tools. As far as possible, pipes may be buried for short distances provided adequate protection is given against damage and where so required special care to be taken at joints. Where directed by the Architects/Consultants, pipe sleeves shall be fixed at a place where the pipe is passing through a wall or floor reception of the pipe and allow freedom for expansion and contraction and other movements. In case of pipe is embedded in walls or floors, it should be painted with anticorrosive bitumastic paints of approved quality. Under the floors, the pipes shall be laid in layer of sand filling.

Galvanized iron pipes shall be jointed with threaded and socket joints, using threaded fittings. Care shall be taken to remove any burr from the end of the pipes after threading. White lead or an equivalent jointing compound of proprietary make shall be used, according to the manufacturer's instructions, with a grummet of a few strands of fine yarn while tightening compounds containing red lead shall not be used because of the danger of contamination of water. Any threads exposed after jointing shall be painted with bituminous paint to prevent corrosion.

Laying and Jointing of UPVC Pipes

UPVC pipes and fittings shall be jointed using solvent cement. It is recommended to use formulated heavy duty solvent cement supplied by the company for trouble free performance of the system.

The jointing procedures are as follows:

Cut the pipe square to the required length by cutter.

Chamfer the cutting edges.

Insert the pipe into the fitting and check to that the interface occur about 1/3rd to 2/3rd of the socket depth.

Remove any dirt, moisture or grease from pipe end and fitting sockets with clean dry rag.

Roughen the contacting surfaces.

Application of solvent cement – Apply cement lightly but uniformly to inside of socket and outside of pipe end with suitable applicator.

Immediately after applying the last coat of cement to the pipe and while the cement is still fluid or wet, forcefully bottom the male end of the pipe in the socket, giving pipe or fitting ¼ turn (but not after pipe is bottomed) to distribute the cement evenly. Remove excess cement from the end of the fitting socket. The joint must not be disturbed immediately after cementing so that the joint can be properly cured.

Laying and Jointing of CPVC Pipes

CPVC pipes and fittings shall be jointed using solvent cement. It is recommended to use formulated heavy duty solvent cement supplied by the company for trouble free performance of the system.

The jointing procedures are as follows:

Cut the pipe square to the required length by cutter.

Chamfer the cutting edges.

Insert the pipe into the fitting to check that the interface occur about $1/3^{\text{rd}}$ to $2/3^{\text{rd}}$ of the socket depth.

Remove any dirt, moisture or grease from pipe end and fitting sockets with clean dry rag.

Roughen the contacting surfaces.

Application of solvent cement. – It is recommended that to use Only CPVC cement or all-purpose cement conforming to ASTM F-493 for pipe jointing. Apply cement lightly but uniformly to inside of socket and outside of pipe end with suitable applicator.

Immediately insert the tubing into fitting socket, rotating the tubing $1/4''$ to $1/2''$ turn while inserting. This motion ensures an even distribution of cement within the joint. Properly align the fitting. Hold the assembly for approximately 10 seconds, allowing the joint to set-up. An even bead of cement should be evident around the joint. Wipe excess cement from the tubing and fitting surfaces.

Laying and jointing of Copper Pipes

Pipes in nominal sizes from 15 to 54mm (inclusive) shall be connected with capillary fittings with integral tin-copper or silver solid ring to B.S. 864:1972 Part 2.

After the tubing is cleaned, the ring is slipped into the fittings and heat is applied to the fittings by high-temperature gas flame. When a sufficient temperature is reached, the solder melts and a bead appears at the edge of the fittings around the entire circumference. As this type of fittings is usually of considerable thickness, it requires a hot flame to melt with the solder. The contractor should maintain every care in order to avoid damage to other fittings or valves that may be near the fittings being heated.

Pipes in nominal sizes from 67mm to 219mm (inclusive) shall be connected with gunmetal silver brazing fittings by welding to the relevant welding code B.S. 1723:1963 (brazing). All brazing fittings shall be cast in one piece. Local welded lobster fittings shall not be accepted. All welders shall be fully qualified. Welding rods shall be of not less than 50% silver content and suitable for the piping materials and atmospheric conditions to B.S. 1845:1977.

Pipes shall be supported by cast brass pipe brackets or hangers of approved pattern.

End or end butt-welded joints shall not be permitted.

Vertical pipes shall be fixed with copper or copper alloy holder bats or pipe brackets of approved pattern.

Horizontal pipes shall be fixed with heavy duty copper or copper alloy pipe brackets or hangers of approved pattern.

Pipe Cleaning

Upon completion of the domestic water system, disinfect this system, including water service connections, with chlorine in accordance with local practice.

The water storage tanks and pipes shall first be filled with water thoroughly flushed out. The storage tanks shall be filled with water again and disinfecting chemical containing chlorine shall be added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give water a dose of 50parts of chlorine to one million parts of water. If ordinary bleaching powder is used, the proportions will be 150gms of powder to 1000liters of water. The powder shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be specified by the makers. When the storage tank is full, the supply shall be stopped and all the taps on the distributing pipes are opened successively. Each tap shall be closed when the water discharged begins to smell chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flushed out before any water is used for domestic purposes.

All valves, after they have been disinfected, shall be opened and closed several times during the eight-hour period. Disinfection shall be repeated until piping meets the local bacteriological test criteria.

All other piping systems shall be flushed free of foreign matter with clean water and left with strainers clean upon completion of the work.

6.6 HANGERS, SUPPORTS, ANCHORS AND GUIDES

Provide hangers of heavy construction suitable for the size of pipe to be supported. All materials to be of hot dipped galvanized steel (touch up all cut ends with galvanized paint) except rollers which are to be of wrought or malleable iron. Hangers for pipes up to and including 125mm to be adjustable swivel ring, split ring, wrought pipe clamp, or adjustable wrought clevis type.

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Support vertical piping with double bolt riser clamps attached to the pipe, resting on pre-engineered spring hanged attached to the floor slab. Use one clamp at every floor. Where pipes are in open shafts, provide forged steel bar brackets fixed to wall.

The following tables will establish a minimum level of acceptance for pipe hangers, supports and attachments.

kk) Hangers and Supports

Service	Hanger Type	Maximum Pipe Size
Un-insulated PVC	Clevis	300mm
Un-insulated Copper	Clevis	300mm
Copper Pipe	Riser Clamp	150mm
All Insulated	Full Clamp & Insulation Shield	600mm
All	Trapeze	600mm
All	Wall Bracket	125mm
All	Wall Bracket	300mm

ll) Structure Attachments

Type	Maximum Rod Size	Maximum Pipe Size
Beam Clamp	20mm	200mm
Beam Clamp	40mm	600mm
Side Mount Clamp	20mm	200mm
Channel Clamp	20mm	200mm
Expansion Shield	20mm	200mm

mm) Job or site fabricated products will not be allowed.

Execution

Pipe Size	Rod Size
25mm and smaller	10mm
32mm to 50mm	10mm
65mm to 80mm	15mm
100mm to	15mm

125mm	
150mm	20mm
200mm to 300mm	25mm
350mm to 400mm	25mm
450mm	30mm
500mm	35mm
600mm	40mm

nn) Provide hanger rod sizes in accordance with the following schedule:

B. Provide hangers in accordance with the following schedule:

Hanger Spacing Schedule		
Piping Material	Pipe Size	Maximum Hanger Spacing
Copper	35mm & less	1800mm
Copper	42mm & larger	3000mm
UPVC	50mm & larger	1350mm
GI	50mm & less	2000mm
GI	65mm & larger	2500mm

Provide hangers at each change in direction on both sides of each valve and on both sides of cast iron pipe fittings.

For flat slab construction only, support hangers from concrete inserts. Furnish, locate and set such inserts and make sure that such inserts are in place when the concrete is poured. Construct inserts of malleable iron or pressed steel with space for rods of all sizes. Install all inserts for pipes 80mm and larger in size with a reinforcing rod 15mm in diameter run through a slot in the insert specifically provided for this purpose.

For flat slab construction only, if any pipe is to be hung in a space where no inserts have been provided, drill holes in the slab (subject to the Engineer prior approval) and provide rods and hanger attached to an approved fishplate or install double expansion shields connected by a 50mm x 50mm angle, from which the hanger rod is to be suspended. For pipe size 50mm and under, use single shields but the hanger spacing defined herein before to be reduced to 1.5m. The carrying capacity and size of each shield to be calculated on the basis of the spacing indicated above but the minimum size to be 10mm. Install additional shields of the same size so that the number of hangers are of adequate size to support the loads which they carry. Shields may be used in flat concrete slabs only.

Regardless of the type of construction (i.e., concrete, concrete-deck-steel or other variations) take particular care to support all main lines and all large and heavy pipes in an approved manner, including the furnishing and installation of supplementary steel, if required. Supplementary steel sections are to be mill-rolled. Submit shop drawings, indicating support methods, point loadings to the building structure and hanger locations for review sufficiently in advance of concrete pouring schedules to permit evaluation, critique and any necessary changes to handling and support methods.

Set all inserts for all pipes in ample time to allow concrete work to be performed on scheduled time.

Hangers may be directly attached to steel beams of building construction, where they occur, if approved by Engineer. Smaller pipes may be suspended from crosspieces of pipe or steel angles, which in turn, are to be securely fastened to building beams. The intention is to provide supports which, in each case, will be amply strong and rigid for the load, but which will not weaken or unduly stress the building construction.

Provide approved roller support, floor stands, wall brackets, etc., for all lines running near the floor or near walls, which can be properly supported or suspended by the floors or walls. Pipelines near walls may also be hung by hangers carried from approved wall brackets at a level higher than the pipe.

Do not hang piping from other piping. Support of hangers by means of vertical expansion bolts is not permitted.

Anchor piping as required to localize expansion or to prevent undue strain on piping and branches. Anchors to be entirely separate from hangers. All anchor designs to be submitted flex bellows flanged or screw type for approval and to include piping reactions which respective anchors are capable of supporting. Provide all indicated or required expansion loops.

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Support all lines of copper tubing individually by approved type hangers not more than 2m apart, or as shown on the drawings. Use hangers especially designed for copper tubing and of exact outside diameter of tubing. On hangers for covered tubing, use broad straps fitting outside of covering.

Hangers used for cold piping will support the pipe without piercing the insulation. Use insulation shields to protect the insulation on cold pipes. Weld insulation protection saddles to insulated hot pipes, or any piping subject to axial movement, at roller supports. Space between pipe and saddle to be filled with insulation.

For piping 100mm and larger, support the elbows of the piping adjacent to the pumps with steel base elbow supports from the inertia base which pump is on to prevent loading heavy weights of piping on pump casing. Where inertia base is not provided, base elbows to be supported on floor with 25mm neoprene pad.

All pipes supports shall be of such design and type to allow for the removal of any pipe section without the necessity of disconnecting other adjacent pipes.

In all plant and pump rooms discharge pipe work from pumps, and all pipe work where vibration could be transmitted to the building structure, shall be supported with brackets having a tough rubber lining in contact between the bracket and the pipe shall have anti-vibration hangers/supports.

Special attention shall be paid to that adequate pipe anchors shall be provided at the ends or turning points of UPVC/PPR pipes to prevent fracture of the pipe resulted from water hammer. Such anchor points shall be fixed in a manner that the inertia in the flow will be directly transmitted onto the anchors thus releasing the UPVC/PPR pipes from being under stress.

Where pipes pass through walls, floors, etc., the Contractor shall provide pipe sleeves. Sleeves for UPVC/PPR pipes & copper pipes shall be galvanized steel. For pipes, where sleeves are fitted through floors/wall they shall extend to at least 20mm clear stud out from the finished floor level.

The space between pipe sleeves and the pipe or insulation shall be completely backfilled with materials having the same fire resistant rating as the walls and floors by the Contractor. Should multi-services or more than one single pipe be laid through box-out, the space between the individual pipe sleeves shall be sealed off. The space between the pipe sleeves and the service pipes shall be back-filled.

Sleeves shall be of sufficient size to allow free movement of pipes and furthermore where pipes are insulated the sleeves shall be oversized to allow the insulation to be carried through the sleeves. The Contractor's attention is drawn to the vertical pipe ducts at all floor levels. Where pipes pass through floors, sleeves shall be provided. The Contractor shall supply sleeves for setting in walls, floors, etc., and in the shuttering before concrete is poured.

Details of pipes through walls and floors shall be approval by the Engineer before installation.

Where pipes pass through flat roofs covered with roofing material: -

- oo) Cast or build in galvanized mild steel sleeve with 2 to 12mm clearance projecting 150mm above roof finish.

- pp) Caulk space and point both ends with approved sealant.
- qq) Cover tops of sleeves with lead collars as per roofing Specification.

6.7 VALVES

General

The Contractor shall supply and install all valves as indicated on the drawings and as required for the proper and efficient operation and maintenance of the entire systems.

All valves supplied shall be suitable for the working pressure and test pressure of the various water supply systems.

All valves other than automatic control valves shall be full line size.

Each valve shall have a purpose made reference number plate or label engraved or stamped indicating the manufacturer's catalogue number, pressure and temperature ratings. Valves shall be arranged so that clockwise rotation of the spindle will close the valve. Demo labels are not acceptable.

Furnish all valves and accessory material necessary in the piping whether or not shown on drawings as follows.

All valves shall be packed with an approved packing and threads shall be coated with oil and graphite. Packing should be replaced when found deteriorated on site.

Where possible locate all valves at convenient positions of operation from the floor with valve stems upright.

Valves that are flanged shall have flanges comply with BS 4504 as for pipe work.

Provide valves of the same manufacturer throughout, where possible.

All valves shall be with screwed or flanged ends as required by the piping system in which they are installed.

Valves shall be selected for the working pressure required.

Plastic or metal plates (rust-less) shall be provided to indicate the open/close status as well as the use of each valve in the pump and tank rooms, and in the town main.

Valves & Controls - Specifications

All valves (gate, globe, ball, check, and safety) shall be of gun metal non rising spindle valves suitable for the particular service as called for. All valves shall be of the particular duty and design as called for. Valves shall either be of screwed type or flanged type, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valves. Gate, globe and check valves shall conform to Indian Standard IS:778 and non-return valves to swing check type reflux to IS:5312.

Sluice valves, where called for shall be flanged sluice valves of cast iron body. The spindle, wall seat and wedge nuts shall be gunmetal. They shall generally

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have non-rising spindle and shall be of the particular duty and design called for. The valves shall be supplied with suitable flanges, non-corrosive bolts and asbestos fiber gasket. Sluice valve shall conform to Indian standard IS:780 and IS:2906.

Ball valves with floats to be fixed in storage tanks shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the position and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system. Where called for brass valves shall be supplied with brass hexagonal back-nuts to secure them to the tanks and a socket to connect to supply pipe.

	Type of Valve	Size	Contraction	Ends
a)	G.M valve	15mm to 50mm 50mm and above	Gun metal Gun metal	Screwed Flanged
b)	Sluice valve & butterfly valve	65mm and above	Cast iron/ iron	Flanged
c)	G.M Non return valve	15mm to 50mm 50mm and above	Gun metal Gun metal	Flanged Flanged
d)	Flap type Non return above	65mm and above	Cast iron	Flanged

Execution

All valves shall be installed only in the upright vertical or horizontal positions unless specifically otherwise required by the drawings.

All valves shall be installed in accessible locations to facilitate easy removal for repair or replacement.

Install with operating clearance for handle and stem.

Install isolation valves on equipment so that valve and piping do not interfere with equipment removal or maintenance. Install unions or flanges on equipment side of valves.

Provide 25mm drain valves with threaded ends for hose connections at drain points, at main shutoff valves, low points of piping systems, bases of vertical risers, and at equipment.

Provide required manual or automatic vent valves at high points of piping systems to facilitate venting of air and to ensure quiet operation.

Provide renewable bronze seat rings and bronze spindles for cast iron body valves.

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Provide chain operated sheaves and chains for all valves which are more than 2.5m above the floor in Mechanical Equipment Rooms.

Furnish and install other valves, check valves, cocks, etc., as required for the complete and proper valving of the entire installation.

Install butterfly valves in horizontal piping with stem in the horizontal position so that bottom of disk lifts in the direction of flow.

Install butterfly valves in vertical piping at pumps with stem perpendicular to pump shaft.

6.8. STRAINERS

Strainers shall be installed in all pump suctions and tanks.

Strainer under 65mmdia shall be pipeline Y-type strainer. Strainer of 65mm or above shall be of vertical (bucket) type, cast iron body with flanged connectors.

Strainer mesh shall be stainless steel 316 with filtering area of at least three times the sectional area of the pipe inlet.

6.9. FLEXIBLE CONNECTOR

Flexible connectors shall be of synthetic fiber reinforced rubber, twin sphere type for flush water and 316 stainless steel bellow type for type fresh water system. Details shall be submitted to the Architect at the time of tender.

Pressure rating of the flexible connectors shall be the same as the system pipe work unless otherwise noted on drawings.

Flexible connectors shall be installed at where shown on drawings and at all pump suctions and discharges. The materials of the flexible connectors shall be suitable for the substances to be conveyed.

7.0 EXTERNAL DRAINAGE (SOIL, WASTE & RAINWATER)

7.1 SCOPE OF WORK

Work under this section shall consist of furnishing all labor, materials, equipments and appliances necessary and required to completely install the drainage system as required by the drawings and specified hereinafter or given in the schedule of quantities.

Without restricting to the generality of the foregoing, the drainage system shall include:-

Sewer Lines including excavations, pipe lines, manholes, drop connection and connections to the municipal or existing sewer, underground storm water drains, including pipes, manholes, catch basins and drop connections.

7.2 GENERAL REQUIREMENTS

All materials shall be new of the best quality conforming to specifications and subject to the approval of Consultants.

Drainage lines shall be laid to the required gradients and profiles.

All drainage work shall be done in accordance with the local municipal bye-laws.

Contractor shall obtain necessary approval and permission for the drainage system from the Municipal or any other competent authority.

Location of all manholes, catch basins etc. shall be got confirmed by the Architect/Consultants before the actual execution of work at site.

All works shall be executed as directed by Consultants.

All pipe lines shall be subjected to testing as per specification.

7.3 ALIGNMENT AND GRADE

The Sewer and Storm water drainage pipes shall be laid to alignment and gradient shown on the drawings but subject to such modifications as shall be ordered by Architect/Consultants from time to time to meet the requirements of the works. No deviations from the lines, depths of cutting or gradients of sewers shown on the plans and sections shall be permitted except by the express direction in writing of Architect/Consultants.

7.4 EXCAVATION

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

7.5 OPENING OUT TRENCHES

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

The contractor shall grub up the clear the surface over the trenches and other excavations of all trees, stump roots and all other encumbrances affecting

executing of the work and shall remove them from the site to the approval of Architect/Consultants.

7.6 REMOVAL OF FILTH

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

7.7 EXCAVATION TO BE TAKEN TO PROPER DEPTHS

The Trenches shall be excavated to such a depth that the sewer shall rest on concrete as described in the several clauses relating there to and so that the inverts may be at the levels given in the sections. In bad ground, the Architect/Consultants may order the contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of the sewers with concrete, broken stone, gravel or other materials. For such extra excavation and concrete, Broken Stone, Gravel or other materials, the contractor shall be paid extra at rates laid down for such works in the schedule. If the extra work was operated by the Architect/Consultants in writing, but if the contractor should excavate the trench to a greater depth than is required without a specific order to that effect in writing of the Architect/Consultants the extra depth shall have to be filled up with concrete at the contractor's own costs and charges to the requirements and satisfactions of the Architect/Consultants.

7.8 REFILLING

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

7.9 CONTRACTOR TO RESTORE SETTLEMENT AND DAMAGES

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

7.10 DISPOSAL OF SURPLUS SOIL

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

7.11 TIMBERING OF SEWER AND TRENCHES

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

7.12 REMOVAL OF WATER FROM SEWER, TRENCH ETC.

- uu) The contractor shall at all times during the progress of the work keep the trenches and excavations free from water which shall be disposed of by him in a manner as will neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surface of any roads or streets, nor cause any interference with the use of the same by the public.
- vv) If any excavation is carried out at any point or points to a greater width than the specified cross section of the sewer with its envelope, the full width of the trench shall be filled with concrete by the contractor at his own expenses and charges to the requirements of the Architect/Consultants.

7.13 WIDTH OF TRENCH

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

Recommended width of trenches at the bottom of the trench are as follows:-

100 mm dia Pipe	55 cms
150 mm dia Pipe	55 cms
225-250 mm dia Pipe	60 cms
300 mm dia Pipe	75 cms

Maximum width of the bed concrete shall also be as above. No additional payment is admissible for widths greater than specified.

7.14 SALT GLAZED STONEWARE PIPES

Stoneware pipes shall be of first class quality salt glazed and free from rough texture inside and outside and straight. All pipes shall have the manufacturer's name marked on it and shall comply to I.S. 651 of makes approved by the Architect/Consultants

7.15 LAYING AND JOINTING OF SALT GLAZED STONEWARE PIPES

Pipes are liable to be damaged in transit and notwithstanding tests that may have been made before dispatch each pipe shall be examined carefully on arrival at site. Each pipe shall be rung with a wooden hammer or mallet and those that do not ring true and clear shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes should be segregated, marked in a conspicuous manner and their use in the works prevented.

The pipes shall be laid with sockets leading uphill and should rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the pipe jointer room to work right round the pipe and as short as practicable to admit the socket and allow the joint to be made.

Where pipes are not bedded on concrete the trench bottom shall be left slightly high and carefully bottomed up as pipe laying proceeds so that the pipe barrels rest on firm bound. If excavation has been carried too low it shall be made up with cement concrete at the contractor's cost and charges.

If the bottom of the trench consists of Rock or very hard ground that cannot be easily excavated to a smooth surface, the pipes shall be laid on cement concrete bed to ensure even bearing.

Jointing of Pipes

Tarred gaskin shall first be wrapped round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid, the pipe shall then be adjusted and fixed in its correct position and the gaskin caulked tightly home so as to fill not more than one quarter of the total length of the socket.

The remainder of the socket shall be filled with stiff mix of cement mortar (1 cement : 1 clear sharp washed sand). When the socket is filled, a fillet should be formed round the joint with a trowel forming an angle of 45 degrees with the barrel of the pipe the mortar shall be mixed for immediate use and no mortar shall be used after it has begun to set.

After the joint has been made any extraneous materials shall be removed from inside of the joint with a suitable scraper of "Badger". The newly made joints shall be protected until set from the sun, drying winds, rain or dust. Sacking or other materials which can be kept damp shall be used. The joints shall be exposed and space left all round the pipes for inspection by the Architect/Consultants. The inside of the sewer must be left absolutely clear in bore and free from cement mortar or other obstructions throughout its entire length, and shall efficiently drain and discharge.

Testing

All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 1.5meter head of water. The test pressure shall, however, not exceed a meter head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

Sewer Lines shall be tested for a straightness by:

- ww) Inserting a smooth ball 12mm less than the internal diameter of the pipe. In the absence of obstructions such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end.
- xx) Means of a mirror at one and a lamp at the other end. If the pipe line is straight the full circle of light will be seen otherwise obstruction of deviation will be apparent.

The contractor shall give a smoke test to the drains and sewer at his own expense and charges, if directed by the Architect/Consultants.

A test register shall be maintained which shall be signed and dated by contractor, and representative of Architect/Consultants.

7.16 GULLY TRAPS

The gully traps shall be of the first quality and free from rough texture.

Gully traps shall be fixed in cement concrete 1:5:10mix and a brick masonry chamber 30x30cms inside in cement mortar 1:5 with 15x15cms grating inside and 30x30cms C.I. sealed cover and frame weighing not less than 7.3kg to be constructed as per standard drawing. Where necessary, sealed cover shall be replaced with C.I. grating of the same size (1 cement :5 coarse sand :10 stone aggregate 40mm nominal size).

7.17 REINFORCED CEMENT CONCRETE PIPES

All underground storm water drainage pipes and sewer lines where specified (other than those specified cast iron shall be centrifugally spun RCC pipes of specified class. Pipes shall be straight with uniform bore, throughout. Cracked, warped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the contractor shall produce, when directed a certificate is that effect from the manufacturer.

Laying

R.C.C. Spun Pipes shall be laid on cement concrete bed or cradles as specified and shown on the detailed drawings. The cradles may be pre-cast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12mm below the invert level of the pipe properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and boning rods etc. cradles or concrete bed by be omitted, if directed by the Architects/Consultants.

Jointing

After setting out the pipes the collar shall be centered over the joint and filled in with tarred gaskin, so that sufficient space is left on either side of the collar to receive the mortar. The space shall then be filled with cement mortar 1:2 (1cement: 2fine sand) and caulked by means of proper tools. All joints shall be finished at an angle of 45degrees to the longitudinal axis of the pipe on both sides of the collars neatly.

Testing

All pipes shall be tested to a hydraulic test of 1.5M head for at least 30minutes at the highest point in the section under test. Test shall also be carried out similar to those for stoneware pipes given above. The smoke test shall be carried out by the contractor, if directed by the Architect/Consultants, at the expense and charges of the contractor. A test register shall be maintained which shall be signed and dated by contractor, and representative of Architect/Consultants.

7.18 CAST IRON PIPES FOR DRAINAGE

All drainage lines passing under Building, floors and roads with heavy traffic, in exposed position above ground E.G. service floor and basement ceiling shall be cast iron pipes. Position of such pipes shall generally be shown on the drawings.

Cast Iron pipes shall be centrifugally spun iron pipes conforming to I.S. 1536-1967. Quality certificates shall be furnished.

Fittings and Inspection Chambers

Fittings used for C.I. Drainage pipe shall conform to I.S :1538-1967. Wherever possible junction from branch pipes shall be made by a Y Tee.

Contractor shall provide as indicated on drawings or directed by Architect/Consultants cast Iron inspection chamber at all Junction. Inspection chambers shall be specially cast with inlet, outlet and branches of appropriate and required sizes. Branches shall be Y type wherever possible.

Cleanout plugs shall be provided on head of each drain and at location indicated on plans or directed by Architect/Consultants. Cleanout plugs shall be of size matching the full bore of the pipe. Plugs shall be made out with G.I coupling caulked into the socket of the pipe or fittings. The end shall be provided with a brass screwed plug with suitable key for opening.

Laying

All Cast Iron Pipes and fittings shall be jointed with best quality soft pig lead which shall be free from impurities. In wet trenches joints shall be made from lead wool. Nothing extra will be paid for lead wool joints. Depth of pig lead and weight for joints shall be as given in the sub section "B" of Section II.

The Spigot of pipe or fittings shall be centered in the adjoining socket by caulking. Sufficient turns of tarred gaskin will be given to leave unfilled the required depth of socket for depth of 45mm when the gaskin has been caulked tightly home. Joining ring shall be placed round the barrel and against the face of the socket. Molten pig lead shall then be poured to fill the remainder of the socket. This shall then be done in one pouring. The lead shall then be solidly caulked with suitable tools and hammers weighing not less than 2 kg.

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

Alternatively, cast iron pipes and fittings shall also be jointed with drip seal joints as per manufacturer's specifications where called for.

Testing

All Cast Iron Pipes for drainage shall be tested to a hydraulic test of 3 meter head. Test for straightens shall be same as for stoneware pipe given above. A test register shall be maintained which shall be signed and dated by contractor, and representative of Architect/Consultants.

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

Materials

Water

Water used for all the construction purposes shall be clear and free from oil, acid, alkali, organic and other harmful matters, which shall deteriorate the strength and/or durability of the structure. In general, the water suitable for drinking purposes shall be considered good enough for construction purpose.

Aggregate for concrete

The aggregate for concrete shall be in accordance with I.S. 383 and I.S. 515. In general, these shall be free from all impurities that may cause corrosion of the reinforcement. Before actual use these shall be washed in water, if required as per the direction of Architect/Consultants. The size of the coarse aggregate shall be done as per I.S. 383.

Sand

Sand for various construction purposes shall comply in all respects with I.S. 650 and I.S. 2116. It shall be clean, coarse hard and strong, sharp, durable, uncoated, free from any mixture of clay, dust, vegetable matters, mica, iron impurities soft or flaky and elongated particles, alkali, organic matters, salt, loam and other impurities which may be considered by the Architect/Consultants as harmful for the construction.

Cement

The cement used for all the constructional purposes shall be ordinary portland cement or rapid hardening portland cement conforming to I.S. 269.

Mild Steel reinforcement

The Mild Steel for the reinforcement bars shall be in the form of round bars confirming to all requirements of I.S. 432 Grade I.

Bricks

Bricks shall have uniform color, thoroughly burnt but not over burnt, shall have plain rectangular faces with parallel sides and sharp right angled edges. They should give ringing sound when struck. Brick shall not absorb more than 20% to 22% of water, when immersed in water for 24 hours. Bricks to be used shall be approved by the Architect/Consultants.

Others Materials

Other materials not fully specified in these specifications and which may be required in the work shall conform to the latest I.S. All such materials shall be approved by the Architect/Consultants.

Cement concrete (Plain or Reinforced)

Cement concrete pipes bedding, cradles, foundations and R.C.C. Slabs for all works shall be mixed by a mechanical mixer where quantities of the concrete poured at one time permit. Hand mixing on properly constructed platforms may be allowed for small quantities by the Architect/Consultants. Rate for cement concrete shall be inclusive of all shuttering and centering at all depth and heights.

Concrete work shall be of such thickness and mix as given in the schedule of quantities.

All concrete work shall be cured for a period of at least 7 days. Such work shall be kept moist by means of gunny bags at all times. All pipes trenches and foundations shall be kept dry during the curing period.

7.20 MASONRY WORK

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

Cement Concrete for pipe Support

Wherever specified or shown on the drawings, all pipes shall be supported in bed all round or in haunches. The thickness and mix of the concrete shall be given in the schedule of quantities. Width of the bedding shall be as per para 4.14.

Unless otherwise directed by the Architect/Consultants cement concrete for bed, all round or in haunches shall be laid as follows :-

	Up to 1.5m Depth	Up to 3m Depth	Beyond 3m Depth
RCC or S.W pipes in open ground (No sub soil water)	all round (1:4:8:)	In Haunches (1:4:8:)	all round (1:4:8)
RCC or S.W. in sub soil water	All Round (1:3:6)	In Haunches (1:3:6)	In Haunches (1:3:6)
C.I. Pipes (In all conditions)	All Round (1:3:6)	In Haunches (1:3:6)	In Haunches (1:3:6)

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RCC Pipes or CI Pipes All round In Haunches In Haunches under of Building (1 cement: 3coars: 6 stone aggregate 40mm nominal size)

R.C.C Pipe or C.I. Pipes may be supported on brick masonry or pre-cast R.C.C. or in situ cables. Cradles shall be as shown on the drawings.

Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

7.21 MANHOLES AND CHAMBERS

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

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

Size of Manhole	900x800 Rect.	20x90 Rect.	90dia Conical	140dia Conical
Maximum Depth	200	200	250	250
Average Thickness of R.C.C Slab	15	15	-	-
Size of cover and frame	90x45	50dia	50dia	50dia

All Manholes shall be provided with cement concrete benching in 1:2:4 mix. The benching shall have a slope of 10cms towards the channel. The depth of the channel shall be full diameter of the pipe. Benching shall be finished with a floating coat of neat cement. (1 cement: 2coarse sand: 4 stone aggregate 20 mm nom. size)

All Manhole shall be plastered with 12/15 mm thick cement mortar 1:3 (1 cement: 3 coarse sand) and finished with a floating coat of neat cement inside. Manhole shall be plastered outside as above but with rough plaster.

All Manholes with depths greater than 1m. shall be provided with 20mm square or 25mm round rods catch rings set in cement concrete blocks 25x10x10cms in 1:2:4 mix 30cms vertically and staggered. Foot rests shall be coated with coal tar before embedding.

All Manholes shall be provided with cast iron covers and frames and embedded in reinforced cement concrete slab. Weight of cover, frame and thickness of slab shall be as specified in the schedule of quantities or given above.

7.22 DROP CONNECTION

Drop connections shall be provided between branch sewer and main sewer itself in steep ground when the difference in invert level of the two exceeds 45 cms of the required sizes.

Drop connections from gully traps to main sewer on rectangular manholes shall be made inside the manholes and shall have H.C.I. special type door bend on top and heel rest bend at bottom connected by a H.C.I. pipe. This pipe shall be supported by holder bat clamps at 180cms intervals with at least one clamp for each drop connection. All joints shall be lead caulked joints 25mm deep.

Drop connections from branch sewer to main sewer shall be made outside the manhole wall with glazed stoneware pipe tee connections, vertical pipe and bend at the bottoms. The top of the tee shall be finished up to the surface level and provided with a C.I. Hinged type frame and cover 30cms x 30cms. The connection shall be embedded in cement concrete 1:2:4 mix 5cms all round the pipe and tee up to the surface chamber of the tee.

Drop connection made for vertical stacks directly into manholes shall not be considered as drop connections. They shall be paid for under the relevant soil and waste pipes.

7.23 MAKING CONNECTIONS

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

7.24 ROUTE MARKERS

Markers indicating the particular service installed shall be provided along the routes of pipe trenches. Markers shall be of mild steel indicating the type of service installed and the direction of flow painted on it. The markers shall be set firmly in a concrete base and installed at all corner and turning points. Over straight runs, markers shall be spaced at 50 meter centers generally.

7.25 MEASUREMENTS

Excavation

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

Ordinary soil

Hard soil (Hard Moorum & Soft Rock)

Hard Rock requiring chiseling

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Hard Rock required blasting.

Trenches shall be measured between outside walls of manhole at top and depth shall be the average depth between the two ends to the nearest cm. The rate quoted shall be for a depth up to 1.5 m or as given in the schedule of quantities.

Payment for trenches more than 1.5 m in depth shall be made for extra depth as given in the schedule of quantities and above the rate for depth up to 1.5 m.

Timbering and Shoring

Timbering and shoring as described above shall be measured per Sqm and paid for as per the type of timbering of shoring done at site and as per the relevant item in the schedule of quantities. Rate for timbering and shoring shall be for all depths and types of soil classifications including saturated.

Saturated Soil

No extra payment for pumping and bailing out water shall be made for excavation with an average depth of 1.5m in saturated soil, surface water from rain falls or broken pipes lines, or sieves and other similar sources. An extra rate as quoted in the schedule of quantities shall be paid for excavation in saturated soil for pipe trenches above average depth of 1.5 m. No payment is admissible for water collected from surface sources and broken pipe lines or sewers.

Refilling, Consolidation and Disposal of surplus earth

Rate quoted for excavation of trenches shall be inclusive of refilling, consolidation and disposal of surplus earth within a lead of 50 m.

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

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

Gully Trap

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

Cement Concrete for Pipes

Cement concrete in bed and all-round or in Haunches shall be paid per running meter between the outside wall of manholes at bottom of the trench. No additional payment is admissible in respect of concreting done for widths

greater than specified, for shuttering or centering and concreting in sub soil water conditions.

Manholes

All manholes shall be measured by numbers and shall include all items specified above and necessary excavation, refilling and disposal of surplus earth.

Manholes with depth greater than specified under the main item shall be paid for under "Extra Depth" and shall include all items as given for manholes. Measurement shall be done to the nearest cm. depth of the manholes shall be measured from top of the manhole cover to bottom of channel.

Drop Connections

Drop connections shall be measured by number for a depth of 60cms or part thereof between invert levels. Additional depth shall be paid for as extra per meter depth as per the actual length of the drop connection, measured to the nearest cm.

Making Connections

Item for making connection to municipal sewer shall be paid for by number and shall include all items given in the schedule of quantities and specifications.

Masonry Drains

Payment for masonry drains shall be made under individual items of masonry, cement concrete and plaster by volume or area as given in the schedule of quantities. Except for such drawings which are specifically provided in schedule of quantities.

SOIL, WASTE & RAINWATER SYSTEM

GENERAL

Water supply system to cater for drinking, washing, flushing & other requirements shall be installed as called for on the drawings.

The piping system consists of PVC SWR System, UPVC Pipes or other material as called for. The size and makes are specified in the Schedule of Quantities.

9.1 SCOPE OF WORK

Work under the section shall consist of furnishing all labor, materials, equipments and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes as required by the drawings, specified hereinafter and given in the schedule of quantities.

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Without restricting to the generality of the foregoing the soil, waste, vent, and rainwater pipes system shall include the following:-

Vertical and Horizontal soil, waste and vent pipes, rainwater pipes and fittings, joints, clamps and connections to fixtures.

Connection of all pipes to sewer and storm water lines as show on the drawings.

Waste pipe connections from all fixtures W.C. Wash Basin, Sinks, Urinals, Kitchen equipment and Plant room equipment.

9.2 TRAPS

External Traps

All traps for drains shall be socket-less tar free cast iron with water seal. Traps shall be provided with an expansion plug and a with a water tight plate at the base for traps located above ground.

Nahani Trap or Floor Traps.

Nahani traps or floor traps shall be cast iron/PVC, deep seal with an effective seal of 50mm. The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:4 mix (1cement: 2 coarse sand: 4 stone aggregate 20mm nominal size) and extended to 40mm below finished floor level. Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30x30cms. of the required depth.

9.3 FLOOR DRAINS AND ROOF DRAINS

All floor drain shall have 80mm trap.

Floor drains for mechanical room shall have cast iron grating and body. These floor drains shall be heavy duty.

Roof Drains shall have cast iron body, flushing clamp and gravel stop with cast iron dome (JR Smith or equivalent).

9.4 FLOOR TRAP INLET

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

9.5 C.P./STAINLESS STEEL GRATINGS

Floor and Urinal traps shall be provided with square or round C.P./ Stainless steel grating, with rim of approved design and sharp. Minimum thickness shall be 4 to 5 mm or as specified in the schedule of quantities.

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9.6 JOINTING

Cast Iron Soil, Waste vent and rainwater pipes shall be jointed with refined Pig lead confirming to IS: 89-1977 sufficient skein of jute row shall be caulked to live a minimum space for the pig lead as given in 3.1.2 to be poured in. After the pouring the lead shall be caulked into the joint with caulking tool and hammer. All surplus lead should be cut and joint left flush with the edge of socket neatly. Alternative to lead joint, cast iron pipes may also jointed with Drip Seal Joint as per manufacturer recommendations. All PVC SWR systems for drainage shall be jointed with rubber lubricant ring joints.

9.7 CLEANOUTS

A. Provide cleanouts at the base of all soil, waste and leader stacks, all changes in direction of horizontal piping, every floor of sanitary, vent and rain water stacks, all branch connections to stacks and every 15m of horizontal pipe runs. Cleanout plugs shall be threaded and provided with key holes for opening. Cleanout plugs shall be fixed to the pipe by a GI socket and lead caulked joint.

UPVC Pipe Cleanouts. Heavy plastic cleanout screw plug in UPVC fitting with sound square nut.

Extend cleanouts to walls and floor with long sweep ells or "wye" and 1/8 bends with plugs and face or deck plates to conform to the architectural finish in the room. Where no definite finish is indicated on drawings provided by other Divisions of this Specification, use stainless steel wall plates and floor plates of nickel bronze.

9.8 WASTE PIPE FROM APPLIANCES

Waste Pipe from appliances e.g. washbasins, sinks, urinals, water coolers, shall be of galvanized steel, as given in the schedule of quantities.

All pipes shall be fixed in gradient towards the out falls of drains. Pipes shall be in chase unless otherwise shown on drawings.

9.9 CONDENSATE INSULATION

Provide 25mm THK expanded rubber insulation on branch waste pipe works for condensate drain from air conditioning system.

9.10 INSTALLATION

General

All materials shall be new and installed in a first class manner.

All drainage piping, unless otherwise indicated, shall be pitched at a minimum rate in direction of flow, in accordance with Indian Standard.

Branch connections to stacks or main drain shall not be made in a manner which will permit backflow.

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The Contractor shall handle fittings into and out of store to job site and they shall be well protected from damage. After the installation, the fixtures shall be covered by protective crating with carton cardboard and plastic sheets until handover to the employer.

The Contractor shall supply all jointing and fixing materials and seal to structure with polysulphide sealant and make all connections to water supply services, overflows and waste.

All pipe work and fitting connected to pit shall be cast in prior the pouring of concrete.

Rainwater drain shall be set in position and make good. The Contractor shall ensure that the works are coordinated.

yy) Testing

All testing to be carried out in accordance with the local authority requirements and Indian Standards.

During the progress of the work, test the waste and storm drainage systems to permit general construction and building in of rough work to proceed.

Provide all apparatus and temporary work for tests. Take all due precautions to prevent damage to any part of the building.

No caulking of pipe joints to remedy leaks will be permitted except where lead and oakum joints are used.

Each sections of drainage and roughing piping tested shall have all openings tightly closed with screw plugs, or equal device, and shall stand without loss of level for a period of four hours when filled with water to produce at least a 3meter head at the highest point of the section tested.

The Contractor shall maintain system until handover and ensure that at handover the systems are clean and free of blockage.

Test Procedure

Before use at site, all CI soil pipes shall be tested by filling up with water for at least 10 minutes. After filling, pipes shall be struck with a hammer and inspected for blow holes and cracks. All defective pipes shall be rejected and removed from the site.

Pipes shall be tested after installation, by filling up the stack with water. All openings in connection shall be suitably plugged. The total head in the stack shall be, however, not exceed 3 m.

Alternatively, contractor may test all soil and waste stacks by smoke testing machine. Smoke shall be pumped into the stack after plugging all inlets and connections. The stack then be observed for leakages and all defective pipes and fittings removed or repaired as directed by the owner/consultant.

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A test register shall be maintained and all entries shall be signed and dated by contractors and got approved from owner/consultant.

9.11 CEMENT CONCRETE

Cast Iron soil and Waste pipes under floor in sunken slabs and in wall chases (vane cut specially for the pipe) shall be encased in cement, concrete in 1:2:4 mix. The encased pipe shall be supported with suitable cement, concrete, pillars of required height and size at intervals as directed by owner/ consultant.

9.12 PAINTING

Soil, waste vent and rainwater pipes in exposed location, in shafts and pipe spaced shall be painted with two or more coats of synthetic enamel paint to give an ever shade.

Paint shall be of approved quality and shade, where directed pipe shall be painted in accordance with approved pipe color code.

Waste pipe in chase shall be painted with two coats of bitumen paint covered with polythene tape/fiberglass tissue wrapping and final coat of bitumen paint. Exposed pipes shall be painted with two or more coats of synthetic enamel paint.

Pipe content	Basic colour (150mm)	Colour code indication (100mm)	Basic colour (150mm)
Water			
Drinking	Green	Blue	Green
Grey Water	Green	Black	Green
Reclaimed Water	Green	Black – White - Black	Green
Cooling (primary)	Green	White	Green
Boiler feed	Green	Crimson – White – Crimson	Green
Condensate	Green	Crimson – Em Green - Crimson	Green
Chilled	Green	White – Em Green – White	Green
Heating < 100°C	Green	Blue – Crimson – Blue	Green
Heating > 100°C	Green	Crimson – Blue – Crimson	Green
Cold distribution	Green	White – Blue – White	Green
Hot distribution	Green	White – Crimson – White	Green
Fire distribution	Green	Safety Red	Green
Sea, river-untreated		Green	
Gas			
Natural	Yellow Ochre	Yellow	Yellow Ochre
Manufactured	Yellow Ochre	Em Green	Yellow Ochre
Oil			
Diesel fuel	Brown	White	Brown
Compressed air		Light Blue	
Vacuum	Light Blue	White	Light Blue
Steam		Silver Grey	

9.13 CUTTING AND MAKING GOOD

Pipes shall be fixed and tested as work proceeds. Contractor shall provide on necessary holed out, cuts and chase in structure member as required. Wherever, holes are cut or left originally, they shall be made good with cement concrete 1:2:4 (1 cement :2 coarse sand :4 stone aggregate 20 mm nominal size) or cement mortar 1:2 (1cement : 2 coarse sand) and the surface restored as in original condition.

9.14 MEASUREMENT

General

Rates for all items quoted shall be inclusive of all work and items given in the above mentioned specification and schedule of quantities and applicable for the work under floor, in shafts or at ceiling level at all heights and depths.

All rates are inclusive of cutting holes and chases in RCC and masonry work and making good the same.

All rates are inclusive of pre-testing and on site testing of the installations, materials and commissioning.

Pipes (Unit of Measurement). Linear meter to the nearest centimeters.

CI (L.A.) pipes shall be measured net when fixed correct to a centimeter including all fittings along its length.

CI soil, waste vent and rain water pipes shall be measured overall along the centre line correct to a centimeter including all fittings along its length. The rate for these pipes shall be inclusive of all fittings, holder bat clamps, lead caulked joints painting and all other items described in the schedule of quantities. Traps structural clamps and cement concrete shall, however, be paid separately under the relevant item.

GI pipes shall be measured per running meter correct to a centimeter for the finished work, which shall includes fittings e.g. bends, tees, elbows, reducers, crosses, sockets, nipples, nuts and painting. The length shall be taken along the centre line of pipes and fittings. All pipes and fittings shall be classified according to their diameter, method of jointing and fixing substance, quality and finish diameter shall be nominal diameter of internal bore. Pipe shall be described as including all cutting and waste. Incase of fitting of an equal bore, the large bore shall be measured.

Cement concrete around pipe shall be measure per along centre of the pipe line measured per linear meter.

Slotted angels/channels shall be measure per linear meter of finished length and shall include support bolts and nuts embedded in machinery which cement concrete blocks nothing extra will be paid for making good the same.

Painting

Painting of pipes shall be measured in meter along the centre line of pipes installed. The rate shall include the painting of clamps, suspenders and supports.

Structural Clamps

Structural Clamps and U clamps shall be paid for by weight per Kg. Rate shall be inclusive of all anchor fasteners, nuts, bolts, drilling, cutting, welding and painting. Weight of clamps shall be calculated from the actual length used in structural member multiplied by its theoretical weight given in manufactures catalogue. Weight of nuts, bolts shall not be taken into account.

Excavation for soil pipes.

No extra payment shall be admissible with respect to excavation refilling and disposal of surplus earth for cast iron and caste pipes.

9.15 Grease Trap

As the name suggests; grease trap separates grease waste-water, before being discharged. Grease Traps should be easy to clean and the covers should be fitted with stainless steel (SS) bolts. The grease traps should include a SS tray which collects the grease.

Grease Traps should be air-tight with zero chances of leakage or foul odor suitable to install as required.

Should be made of C I Casting IS: 210 FG: 220 grade & SS-316 as specified in BOQ & final design.

The standard design parameters should be as under.

Flow - ltr/min	Inlet / Outlet	Holding capacity - ltrs	Bottom to centre of inlet	Bottom to centre of outlet	Width	Length	Height	Grease capacity - kgs
18	50mm	15.9	187.5	187.5	262.5	355	280	3kgs
28	50mm	25.5	203.125	203.125	337.5	404.5	303.125	7kgs
38	60mm	34.3	203.125	203.125	362.5	503.125	303.125	9kgs
57	75mm	47.5	259.375	259.375	400	512.5	343.75	13kgs
75.5	87.5mm	57.5	287.5	287.5	400	562.5	375	18kgs
95	87.5mm	72	300	300	437.5	612.5	412.5	23kgs
132	87.5mm	104	353	353	450	712.5	481.25	32kgs
189	112mm	156	406.25	406.25	556.25	762.5	537.5	45kgs

Grease Trap - Cast Iron (IS:210 FG:220 Grade)	Length	Width	Height	Flow rate	Grease capacity
4" inlet outlet	1305mm	615mm	490mm	100 ltrs/min	25 kgs
6" inlet outlet	1305mm	615mm	490mm	145 ltrs/min	42 kgs
Grease Trap - MS/SS	Length	Width	Height	Flow rate	Grease capacity

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2" inlet outlet	510mm	380mm	445m m	50 ltrs/min	11 kgs
2.5" inlet outlet	510mm	380mm	445mm	70 ltrs/min	21 kgs

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9.16 Patel Pattern or Collection Pipe/inspection chamber

Patel Pattern Inspection Chamber Box will be used for draining soil & waste pipes from multiple locations into one single outlet typically installed at service floor.

- a) Chambers should be air-tight with zero chances of leakage or foul odour . Possibility to hung on ceilings at Service floor or basements
- b) Should be able to act as hub for numerous pipes (LA class and/or PVC) to converge, for directing flow
- c) Should be able to customize chamber boxes offering any angles required by design.
- d) Chamber should have a cover fitted with 10 stainless steel bolts. Easy to clean if chamber clogs.
- e) Basic material of construction should be C I.

E.DECLARATION

(To be typed and given on the letter - head of the Vendor)

I/We have inspected all the sites of the **Proposed Composite Construction Of A Multi-Storey Building (Lower basement + Upper basement +Ground floor to sixth floor) including civil, plumbing, Electrical and Other Services (Green Building With Gold Rating in LEED /GRIHA) For State Bank Of India At Final Plot No.116, T.P. Scheme No. 3, Bhayali, Vasna-Bhayali Road Vadodara (Gujarat)** of State Bank of India and I/We have made me/ us fully acquainted with the local conditions in and around the sites of works and proposed layout drawings of works, drawings of each items, TENDER, Technical bid & Price bid, etc. complete.

I/We hereby declare that I/ We have carefully gone through the conditions laid down in the Notice Inviting Tender, General notes, General Conditions of Contract, Special conditions, Schedule of approximate quantities and rates , Form of Agreement, General Specification, Approved manufacturers/ natural source of materials (i.e. all parts of Technical bid), Technical Specifications of schedule of quantities (i.e. all parts of Price bid), and clearly understood all the same and on the basis of the same I/ We have quoted our rates in the Schedule of Quantities/ Price Bid attached with the tender documents.

We accept all the terms and conditions of tender documents. We will abide by the technical specification mentioned in the tender. We here by undertake to use only specified material/ make as per the tender schedule.

I/ We hereby declare that, in particular during execution of all works at site; it will be my/ our sole responsibility to strictly adhere to/ meticulously follow the General Specification, Approved manufacturers/ natural source of materials; Safety, Health and Environmental (SHE) guidelines; Labour Laws; Technical Specifications of schedule of quantities, all drawings of layout and items.

For any type of deviation (to any of above or subsequent instructions), it will be my/our responsibility to obtain the written instruction of the APMCF/SBI, appropriate Government Authorities, local bodies for the same failing which it shall be deemed that I have carried out any such deviations at my own and I shall be duty bound to replace all the deviated material/ works from the site at my/ our cost as well as I shall be liable to penalized by the employer as deemed fit and for all such loses made thereof, I/ we shall not have any right to arbitrate in any manner.

I/ We hereby declare that I/ We shall obtain necessary clarifications, drawings of items from APMCF/SBI in time and shall uniformly maintain such progress as may be directed by the APMCF/SBI to ensure completion of same within the target date/ time as mentioned in the tender document.

Date:

Signature and seal of Contractor/Tenderer

Witness:

- 1.
- 2.