



श्री सिद्धिविनायक

श्रीसिद्धिविनायक गणपती मंदिर न्यास

(महाराष्ट्र शासन नियंत्रित)

एस्. के. बोले मार्ग, प्रभादेवी, मुंबई ४०००२८.

दूरध्वनी : ०२२ - ६२४९ ११११ / ११२

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वेबसाईट : www.siddhivinayak.org

:ई-निविदा सूचना:

मंदिर व प्रतिक्षालय इमारतीच्या अंतर्गत भागाचे नूतनीकरण करण्यासाठी ई-निविदा मागविण्याकरीता अनुभवी व सुयोग्य अभिकर्त्याकडून ई-निविदा ऑनलाईन मागविण्यात येत आहे. तसेच सदर ई-निविदा www.mahatenders.gov.in व www.siddhivinayak.org या संकेतस्थळावर प्रसिध्द करण्यात येत आहे.

ई-निविदा प्रसिध्दीचा वार व दिनांक	मंगळवार १८ नोव्हेंबर, २०२५
निविदापूर्व बैठक दिनांक	सोमवार २४ नोव्हेंबर, २०२५, दुपारी ०२.०० वा.
ई-निविदा स्विकारण्याचा अंतिम दिनांक	बुधवार ३ डिसेंबर, २०२५, दुपारी ०२.०० वा.
तांत्रिक निविदा उघडण्याचा दिनांक व वेळ	गुरुवार ४ डिसेंबर, २०२५, दुपारी ०३.०० वा.
मूल्य निविदा उघडण्याचा दिनांक व वेळ	शनिवार ६ डिसेंबर, २०२५, दुपारी ०१.०० वा.
स्थळ	श्रीसिद्धिविनायक मंदिर, तिसरा मजला, न्यास कार्यालय.



(वीणा पाटील)

कार्यकारी अधिकारी

E-Notice No.

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SHREE SIDDHIVINAYAK GANAPATI TEMPLE TRUST, MUMBAI,
PRABHADEVI, MUMBAI 400028

e-Procurement Notice

INVITATION FOR BIDS (IFB)

Date :

Bid No:

1. **Executive Officer, Shree Siddhivinayak Ganapati Temple Trust, Mumbai** invites Competitive Bids from the contractors in India who fulfill the Qualifying Criteria in this document for Structural & Allied repair works detailed in the Table.

TABLE

S. N.	Name of work	Approximate value of work (Rs)	Bid Security (Rs)	Cost of document (Rs)	Period of completion
1	2	3	4	5	6
1	Proposed Structural, Civil & Interiors including Electrification, Fire Fighting, HVAC of the Existing Main Temple and Pratikshalaya Structure at Siddhivinayak Temple, Prabhadevi.	/-	14,00,000/-	Rs. 15,000/-- (Inclusive of GST Tax)	24 calendar months (Twenty Four Months including Monsoon)

2. The period of availability of online bid / date and time of Pre-bid meeting / date and time of online bid submission and date and time of opening of bids are given below.

Availability of tender for on-line download for bidders		Date and time of pre bid meeting	Start and end date and time for on-line submission of bid	Date and time of Opening of bids.	
From	To			Technical Bid	Financial Bid.
As stated in Tender Inviting Notice		-----NIL-----	As stated in Tender Inviting Notice	Date & Time as stated in Tender Inviting Notice and at the office of Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi, Mumbai 400028 @ 3 rd floor. If it is not possible to open it on the date specified above, the Bid opening authority shall communicate the change in opening date	

3. Bidding documents can be downloaded from the web site <https://mahatenders.gov.in>. The documents downloaded from the web site should not be tampered, and if any such tampering is detected before or after the opening of bids, the bidder shall be penalized and black listed.

4. Tender form, conditions of contract, specifications and contract drawings can be downloaded from the e-Tendering portal of Public Works Department, Government of Maharashtra web site <https://mahatenders.gov.in>. The Contractors shall make online payment as specified in column 5 of table above using payment gateway. The fees of tender document will be non-refundable.
5. Before submission of on-line bids, bidders must ensure that the scanned copies of all the necessary documents have been attached with bid.
6. The bidders should keep checking the website for any addenda/corrigenda to the notice / bidding documents till the date of on-line submission of bids, and bidders should incorporate the same in their bid documents.
7. The bids will be opened online as per time schedule mentioned in the table above in the presence of bidders who wish to attend on the scheduled date and time in the office of **Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi, Mumbai 400028 @ 3rd floor**. If the office happens to be closed on the date of opening of bids as specified, the bids will be opened on the next working day at the same time and venue.
8. Bid documents consisting of qualification information and eligibility criteria for bidders, plans specifications, drawings, the schedule of quantities of the various classes of work to be done and the set of terms and conditions of contract to be complied with by the contractors can be seen on website <https://mahatenders.gov.in> and scanned copies of the required documents and information as per section 2 (Formats and annexure) should be attached in the Technical Bid as prescribed in Standard Bidding Document (SBD).
9. Uploaded documents of valid successful bidders will be verified with the original before signing the agreement. The valid successful bidder has to provide the original to the concerned authority on receipt of such letter, which will be sent through registered post/e-mail.
10. Bids once submitted cannot be resubmitted or withdrawn after the proposal due date and time.
11. Conditional bids and the bids not meeting the qualification criteria on the date of receipt of bids shall be summarily rejected.
12. The pre-bid meeting will be held as specified in the table above to clarify the issues and to answer on any matter that may be raised at that stage as stated in Clause 9.2 of the “instructions to Bidders” bidding document.
13. The rates quoted by the contractor shall be deemed to be inclusive of all tax other than Goode and Service Tax 2017 that the contractor will have to pay for performance of this contract. The rate quoted by the contractor shall be exclusive of Goods and Service tax 2017 which shall be paid extra by the employer at prevailing rates. The employer will perform such duties in regard to the deduction of such taxes at sources as per applicable law.

DISCLAIMER

1. Detailed Time-Table for the various activities to be performed in e-tendering process by the Tenderer for quoting their offer is given in this Tender. Contractor should carefully note down the cut-off dates for the carrying out each e-tendering process/activity.
2. Every effort is being made to keep the Website up to date and running smoothly 24x7 by the Government and the Service Provider. However, Government takes no responsibility, and will not be liable for, the website being temporarily unavailable due to any technical issue at any point of time.
3. In that event Public Works Department will not be liable or responsible for any damages or expenses arising from any difficulty, error, imperfection or inaccuracy with this Website. It includes all associated services, or due to such unavailability of the Website or any part thereof or any contents or any associated services.
4. Tenderers must follow the timetable of e-tendering process and get their activities of e-tendering processes done **well in advance** so as to avoid any inconvenience due to unforeseen technical problems if any.
5. Public Works Department will not be responsible for any incomplete activity of e-tendering process of the tenderer due to technical error/failure of website and it cannot be challenged by way of appeal, arbitration and in the Court of Law.
Contractors must get done all the e-tendering activities well in advance.

SECTION 1
INSTRUCTIONS TO BIDDERS
(ITB)

Section 1: Instructions to Bidders
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I. E-Tendering Procedure

1. Blank Tender Forms

Bidding documents can be purchased/down loaded from the e-Tendering Portal of Public Works Department, Government of Maharashtra i.e. <https://mahatenders.gov.in> after paying Tender Fees via online mode as per the Tender Schedule.

- 1.1.1 If it is not possible on line to down load the drawings, the set of drawing may be supplied to the bidders in "Hard Copy" by the Department, on Proof of receipt of payment towards cost of bidding documents as per the tender schedule.
- 1.1.2 The bid submitted by the bidder shall be unconditional. Conditional bids shall be summarily REJECTED.
- 1.1.3 All bidders are cautioned that bids containing any deviation from the contractual terms and conditions, specifications or other requirements and conditional bids will be treated as non-responsive. The bidder should clearly mention in forwarding letter that his offer (in envelope No. 1& 2) does not contain any conditions, deviations from terms and conditions stipulated in the tender.
- 1.1.4 Bidders should have valid Class-II/III Digital Signature Certificate (DSC) obtained from any Certifying Authorities.
- 1.1.5 If any assistance is required regarding any e-Tendering (upload & download including DSC), please contact NIC E-procurement24x7 Help Desk Number 0120-4200462, 0120-4001002 or via email at support-eproc@nic.in.

Guidelines to Bidders on the operations of Electronic Tendering System of Public Works Department is available at E-Tendering portal i.e. <https://mahatenders.gov.in>. The bidder shall obtain clarification/help from assistance mentioned in para 1.1.5. No grievances /claims will be entertained on failure of submission of online bid.

2. Preliminaries

Bidder should have valid class II / III digital signature certificates (DSC) obtained from any Certifying Authority. In case of requirements of DSC, interested Bidders should go to <http://mahatenders.gov.in>, information about DSC and follow the procedure mentioned in the document 'Procedure for Application of Digital Signature Certificate'.

Bidder should do Online Enrolment in this Portal using the option 'Click Here to Enroll' available in the Home Page. Then the Digital Signature enrollment has to be done with the e-token, after logging into the portal. The e-token may be obtained from one of the authorized Certifying Authorities such as e-Mudhra CA/GNFCIDRBTMTNLTrustline/SafeScripT/TCS.

The e-token that is registered should be used by the bidder and should not be misused by others.

DSC once mapped to an account cannot be remapped to any other account. It can only be inactivated.

Bidder then can log into the portal giving user Id / password chosen during enrollment.

Tender Forms can be downloaded from e-Tendering Portal of Public Works Department, Government of Maharashtra <http://www.mahatenders.gov.in> after entering the details of payment toward Tender Fees as per the Tender Schedule / Tender Notice

3. Bid Preparation

After downloading / getting the tender schedules, the **Bidder should go through them carefully and prepare for the documents as per the requirements mentioned tender document. Refer the Check List.** In case of shortfalls he will not be eligible.

The bidder reads the terms and conditions and accepts the same to proceed further to submit the bids.

The bidder shall submit the bid documents under online mode only, through this portal. Offline documents will not be handled through this system.

The Bidders are advised to update the documents frequently required for bidding in advance such as Licenses, Certificates, Registrations, Purchase / Work Order details, Work Completion Certificates, IT Returns, Partnership Documents, Authority given on behalf of bidder, Statements in prescribed format, Guarantee, Undertakings etc well in advance, under 'My Documents' option and these can be selected as per tender requirements and then attached along with bid documents during bid submission. This will ensure only required upload of bid documents and save time.

The documents should be in PDF/XLS/RAR/DWF formats. If there is more than one document, they can be clubbed together.

There is no limit on the size of the file to be uploaded at the server end. However, the upload is decided on the Memory available at the Client System as well as the Network Bandwidth available at the client side at that point of time. In order to reduce the file size, bidders are suggested to scan the documents in 75-100 DPI so that the clarity is maintained and also the size of file also gets reduced. This will help in quick uploading even at very low bandwidth speeds.

4. Bid Submission

Bid Security shall be paid in online mode. Refer online payment.

Bidder shall verify checklist for documents to be submitted in Technical Bid (Envelope 1)

Bidder shall fill details of Financial Bid. The documents submitted by the bidder shall be digitally signed using the e-token of the bidder and then he shall upload

digitally signed tender documents in Envelope No. II. Take note of Additional (Performance) Security Deposit conditions.

It is important to note that, the bidder has to click on the 'Freeze Bid' button, to ensure that he/she completes the Bid Submission Process. Bids, which are not frozen, are considered as Incomplete/Invalid bids and are not considered for evaluation purposes.

At the time of freezing the bid, the e-Procurement system will give a successful bid updation message after uploading all the bid documents submitted and then a bid summary will be shown with the bid no, date & time of submission of the bid with all other relevant details.

Successful bid submission from the system means, the bids as uploaded by the bidder is received and stored in the system. System does not certify for its correctness.

After the bid submission, the bid summary has to be printed and kept as an acknowledgement as a token of the submission of the bid. The bid summary will act as a proof of bid submission for a tender floated and will also act as an entry point to participate in the bid opening event.

All the data being entered by the bidders would be encrypted at the client end the software uses PKI encryption techniques to ensure the secrecy of the data. The data entered will not be viewable by unauthorized persons during bid submission and not viewable by any one until the time of bid opening. Overall, the submitted bid documents become readable only after the tender opening by the authorized individual.

During transmission of bid document, the confidentiality of the bids is maintained since the data is transferred over Secured Socket Layer (SSL) with 256bit encryption technology. Data encryption of sensitive fields is also done.

5. BIDDERS TO TAKE NOTE

If any assistance is required regarding any e-Tendering (upload & download including DSC), please contact NIC E-procurement24x7 Help Desk Number 0120-4200462, 0120-4001002 or via email at support-eproc@nic.in

The bidder has to submit the tender document(s) online / e-Procurement system well in advance before the prescribed bid submission end date and time as per server system clock to avoid any delay or problem during the bid submission process.

Realization of NEFT/RTGS payment normally takes 2 to 24 hours, so it is advised to make sure that NEFT/RTGS payment activity should be completed well in time.

The time that is displayed from the server clock at the top of the Tender Portal, will be valid for all actions of requesting bid submission, bid opening etc., in the e-Procurement portal. The Time followed in this portal is as per Indian Standard Time (IST), which is GMT+5:30. The bidders should adhere to this time during bid submission.

The Tender Inviting Authority (TIA) shall not be responsible for any sort of delay or the difficulties faced during the submission of bids online by the bidders due to contemporary / local issues.

Bidder shall refer conditions of “Additional (Performance) Security Deposit”.

The bidder should see that the bid documents submitted should be free from virus and if the documents could not be opened, due to virus, during tender opening, the bid is liable to be rejected.

The tender submitted by the Bidder shall be based on clarification, additional facility issued (if any) by the Department, and this tender shall be unconditional. All Bidders are cautioned that the tenders containing any deviation, from the contractual terms and conditions, specifications or other requirements and conditional tenders; will be rejected as non-responsive.

The BOQ template must not be modified/ replaced by the bidder and the same should be uploaded after filling the relevant columns, else the bidder is liable to be rejected for that tender. Bidders are allowed to enter the Bidder Name and Values only.

If there are any clarifications, this may be obtained online through the e-Procurement Portal, or through the contact details given in the tender document. Bidder should take into account of the corrigendum published before submitting the bids online.

6. Terms and Conditions for Online-Payment.

Cost of bidding documents & BID SECURITY must be paid Online Net banking mode only.

General Terms and Conditions for E-Payment.

1. Once a User has accepted these Terms and Condition, he/she may register on Merchant's website and avail the services.
2. Merchant's rights, obligations, undertakings shall be subject to the laws in force in India, as well as any directives/ procedures of Government of India, and nothing contained in these Terms and Conditions shall be in derogation of Merchant's right to comply with any law enforcement agencies request or requirements relating to any User's use of the website or information provided to or gathered by Merchant with respect to such use. Each User accepts and agrees that the provision of details of his / her use of the Website to regulators or police or to any other third party in order to resolve disputes or complaints which relate to the Website shall be at the absolute discretion of Merchant.
3. If any part of these Terms and Conditions are determined to be invalid or unenforceable pursuant to applicable law including, but not limited to , the warranty disclaimers and liability limitations set forth herein, then the invalid or unenforceable provision will be deemed superseded by a valid , enforceable provision that most closely matches the intent of the

original provision and the remainder of these Terms and Conditions shall continue in effect.

4. These Terms and Conditions constitute the entire agreement between the User and Merchant, These Terms and Conditions supersede all prior or contemporaneous communications and proposals, whether electronic, oral, or written, between the User and Merchant. A printed version of these Terms and Conditions and of any notice given in electronic form shall be admissible in judicial or administrative proceedings based upon or relating to these Terms and Conditions to the same extent and subject to the same conditions as other business documents and records originally generated and maintained in printed form.
5. The entries in the book of Merchant and / or the Payment Gateway Service Providers kept in the ordinary course of business of Merchant and / or the Payment Gateway Service Providers with regard to transactions covered under these Terms and Conditions and matters therein appearing shall be binding on the User and shall be conclusive proof of the genuineness and accuracy of the transaction.
6. Refund for Charge Back Transaction : In the event there is any claim for / of charge back by the User for any reason whatsoever, such User shall immediately approach Merchant with his / her claim details and claim refund from Merchant alone. Such refund (if any) shall be affected only by Merchant via payment gateway or by means as Merchant deems appropriate. No claims for refund / charge back shall be made by any User to the Payment Gateway Service Provider(s) and in the event such claim is made it shall not be entertained.
7. In these Terms and Conditions, the term "**Charge Back**" shall mean approved and settled credit card or not banking purchase transaction(s) which are at any time refused, debited or charged back to merchant account (and shall also include similar debits to Payment Gateway Service Provider's accounts, if any) by the acquiring bank or credit card company for any reason whatsoever, together with the bank fees, penalties and other charges incidental thereto.
8. Refund for fraudulent/ duplicate transaction(s): The User shall directly contact Merchant for any fraudulent transaction (s) on account of misuse of Card/ Bank details by a fraudulent individual/ party and such issues shall be suitably addressed by Merchant alone in line with their policies and rules.
9. Server Slow Down/ Session Timeout: In case the Website or Payment Gateway Service Provider's webpage. That is linked to the Website, is

experiencing any server related issues like 'slow down' or 'failure' or 'session timeout' the User shall, before initiating the second payment, check whether his/ her Bank Account has been debited or not and accordingly resort to one of the following options.

- i) In case the Bank Account appears to be debited, ensure that he/she does not make the payment twice and immediately thereafter contact Merchant via e-mail or any other mode of contact as provided by Merchant to confirm payment.
- ii) In case the Bank Account is not debited, the User may initiate a fresh transaction to make payment.

However, the User agrees that under no circumstances the Payment Gateway Service Provider shall be held responsible for such fraudulent / duplicate transactions and hence no claims should be raised to Payment Gateway Service Provider. No communication received by the Payment Gateway Service Provider(s) in this regard shall be entertained by the Payment Gateway Service Provider.

Limitation of Liability.

1. Merchant has made this Service available to the User as a matter of convenience. Merchant expressly disclaims any claim or liability arising out of the provision of this Service. The User agrees and acknowledges that he/ she shall be solely responsible for his/ her conduct and that Merchant reserves the right to terminate the rights to use of the Service immediately without giving any prior notice thereof.
2. Merchant and / or the Payment Gateway Service Providers shall not be liable for any inaccuracy, error or delay in, or omission of **(a)** any data. Information or message, or **(b)** the transmission or delivery of any such data. Information or message; or **(c)** any loss or damage arising from or occasioned by any such inaccuracy, error, delay or omission, non-performance or interruption in any such data, information or message. Under no circumstances shall the Merchant and / or the Payment Gateway Service Providers, its employees, directors, and its third party agents involved in processing, delivering or managing the Services, be liable for any direct, indirect, incidental, special or consequential damages, or any damages whatsoever, including punitive or exemplary arising in the provision of the Services or resulting from unauthorized access or alteration of transmissions of data or arising from suspension or termination of the Services.

3. The Merchant and the Payment Gateway Service Provider(s) assume no liability whatsoever for any monetary or other damage suffered by the User on account of :
 - i) The delay, failure, interruption, or corruption of any data or other information transmitted in connection with use of the Payment Gateway or Services in connection thereto : and / or.
 - ii) Any interruption or errors in the operation of the Payment Gateway.
4. The User shall indemnify and hold harmless the Payment Gateway Service Provider (s) and Merchant and their respective officers, directors, agents , and employees, from any claim or demand , or action arising out of or in connection with the utilization of the Services.

The User agrees that Merchant or any of its employees will not be held liable by the User for any loss or damages arising from your use of, or reliance upon the information contained on the Website, or any failure to comply with these Terms and Condition where such failure is due to circumstance beyond Merchant's reasonable control.

Miscellaneous Condition:

1. Any waiver of any rights available to Merchant under these Terms and Condition shall not mean that those rights are automatically waived.
2. The User agrees, understands and confirms that his/ her personal data including without limitation details relating to debit card/ credit card transmitted over the Internet may be susceptible to misuse, hacking, theft and / or fraud and that Merchant or the Payment Gateway Service Provider(s) have no control over such matters.
3. Although all reasonable care has been taken towards guarding against unauthorized use of any information transmitted by the User, Merchant does not represent or guarantee that the use of the Services provided by / through it will not result in theft and / or unauthorized use of data over the Internet.
4. The Merchant, the Payment Gateway Service Provider(s) and its affiliates and associates shall not be liable, at any time, for any failure of performance, error, omission, interruption, deletion, defect, delay in operation or transmission, computer virus, communications line failure, theft or destruction or unauthorized access to alteration of or use of information contained on the Website.

5. The User may be required to create his/ her own User ID and Password in order to register and / or use the Services provided by Merchant on the Website . By accepting these Terms and Conditions the User agrees that his/ her User ID and Password are very important pieces of information and it shall be the User's own responsibility to keep them secure and confidential. In furtherance hereof , the User agrees to :
 - i) Choose a new password, whenever required for security reasons.
 - ii) Keep his/ her User ID & Password strictly confidential.
 - iii) Be responsible for any transactions made by User under such User ID and Password. The User is hereby informed that Merchant will never ask the User for the User's password in an unsolicited phone call or in an unsolicited email. The User is hereby required to sign out of his/ her Merchant account on the Website and close the web browser window when the transaction(s) have been completed. This is to ensure that others cannot access the User's personal information and correspondence when the User happens to share a computer with someone else or is using a computer in a public place like library or internet cafe.

Debit/ Credit Card, Bank Account Details.

1. The User agrees that the debit/ credit card details provided by him/ her for use of the aforesaid Service(s) must be correct and accurate and that the User shall not use a debit / credit card, that is not lawfully owned by him/ her or the use of which is not authorized by the lawful owner thereof. The User further agrees and undertakes to provide correct and valid debit/ credit card details.
2. The User may make his/ her payment (Cost of bidding documents & BID Security) to Merchant by using a debit/ credit card or through online banking account. The User warrants, agrees and confirms that when he/ she initiates a payment transaction and / or issues an online payment instruction and provides his/ her card / bank details:
 - i) The User is fully and lawfully entitled to use such credit/ debit card, bank account for such transactions:
 - ii) The User is responsible to ensure that the card/ bank account details provided by him/ her are accurate.
 - iii) The User is authorizing debit of the nominated card/ bank account for the payment of Tender Fee and Earnest Money Deposit.
 - iv) The User is responsible to ensure sufficient credit is available on the nominated card/ bank account at the time of making the payment to

permit the payment of the dues payable or the bill(s) selected by the User inclusive of the applicable Fee.

Personal Information:

1. The User agrees that, to the extent required or permitted by law, Merchant and / or the Payment Gateway Service Provider(s) may also collect , use and disclose personal information in connection with security related or law enforcement investigations or in the course of cooperating with authorities or complying with legal requirements.
2. The User agrees that any communication sent by the User vide e-mail, shall imply release of information therein / therewith to Merchant. The User agrees to be contacted via e-mail on such mails initiated by him/ her.
3. In addition to the information already in the possession of Merchant and/ or the Payment Gateway Service Provider(s), Merchant may have collected similar information from the User in the past. By entering the Website the User consents to the terms of Merchant's information privacy policy and to our continued use of previously collected information. By submitting the User's personal information to us, the User will be treated as having given his/ her permission for the processing of the User's personal data as set out herein.
4. The User acknowledges and agrees that his/ her information will be managed in accordance with the laws for the time in force.

Payment Gateway Disclaimer

The Service is provided in order to facilitate payment of Cost of bidding documents & Bid Security online. The Merchant or the Payment Gateway Service Provider(s) do not make any representation of any kind, express or implied , as to the operation of the Payment Gateway other than what is specified in the Website for this purpose . By accepting / agreeing to these Terms and Conditions, the User expressly agrees that his/ her use of the aforesaid online payment service is entirely at own risk and responsibility of the User.

A. GENERAL

1. Scope of Bid

- 1.1 The Employer (named in Appendix to ITB) invites bids for the Renovation works (as defined in these documents and referred to as "the works") detailed in the table given in IFB. The bidders may submit bids on-line for any or all of the works detailed in the table given in IFB.
- 1.2 The successful bidder will be expected to complete the works by the intended completion date specified in the Contract data.
- 1.3 Throughout these bidding documents, the terms 'bid' and 'tender' and their derivatives (bidder/ tenderer, bid/ tender, bidding/ tendering, etc.) are synonymous.

2. Source of Funds

- 2.1 The expenditure on this project will be met from **Government of Maharashtra Budgeted works**.

3. Eligible Bidders

- 3.1 This Invitation for Bids is open to all bidders who have the necessary qualification & Experience. **No joint venture or consortium shall be acceptable for bidding.**
- 3.2 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a statement that the Bidder is neither associated, nor has been associated, directly or indirectly, with the Consultant or any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract. A firm that has been engaged by the Employer to provide consulting services for the preparation or supervision of the works, and any of its affiliates, shall not be eligible to bid.

4. Qualification of the Bidder

- 4.1 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary. The proposed methodology should include program of construction backed with equipment planning and deployment duly supported with broad calculations and quality assurance procedures proposed to be adopted justifying their capability of execution and completion of work as per technical specifications, within stipulated period of completion.
- 4.2 **A. Qualification Criteria [Online Envelope No. 1 documents]**
The First Online envelope "Envelope No. 1" shall contain the following documents: **(All copies thereof shall be scanned copy of original documents).**

1. The bidder should have satisfactorily completed atleast one (1) similar work having a value not less than ₹1120.00 lakhs, during the last five (5) years, as a prime contractor, at price level 2020-2025

OR

2. The bidder should have satisfactorily completed atleast two (2) similar works each having a value not less than ₹700.00 lakhs, during the last five (5) years, as a prime contractor, at price level 2020-2025

OR

3. The bidder should have satisfactorily completed atleast three (3) similar works each having a value not less than ₹560.00 lakhs, during the last five (5) years, as a prime contractor, at price level 2020-2025

Similar work means Structural, Civil, Waterproofing & Interiors (modular) works, which should also include electrification, fire fighting & HVAC works.

4. Average Annual turnover of minimum in any one year during last five years (The attested copies of original audited profit & loss account and original balance sheet statement for last three years.

- 2020-21
- 2021-22
- 2022-23
- 2023-24
- 2024-25

- a. Minimum Turnover of ₹700.00 lakhs (Average annual turnover last 5 years in lakhs)
- b. Certificate of Financial soundness from bankers of applicants together with their full address / solvency certificate.
- c. In support of this the work done certificate issued by competent authority should be submitted.

5. Executed in any one year, the minimum quantities of the following items of work as indicated in Appendix.

- | | |
|--|------------------------------------|
| - Marble Flooring | 500.00 Sqm |
| - Interior Partition (Glass / gypsum / or any modular) | 300.00 Sqm |
| - Structural Repair / Any civil grouting to the RCC members | 300.00 Sqm /
1000.00 Kg |
| - Electrification work as a prime contractor | |
| - HVAC work as a prime contractor | |

In support of this the work done certificate issued by competent authority should be submitted.

6. Organization / Technical Personal
 - a. Contractor should have his office setup within Mumbai region.
 - b. Key site management and technical personal proposed for this work with requirement of resident engineer.
 - c. Qualification & experience of the engineers to be employees for the said project.
7. Project Schedule
 - a. Baseline schedule of work – CPM Bar chart.
 - b. Work methodology.
 - c. Quality assurance & Quality Control.
 - d. Presentation about project understanding & QAQC.
8. **The Contractor shall be a devotee of ‘Lord Siddhivinayak’ and a Hindu with prior experience in executing works associated with Hindu religious temples. The contractor shall submit copies of work orders, completion certificates, and/or photographic evidence of completed temple-related works as supporting documentation.**

The information shall be submitted in specimen form set forth in Section 2, Sr. No. 1.3.1 including experience certificates as listed. Cost of completed works of previous years shall be given weightage as set forth in Appendix to ITB, Section 1, per year based on Rupee value to bring them to **2024-25** price level. Applicant should first indicate actual figures of costs and amount for the works executed by them without accounting for the above-mentioned factors. After that the multiplying factor as above shall be applied

9. Availability of equipment & technical personnel for this work with adequate experience as required; as per Annexure I & II. The contractor shall deploy as set forth key personnel on the contract work, when the work is in progress. Also upload qualification, experience and salary drawn of key personnel required for administration & execution of the contract in specimen form set forth in Section 2, Sr. No. 1.6.
10. Scanned copy of Tenderer's PAN card
11. Scanned copy of Tenderer's GST registration certificate
12. Evidence of access to line(s) of credit and availability of other financial resources facilities (10 % of contract value) certified by the Bankers. (Not more than 3 months old)
13. Undertaking that the bidder will be able to invest a minimum cash upto 25% of contract value of work during implementation of work
14. Authority to seek references from the Bidder's bankers

15. Details of list of work in hand and work tendered for. The information shall be submitted in specimen form set forth in Section 2, Sr. No. 1.4 (A) including if required, experience certificates as listed.
16. Maximum value of Civil works in any one year during last five years. The information shall be submitted in specimen form set forth in Section 2, Sr. No. 1.4 (B).
17. Details of litigation/arbitration history in which bidder is involved shall be submitted in specimen form set forth in Section 2, Sr. No. 1.11.
18. Scanned copy of original Registered Partnership Deed, Memorandum of Articles of Association, if the tenderer is a Partnership Firm, Joint Stock Company and Power of Attorney and Firm Registration Certificate if any.
19. Contractor shall sign and upload “Affidavit” as set forth in Section - 2, Qualification Information and shall upload the same with online Envelope No. 1.
20. Contractor shall sign and upload “Declaration of the Contractor” as set forth in Section - 2, Qualification Information and shall upload the same with online Envelope No. 1.
21. Contractor shall sign and upload “Undertaking” as set forth in Section - 2, Qualification Information and shall upload the same with online Envelope No.1.
22. The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.
23. Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity at the expected time of bidding is more than the total estimated cost of the works. The available bid capacity will be calculated as under:

Assessed Available Bid Capacity = $(A*N*2)-B$, where

A= Maximum value of Civil or Interior Engineering works executed in any one year during the **last five years** and certified by the officer not below the rank of Executive Officer annual turnover for civil/ interior works during the last 5 years as certified by Chartered Accountant, (updated to **2024-25** level as per Appendix to ITB, Section 1 per year based on Rupee value to bring them to **2024-25** price level), whichever is higher

B= Value at **2024-25** price level of the existing commitments and ongoing works to be completed during the stipulated period of completion of works for which bids are invited; and

N= Number of years prescribed for completion of the works for which the bids are invited. i.e. 24 Months

No joint venture or consortium is allowed.

Note: *The statements showing the value of existing commitments and ongoing works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer in charge, not below the rank of an Executive Officer or equivalent.*

24. Numbering should be done for all papers contained in Envelope No. 1 and indexed. **Files shall be named according to its contents.**

B Financial Bid [Online Envelope No. 2 documents]

The Second Online envelope "Envelope No. 2" shall contain the following documents:

1. The Tenderer should quote his offer duly signed in terms of item rates at the appropriate place of tender documents to be submitted only in Envelope No. 2. He should not quote his offer anywhere directly or indirectly in Envelope No. 1. The contractor shall quote for the work as per details given in the main tender and also based on the detailed set of conditions issued / Additional stipulations made by the Department as informed to him by a letter from Chief Engineer/Superintending Engineer after Pre-Tender Conference. His tender shall be unconditional.
2. The financial bid shall contain the scanned copies of Additional Performance Security Deposit as set forth per Clause 34 ahead.

C. To qualify for a package of contracts made up of this and other contracts for which bids are invited in the IFB, the bidder must demonstrate having experience and resources sufficient to meet the aggregate of the qualifying criteria for the individual contracts.

Sub-contractor's experience and resources shall not be taken in to account in determining the bidder's compliance with the qualifying criteria except to the extent, if explicitly stated in 4.2 (A) above.

4.3 Deleted

4.4 Disqualification

Even though the Applicants meet the above criteria, they are subject to be disqualified and bidder will be blacklisted and their bid security will be forfeited, if they have:

- i. Made misleading or false representation in the form, statements submitted; and/or
- ii. Records of poor performance such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the contractor; consistent history of litigation awarded against the Applicant or financial failure due to bankruptcy. The rescinding of contract of a joint venture on account of reasons other than non-performance, such as Most Experienced partner of joint venture pulling out, court directions leading to breaking up of a joint venture before the start of work, which are not attributable to the poor performance of the contractor will, however, not affect the qualification of the individual partners; and/or
- iii. Participated in the previous bidding for the same work and had quoted unreasonably high bid prices and could not furnish rational justification to the employer; and/or
- iv. Bidder or any of bidder's subcontractors / vendors / distributors / importers /were not blacklisted or debarred or penalized or had adverse observation against them in the past for any of the items in part or whole by any local, state or central government institutes including Competition Commission of India (CCI) / Comptroller and Auditor General of India (CAG)/ Central Vigilance Commission (CVC) in entire India (in the past means since incorporation of the company).

5. One Bid per Bidder

- 5.1 Each bidder shall submit only one bid for one package. A bidder who submits for participates in more than one Bid (other than as a subcontractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

6. Cost of Bidding

- 6.1 The bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible and liable for those costs.

7. Site Visit

- 7.1 The Bidder, at the Bidder's own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

B. BIDDING DOCUMENTS

8. Content of Bidding Documents

- 8.1 The set of bidding documents comprises the documents listed below and addenda issued in accordance with Clause 10:

Section	Particulars	Volume No.
	Invitation for Bids	I
1	Instructions to Bidders	
2	Qualification Information, and other forms	
3	Conditions of Contract	
4	Contract Data	
5	Technical Specifications	II
6	Form of bid	III
7	Bill of Quantities	
8	Securities and other forms	
9	Drawings	IV
10	Documents to be furnished by Bidders	V

- 8.2 One copy of each of the volumes I, II, III and IV will be issued to the bidder. Documents to be furnished by the bidder in compliance to section 2 will be prepared by him and furnished as Volume-V in two parts (refer clause 12).
- 8.3 The bidder is expected to examine carefully all instructions, conditions of contract, contract data, forms, terms, and technical specifications, bill of quantities, forms, Annexures and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk. Pursuant to clause 26 hereof, bids which are not substantially responsive to the requirements of the Bid Documents shall be rejected.

9. Clarification of Bidding Documents

- 9.1 Contractor may raise any in the office of the Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi, Mumbai 400028 @ 3rd floor on or before pre-bid meeting date and time. Pre-bid conference is open to all prospective bidders wherein prospective bidders will have an opportunity to obtain clarifications regarding the work and the Tender Conditions. The prospective bidders may also post their queries online only using post query option for the tender.
- A prospective bidders are free to ask for any additional information or clarification either in writing or orally concerning the work and the reply to the same shall be uploaded on the portal <https://mahatenders.gov.in> and this clarification referred to as Common Set of Conditions/Deviations (C.S.D.) shall form part of tender documents and which will also be common and applicable to all tenderers. The point/points, if any rose in writing and/or verbally/online by the contractor in pre-bid meeting and not finding place in C.S.D. issued after the pre-bid meeting, is/are

deemed to be rejected. In such case the provision in NIT shall prevail. No individual correspondence will be made thereafter with the contractor in this regard.

9.2 Pre-bid meeting

- 9.2.1 The bidder or his official representative is invited to attend a pre-bid meeting which will take place at the address, venue, time and date as indicated in appendix.
- 9.2.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 9.2.3 The bidder is requested to submit any questions in writing or by email or through online portal to reach the Employer only before pre-bid meeting.
- 9.2.4 Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be uploaded on the website without any delay. Any modification of the bidding documents listed in Sub-Clause 8.1 which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 10 and not through the minutes of the pre-bid meeting.
- 9.2.5 Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

10. Amendment of Bidding Documents

- 10.1 Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda.
- 10.2 Any addendum thus issued shall be part of the bidding documents and shall be uploaded on the web-site as corrigendum.
- 10.3 To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at his discretion, extend as necessary the deadline for submission of bids, in accordance with Sub-Clause 20.2 below.

C.PREPARATION OF BIDS

11. Language of the Bid

11.1 All documents relating to the bid shall be in the English language.

12. Documents Comprising the Bid

12.1 The bid to be submitted by the bidder as Volume V of the bid document (refer Clause 8.1) shall be in two separate parts:

PART –I ONLINE ENVELOPE No.1: (Technical Bid)

Refer to Clause 4.2A for Qualification Criteria& documents to be uploaded under Envelope I

PART-II ONLINE ENVELOPE No. 2: (Financial Bid)

Refer to Clause 4.2 B for Financial Bid

12.2 In addition to online submission, Envelope No. 1 & 2 shall be separately sealed and marked in accordance with the Submission of Bids and Sealing & Marking Instructions under Clause 19. The bidder shall prepare two copies of the bid, marking them 'Original' and 'Copy' respectively

IMPORTANT: ALL BIDDERS SHALL NOTE THAT, WITHIN 72 HOURS OF LOCKING OF BID, i.e. AFTER LAST DATE AND TIME OF SUBMISSION OF BID, BIDDER SHALL SUBMIT ALL THE BIDDING DOCUMENTS SUBMITTED ONLINE, IN OFFLINE MODE ALSO (MEANS BIDDER SHALL SUBMIT HARD COPIES OF ALL BID DOCUMENTS IN THE ENVELOPES PRESCRIBED, AS PER 12.1 ABOVE) IN THE OFFICE OF THE SHREE SIDDHIVINAYAK GANAPATI TEMPLE TRUST, MUMBAI.

12.3 Deleted

13. Bid Prices

13.1 The contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Bidder.

13.2 The bidder shall fill in rates and prices in figures for all items of the Works described in the Bill of Quantities as available online. Items for which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities. Corrections, if any, shall be made by crossing out, initialing, dating and rewriting.

13.3 Contractor shall quote his rates exclusive of G.S.T. However, all duties, prevailing taxes (CGST + SGST) , royalty and other levies payable by the contractor under

the contract, or for any other cause shall be included in the rates, prices and total Bid Price submitted by the Bidder.

- 13.4 The rates and prices quoted by the bidder shall be fixed for the duration of the Contract and shall not be subject to adjustment on any account

14. Currencies of Bid and Payment

- 14.1 The unit rates and the prices shall be quoted by the bidder entirely in Indian Rupees. All payments shall be made in Indian Rupees.

15. Bid Validity

- 15.1 Bids shall remain valid for a period not less than 120 days after the deadline date for bid submission specified in Clause 20. A bid valid for a shorter period shall be rejected by the Employer as non-responsive.
- 15.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidders may extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing. A bidder may refuse the request without forfeiting his bid security.

15.3 Deleted

15.4 Deleted

16. Bid Security

- 16.1 The Bidder shall furnish, as part of his Bid, a Bid security in the amount as shown in Invitation for Bid (IFB) for this particular work. This bid security shall be in favour of Employer as named in Appendix and shall be in the form as set forth in Sr. No. I - E-tendering procedures under Instructions to Bidders (ITB) or in a form as specified below
- a) Receipt in challan of cash deposit in the Govt. Treasury in Maharashtra.
 - b) Deposit-at-call Receipt from any scheduled Indian Bank or a foreign Bank located in India and approved by the Reserve Bank of India.
 - c) Indian Post Office/National Savings Certificate duly endorsed by the competent postal authority in India.
 - d) Bank Guarantee from any scheduled Indian Bank, in the format prescribed by the dept/ Temple officials.
 - e) Fixed Deposit Receipt, a certificate cheque or an irrevocable letter of credit, issued by any Scheduled Indian Bank or a Foreign Bank approved by the Reserve Bank of India.
- 16.2 Bank guarantees (and other instruments having fixed validity) issued as surety for the bid shall be valid for 45 days beyond the validity of the bid.

- 16.3 Any bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 16.1 and 16.2 above shall be rejected by the Employer as non-responsive.
- 16.4 The amount of Bid Security will be refunded to the unsuccessful tenderers on deciding about the acceptance or otherwise of the tender.
- 16.5 The Bid Security of the successful bidder will be discharged when the bidder has signed the Agreement and furnished the required Performance Security.
- 16.6 The Bid Security may be forfeited
- a) if the Bidder withdraws the Bid after Bid opening during the period of Bid validity;
 - b) If the Bidder does not accept the correction of the Bid Price, if applicable; or
 - c) in the case of a successful Bidder, if the Bidder fails within the specified time limit to
 - i. Sign the Agreement; or
 - ii. Furnish the required Performance Security.

17. Deleted

18. Format and Signing of Bid

The bidder shall submit online bid comprising of documents as prescribed in clause 12. In addition to that the bidder shall submit hard copies as specified sub-clause 18.1 & 18.2 below

- 18.1 The Bidder shall prepare one original and one copy of the documents comprising the bid as described in Clause 12 of these Instructions to Bidders, bound with the volume containing the "Technical Bid" and "Financial Bid" in separate parts and clearly marked "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.
- 18.2 The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder, pursuant to Sub- Clauses 4.2. All pages of the bid where entries or amendments have been made shall be initialed by the person or persons signing the bid.
- 18.3 The Bid shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person or persons signing the bid.

D. SUBMISSION OF BIDS

19. Submission of Bids and Sealing & Marking of Bids

The bidder shall submit his bid through online portal “Technical Bid (Envelope No. 1)” and “Financial Bid (Envelope No. 2)”. The contents of technical and Financial Bids will be as specified in clause 4.2 A & 4.25 B. All documents are to be signed digitally by the bidders.

Procedure for submission of bids to be as per Sr. No. I - E-tendering procedures under Instructions to Bidders (ITB)

In addition to that the bidder shall submit hard copies as specified sub-clause 18.1 through 19.4 below

- 19.1 The Bidder shall seal the original and copy of the Bid in separate envelopes duly marking the envelopes as "ORIGINAL" and "COPY". These two envelopes (called as inner envelopes) shall then be put inside one outer envelope. Each set of the inner envelope marked "ORIGINAL" and "COPY" shall contain within it two separate sealed envelopes marked "Technical Bid" and "Financial Bid" with additional markings as follows

Original or Copy, as the case may be

Technical Bid: To be opened on _____ (as per NIT) in the presence of Evaluation Committee.

Financial Bid: Not to be opened except with the approval of Evaluation Committee
The contents of Technical and Financial Bids will be as specified in clause 12.1

- 19.2 The inner, outer, and separate envelopes containing Technical and Financial Bids shall

(a) be addressed to the Employer at the address given in Appendix

(b) bear the identification as indicated in Appendix.

- 19.3 In addition to the identification required in Sub-Clauses 19.1 and 19.2, each of the envelopes shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared late, pursuant to Clause 21, or the Evaluation Committee declares the bid as non responsive pursuant to Clause 23.

- 19.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

20. Deadline for Submission of the Bids

- 20.1 Complete Bids (including Technical and Financial) must be uploaded online through a e-portal before the date and time (as per server clock) as specified in the appendix to ITB. The department does not take any responsibility for the delay caused due to non-availability of internet connection or network traffic jam etc.

- 20.2 The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 10, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.
- 20.3 In addition hard copy of as set forth under Clause 12 & Clause 19, hard copies of Complete Bids (including Technical and Financial) must be received by the Employer at the address specified above, not later than the date indicated in appendix. In the event of the specified date for the submission of bids declared a holiday for the Employer, the Bids will be received upto the appointed time on the next working day.
- 20.4 In addition to online uploading of document the bidder shall have submit one set of hard copy of bid document bound with the volume containing the “Technical Bid” and “Financial Bid” in separate envelope and clearly marked at any of the specified location (office) herein. The bidder shall seal the technical and financial bid in separate envelope duly marking the envelopes. This to envelopes (call as inner envelopes) shall then be put inside one outer envelope on hard copy e-tender upload on e-portal website should be submitted within 72 hours after “Bid lock”. In the event of the specified date for the submission of hard copy declared a holiday by the employer, the bids will be received upto the appointed time on the next working day.

Hard copy can be submitted to below office.

Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Phone No – 022-24224438 Fax – 022-24221558 www.siddhivinayak.org

Email : svt@vsnl.com

21. Late Bids

- 21.1 Any Bid received by the Employer after the deadline prescribed in Clause 20 will be returned unopened to the bidder.

22. DELETED

E. BID OPENING AND EVALUATION

23. Bid Opening

- 23.1 The Employer will open all the Bids received (except those received late), in the presence of the Bidders or their representatives who choose to attend at time, date and the place specified in Appendix in the manner specified in Clause 20 and 23.3. In the event of the specified date of Bid opening being declared a holiday for the Employer, the Bids will be opened at the appointed time and location on the next working day.

The procedure of opening of tender opening can be downloaded from website ["https://mahatenders.gov.in"](https://mahatenders.gov.in).

23.2 Deleted

- 23.3 The envelope containing "Technical Bid" shall be opened. The amount, form and validity of the bid security furnished with each bid will be announced. If the bid security furnished does not conform to the amount and validity period as specified in the Invitation for Bids (ref. Column 4), and has not been furnished in the form specified in Clause 16, the remaining technical bid and the sealed financial bid will be returned to the bidder.
- 23.4 (i) Subject to confirmation of the bid security by the issuing Bank, the bids accompanied with valid bid security will be taken up for evaluation with respect to the Qualification Information and other information furnished in Part I of the bid pursuant to Clause 12.
- (ii) After receipt of confirmation of the bid security, if deemed necessary, the employer may seek clarifications from bidder in writing on his technical bid documents, with respect to any rectifiable defects.
- (iii) The bidders shall respond within stipulated time frame set forth by employer in clarification letter.
- (iv) Upon receipt of clarifications, the Evaluation Committee will finalize the list of responsive bidders whose financial bids would be deemed to be eligible for consideration.
- 23.5 At the time of opening of "Financial Bid", the names of the bidders who deemed responsive in accordance with Clause 23.4(iv) will be announced. Only responsive bids shall be opened. The remaining bids (unresponsive bids) shall be returned to the bidders unopened. The responsive Bidders' names, the bid prices, the total amount of each bid, any discounts and any other detail as the Employer may consider appropriate, will be announced by the Employer at the opening. Any bid price or discount, which is not readout and recorded will not be taken into account in bid evaluation.
- 23.6 In case bids are invited in more than one package, the order for opening of the "Financial Bid" shall be that in which they appear in the "Invitation For Bid".
- 23.7 The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with Sub-Clause 23.5.
- 23.8 The decision of the tender opening authority in this regard will be final and binding on the contractors.
- 23.9 The amount of Bid Security will be refunded to the unsuccessful tenderers on deciding about the acceptance or otherwise of the tender. In case of successful

tenderer, it will be refunded on his paying initial Security Deposit and completing the tender document formalities.

- 23.10 The offer successful tenderer shall remain open for acceptance for minimum period of 90 days from the date of opening of Envelope No. 2 (Financial Bid) and thereafter until it is withdrawn by the contractor by notice in writing duly addressed to the authority opening the tender and sent by Registered Post Acknowledgement due.
- 23.11 In Case, there is any technical problem during opening of bid online, Bids submitted physically (Bids submitted in offline mode i.e. hard copy submitted by the bidder), shall be opened and considered for bid evaluation. All bidders note that, Hard copy of the Bid Submitted online by them shall be submitted to the office of Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi, Mumbai 400028 @ 3rd floor within 72 Hours from the last date-time of submission of E-Bids.

24. Process to be Confidential

- 24.1 Information relating to the examination, clarification, evaluation, and comparison of Bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any effort by a Bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his Bid.

25. Clarification of Financial Bids

- 25.1 To assist in the examination, evaluation, and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable/e-mail, but no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 27.
- 25.2 Subject to sub-clause 25.1, no Bidder shall contact the Employer on any matter relating to his bid from the time of the bid opening to the time the contract is awarded.
- 25.3 Any effort by the Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in the rejection of the Bidders' bid.

26. Examination of Bids and Determination of Responsiveness

- 26.1 (A) During the detailed evaluation of "Technical Bids", the Employer will determine whether each Bid
- (i) meets the eligibility criteria defined in Clause 3 and 4;
 - (ii) has been properly signed;
 - (iii) is accompanied by the required securities and;
 - (iv) is substantially responsive to the requirements of the Bidding documents.
- (B) During the detailed evaluation of the "Financial Bid", the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications, and drawings.
- 26.2 A substantially responsive "Financial Bid" is one which conforms to all the terms, conditions, and specifications of the Bidding documents, without material deviation or reservation. A material deviation or reservation is one
- (a) which affects in any substantial way the scope, quality, or performance of the Works in the opinion of Engineer In Charge;
 - (b) which limits in any substantial way, inconsistent with the Bidding documents, the Employer's rights or the Bidder's obligations under the Contract; or
 - (c) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive Bids.
- 26.3 If a "Financial Bid" is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

27. Correction of Errors

- 27.1 "Financial Bids" determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:
- a) where there is a discrepancy between the rates in figures and in words, the rate in words will govern; and
 - b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.
- 27.2 The amount stated in the "Financial Bid" will be corrected by the Employer in accordance with the above procedure and the bid amount adjusted with the concurrence of the Bidder in the following manner:
- a) If the Bid price increases as a result of these corrections, the amount as stated in the bid will be the 'bid price' and the increase will be treated as rebate;
 - b) If the bid price decreases as a result of the corrections, the decreased amount will be treated as the 'bid price' such adjusted bid price shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount the Bid will be rejected, and the Bid security may be forfeited in accordance with Sub-Clause 16.6 (b).

28. DELETED

29. Evaluation and Comparison of Financial Bids

Evaluation and comparison of all received bids shall be prepared as per qualifying criteria mentioned in bid document and the result of same shall be published online. Prospective bidders may remain present during opening of Envelope No. 1 and Envelope No. 2. The Technical & Financial Bids will be opened & evaluated in accordance with provisions mentioned in Government of Maharashtra, Public Works Department Marathi GR No. CAT/2017/Pra-Kra 08/Bldg2, Dt.12.04.2017 & Dt.29.06.2017.

- 29.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Sub-Clause 26.2.
- 29.2 In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid Price as follows:
 - a) making any correction for errors pursuant to Clause 27; or
 - b) making an appropriate adjustments for any other acceptable variations, deviations; and
 - c) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub-Clause 23.6.
- 29.3 The Employer reserves the right to accept or reject any variation or deviation. Variations and deviations and other factors, which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Bid evaluation.
- 29.4 The estimated effect of the price adjustment conditions under Clause 47 of the Conditions of Contract, during the period of implementation of the Contract, will not be taken into account in Bid evaluation.
- 29.5 If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the contract, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 34 be increased "As demanded by Employer (case-by-case)" at the expense of the successful bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful bidder under the Contract.
- 29.6 A bid which contains several items in the Bill of Quantities which are unrealistically priced low and which cannot be substantiated satisfactorily by the bidder, may be rejected as non-responsive.

30. DELETED

31. MATERIAL OBTAINED FROM DISMANTLING.

1. Before start of repair works, existing usable materials like furniture, glass partitions or any other valuable materials should be carefully inspected and decided in consultation with architect and Temple trust for reuse.
2. The un-useable materials to be segregated separately and same should be handed over to the Temple officials or should be disposed outside the premises, as directed by the Temple officials with no cost to client. The charges for same shall be borne by the contractor.
2. Tenders are invited in sealed covers from the experienced contractors for the carrying out 'Proposed Structural, Civil & Interiors including Electrification, Fire Fighting, HVAC of the Existing Main Temple and Pratikshalaya Structure at Siddhivinayak Temple, Prabhadevi.. All salvage / usable materials shall be property of M/s. Shree Siddhivinayak Ganapati Temple Trust.
3. Before actually taking up the works, the contractor shall ensure proper dis-connection of Electrical power to the building and dis-connection of water supply and sanitary connections to the building.
4. The contractor shall ensure the safety requirements laid down by the local authority and/ Or National Building Code and/ Or P.W.D. Manual. The contractor shall be responsible and should indemnify the Executive Officer, Shree Siddhivinayak Ganapati Temple Trust for all injury / damages/ death to the workmen, to persons, animals, things or any other damage to the devotees or surrounding properties which may arise from the operations. Carelessness, accident or neglect of himself or of any of the workmen/ representatives.

F. AWARD OF CONTRACT

32. Award Criteria

- 32.1 Subject to Clause 32, the Employer will award the Contract to the Bidder whose Bid has been determined
- i. to be substantially responsive to the Bidding documents and who has offered the lowest evaluated Bid Price; and
 - ii. Deleted

33. Employer's Right to Accept any Bid and to Reject any or all Bids

- 33.1 Notwithstanding Clause 31, the Employer reserves the right to accept or reject any Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

34. Notification of Award and Signing of Agreement

- 34.1 The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").
- 34.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause 34 and prevailing stamp duty applicable at the time of signing of agreement.
- 34.3 The Agreement will incorporate all agreements between the Employer and the successful Bidder. It will be signed by the Employer and sent to the successful Bidder, within 28 days following the notification of award along with the Letter of Acceptance. Within 21 days of receipt, the successful Bidder will sign the Agreement and deliver it to the Employer.
- 34.4 Upon the furnishing by the successful Bidder of the Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

35. Performance Security

- 35.1 Within 21 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Security in any of the forms mentioned herein for an amount equivalent to 2 % of the Contract price plus additional security for unbalanced Bids in accordance with Clause 29.5 & 35.5 of ITB and Clause 52 of Conditions of Contract:
- 35.2 All compensation or other sums payable by the Contractor under the terms of this contract or any other contract or on any account may be deducted from his Performance Security or from any sums which may be due to him or may become due to him by Government on any account and in the event of the security being reduced by reason of any such above noted deductions, the Contractor shall within 10 days of receipt of notice of demand from the Engineer-in-charge make good the deficit.
- 35.3 There shall be no liability on the Department to pay any interest on the Performance Security deposited by or recovered from the Contractor.
- 35.4 The Performance Security deposit shall be refunded after completion of defect liability period prescribed for this contract.

35.5 Additional Performance Security Deposit

If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the contract, then contractor shall submit Additional Performance Security as set forth in Clause below

- A. If the tenderer has quoted the offer more than 1% more the estimated rates put to tender, then the tenderer shall have to submit Additional Performance Security Deposit in the form of Bank Guarantee / Demand Draft / Fix Deposit Receipt of any Nationalized or Scheduled bank in favour of the **Shree Siddhivinayak Ganapati Temple Trust, Mumbai.**
- B. The scanned copy of the Bank Guarantee / Demand Draft / Fix Deposit Receipt shall be uploaded and submitted in online Envelope no. 2, through e-tendering process, while the original Bank Guarantee / Demand Draft / Fix Deposit Receipt shall be submitted in the sealed envelope in the office of the **Shree Siddhivinayak Ganapati Temple Trust, Mumbai** within 5 working days from the last date prescribed for the receipt of tender.
- C. The amount of the Bank Guarantee / Demand Draft / Fix Deposit Receipt shall be calculated by the tenderer in accordance with the following manner.
 - i. If the offer is more than 5% more the estimated rates and is up to 10% below, then the amount of the Bank Guarantee / Demand Draft / Fix

Deposit Receipt shall be of the value of 5% of the cost put to tender. (For example: If the rates quoted is 10% below, then the amount of Bank Guarantee should be 1% of the cost put to tender)

- ii. If the offer is more than 10% below then the amount of the Bank Guarantee / Demand Draft / Fix Deposit Receipt shall be of the value of 1% of the cost put to tender plus the amount arrived by applying that percent on the cost put to tender which is the difference of percentage quoted by the tenderer and 10. (For example: If the rates quoted is 17% below, then the amount of Bank Guarantee / Demand Draft / Fix Deposit Receipt should be 8%, i.e. 1% of the cost put to tender plus (17-10)% of the cost put to tender)
- D. The Bank Guarantee / Demand Draft / Fix Deposit Receipt shall be valid up to defect liability period prescribed for this contract, (60 months) after the end of completion date of project. The Additional Performance Security shall be returned immediately upon satisfactory completion of work. The certificate of which shall be issued by the Engineer In Charge before releasing the additional security.
 - E. After opening the online Envelope No. 1, if it is found that the tenderer is not qualified for opening his online Envelope No. 2, then his Bank Guarantee / Demand Draft / Fix Deposit Receipt shall be returned within 7 days. Also after opening online Envelope No.2, except the Bank Guarantee / Demand Draft / Fix Deposit Receipt of 1st and 2nd lowest bidders, the Bank Guarantee / Demand Draft / Fix Deposit Receipt of other bidders shall be returned within 7 days.
 - F. Bank Guarantee / Demand Draft / Fix Deposit Receipt of the 2nd lowest bidder shall be returned within time limit of 30 subsequent working days or award of work to L1 whichever is later.
 - G. Demand draft/Fixed Deposit Receipt/Bank Guarantee of the 2nd lowest bidder be returned in 3 days after the issue of work order to the 1st lowest bidder. In case it is found that the documents/demand draft/fixed deposit receipt/bank guarantee submitted by the tenderer are false or misleading, his earnest money shall be forfeited Govt. as well as the registration of the tenderer shall be suspended for the period of 1 year in addition to the other legal action necessary to be taken as per law. The work order shall be given to the concerned tenderer after the verification of the demand draft/fixed deposit receipt/bank guarantee submitted by him.
 - H. The amount of Additional performance security deposit shall be refunded immediately upon satisfactory completion of work, the certificate of which shall be issued by Executive Officer before releasing the additional security.

Non submission of additional security deposit/performance security or submission of less amount of the additional security deposit shall be liable to summarily rejection of his tender.

36. Advance Payment and Security

- 36.1 Advance Payment shall be provided only if permitted under Contract Data and shall be released upon submission of an Advance Bank Guarantee for the corresponding amount. The Advance shall be recovered from subsequent running bills in accordance with the recovery schedule specified in the Contract.

37. Dispute Review Expert

- 37.1 The Employer will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the Contract in question and will declare the firm ineligible, either indefinitely or for a stated Period of time, to be awarded a contract with Government of Maharashtra / State PWD and any other agencies, if it at any time determines that the firm has engaged in Corrupt or fraudulent practices in competing for the contractor, or in execution.
- 37.2 For works costing above Rs.5 Crore the procedure for arbitration will be as per G.R of Law & Judiciary Department issued vide Sankirn - 2016/C.R. 20/ Ka-19 dt. 13/10/2016 regarding "Institutional Arbitration Policy".

38. Corrupt or Fraudulent Practices

- 38.1 The Employer will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question and will declare the firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract with P.W.D. and any other agencies, if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for the contractor, or in execution.
- 38.2 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 23.2 and Sub-Clause 62.2 of the Conditions of Contract.

39. ROLE OF CONSULTANT

Name of Consultant engaged for project -

M/s Structwel Designers & Consultants Pvt.Ltd.
Structwel, Plot No 15, Sector-24,
 Off Sion Panvel Highway, Turbhe,
 Navi Mumbai- 400705

Name of Consultant engaged for the execution as a PMC:
 M/s. SSA, 203/204 Prabhadevi Industrial Estate

Veer Sawarkar Marg, Prabhadevi
Mumbai 400 025

- a. All detailed drawings & working drawings will be provided by The Consultant. Contractor shall execute the work under the direction & guidance of Engineer-In – Charge and I Consultant.
- b. Specifications of materials and method of execution is to be carried as per the guidance of Consultant and Engineer-in-Charge

<u>APPENDIX to ITB</u> Clause Reference With respect to Section-I			
1	Name of the Employer	Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi,	[Cl. 1.1]
2	The Last Five years	2020-2021 2021-2022 2022-2023 2023-2024 2024-2025	
3	This annual financial turn over amount is during last five years	Rs. 700.00 Lakhs	[Cl. 4.2.A(1)]
4	Value of work is	Rs. _____ /-	[IFB Column 3 in Table]
5	Quantities of work are Marble Flooring Internal Partition (Glass / Gypsum / or any modular) Structural Repairs / any civil grouting to RCC members	500.00 Sqm 300.00 Sqm 300.00 Sqm / 1000.00 kg	[Cl.4.2.A(3)]
6	Satisfactory completion of one similar work during last Five years as a prime contractor of value not less than	Refer bid qualification criteria	[Cl.4.2.A(2)]
7	Price Level of the financial year	2024-2025	
8	The pre-bid meeting will take place at	----- NIL -----	[IFB (2)]
10	Address of the Employer	Shree Siddhivinayak Ganapati Temple Trust, Mumbai	
11	Identification		
	Bid for	<u>Proposed Structural, Civil & Interiors including Electrification, Fire Fighting, HVAC of the Existing Main Temple and Pratikshalaya Structure at Siddhivinayak Temple, Prabhadevi.</u>	

	Bid Reference No.		
	Do not open before	dt. __/__/2025 @ 18.00 hrs	
12	The Bid should be submitted online through e-portal https:// https://mahatenders.gov.in Latest by	dt. __/__/2025 @ 18.00 hrs	[IFB (2)]
13	The Bid will be opened at	Dt. __/__/2025 @ 12.30 hrs. Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi, Mumbai 400028 @ 3rd floor	[IFB (2)]
14	The Bank draft in favour of & payable at	Shree Siddhivinayak Ganapati Temple Trust, payable at Mumbai	[Cl.34.1]
15	The Name of Dispute Review Expert is	Chairman of the Temple Trust	[Cl.36.1]
16	Escalation factors (for the cost of works executed and financial figure to a common base value for works completed)		
	Year Before 1) 2020-2021 2) 2021-2022 3) 2022-2023 4) 2023-2024 5) 2024-2025	Multiply Factor 1.10 1.21 1.33 1.46 1.61	
17.	Under taking by the bidder@ 25% i.e. Rs. 3,25,00,000 /-		[Cl. 8]
18.	Liquid assets and /or availability of Credit Facility @ 10 % i.e. Rs. 13,00,000 /-		[Cl. 7]

ANNEXURE-I
List of Key Plant & Equipment to be deployed on Contract Work
[Reference Cl. 4.2 (B) (4)]

A) QUESTIONNAIRE ON MACHINERY:-

Performa for information regarding availability of machinery required for this work.

Sr. No.	Machinery	Numbers	Maximum age as on 01.03.2025 (Years)
1.	Fully Automatic Micro processor based Programmable Logical Control (PLC) with SCADA enabled concrete Batch Mix Plant (Pan Mixer) of minimum 18-20 cubic metre per hours Capacity of any standard company with SCADA	1 Number Owned	15
2.	Transit Mixer of minimum 6 Cubic Metre Capacity	2 Numbers Owned	15
3.	Concrete pumps of desired number and capacity with 200 metre pipeline with backhole loader with 1.2 cubic metre loader.	2 Number Owned	15
4.	Sand Screening Machines	2 Numbers Owned	15
5.	10 H.P. Pump	2 Numbers Owned	15
6.	Compression Testing Machine (CTM) for the testing cement mortar, concrete at the Site, Linked with "SCADA	1 Number Owned	15
7.	Needle Vibrator	6 Numbers Owned	15
8.	Shuttering of myone/ aluminium shuttering / Ply with Jack Span and Props	Minimum 500 Squire Meter Owned or Hire.	10

NOTE -

- i) Scanned copy of proof of ownership shall be produced.
- ii) Scanned copy of valid certificate issued by the Competent Authority of Public Works Department/Semi-Govt/ or any private organization to the effect that these machinery enlisted in Statement No. - 2-'A' attached herewith are in " Efficient Working Condition" and in conformity with M.O.S. T. Specifications must be enclosed in Envelope No.1. in absence of this Certificate, Envelope No.2 will not be opened
- iii) The use of Machinery and Equipment will be verified with the respective Purchase invoices

The above Certificate shall be subject to following conditions vide Dy. Secretary (Bldg.2), Public Works Deptt., Mantralaya, Mumbai's letter No. Sankirna-2017/CR.2 (H)/Bldg.2, dt. 4/09/2017 and 19/9/2017.

1. The life of the new machinery will be considered as 15 years.
2. There will no need of checking by Superintending Engineer (Mechanical) for first 6 years.
3. After 6th year, the machinery shall be checked and certified for its fitness by Superitnending Engineer (Mechanical) / Assistant Chief Engineer (Mechanical) every 3rd year till be 15th year.
4. After the 15th year, the contractor will get machinery certified every year from Superintending Engineer (Mechanical) / Assistant Chief Engineer (Mechanical) and produce the certificate of fitness. The certificate will be required for machinery where it is necessary and not issued by RTO.

ANNEXURE-II

List of Key Personnel to be deployed on Contract Work during the work is in progress

[Reference Cl. 4.2 (B) (4)]

Sr.No.	Personnel	Qualification & Experience	Min Nos.
1	Project Manager	BE /B.Tech Civil with Minimum 10 Years experience.	1
2	Site Engineer	BE /B.Tech Civil with Minimum 3 Years experience. OR Diploma Civil, with Minimum 5 Years experience.	2

SECTION 2

QUALIFICATION INFORMATION

SECTION – 2

Qualification Information

The information to be filled in by bidders in the following pages will be used for purposes of post-qualification as provided for in Clause 4 of the Instructions to Bidders. This information will not be incorporated in the Contract. Attach additional pages as necessary.

1. Individual Bidders

1.1 Constitution or legal status of Bidder : _____

Place of registration : _____

Principal place of business : _____

Power of attorney of signatory of Bid: _____

1.2. Total annual value of works executed and payments received in the last five years preceding the year in which bids are invited. (In support of this, attested copy of Annual Audit Report certified by the Chartered Accountant in which indicates contract receipts should be submitted.

Sr. No.	Year	Rs. In Lakhs
1	2020-2021	
2	2021-2022	
3	2022-2023	
4	2023-2024	
5	2024-2025	

1.3.1 Work performed as prime Contractor (in the same name and style) on Construction works of a similar nature and value over the last five years. In support of this the work done certificate issued by competent authority should be submitted. (Also submit the Information in following format.)

Project Name	Name of Employer*	Description of work	Value of contract	Contract No.	Date of Issue of Work Order	Stipulated Date of Completion	Actual Date of Completion*	Remarks explaining reasons for Delay, if any
1	2	3	4	5	6	7	8	9

• * Attach certificate(s) from the Engineer(s)-in-Charge

** Immediately preceeding the financial year in which bids are received.

*** Attach certificates from chartered Accountant.

1.3.2. Satisfactorily executed in any one year of last Five years for the following minimum quantities of the work in 2020-21, 2021-22, 2022-23, 2023-24, 2024-25 (information to be uploaded in following statement.) In support of this executed quantity certificate issued by competent authority should be submitted. **

Name of Work : _____

Date of Completion : _____

Completion Cost : _____

Year of Execution : _____

Sr. No	Description of Item	Quantity Executed	Unit	Remark
1				
2				
3				
4				
5				
6				
7				

1.4. Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.

Existing commitments and on-going works :

Description of Work	Place and State	Contract No & Date	Name and Address of Employer	Value of Contract (Rs. In Lakhs)	Stipulated period of completion	Value of works remaining to be completed (Rs. Lakhs) *	Anticipated Date of completion
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Information should be submitted in above format. (In support of this the work in hand certificate as on the date of submission issued by competent authority should be submitted.)

Works for which bids already submitted:

Description of Work	Place and State	Name and Address of Employer	Estimated Value of Works (Rs. Lakhs)	Stipulated period of completion	Date when decision is expected	Remarks, if any
(1)	(2)	(3)	(4)	(5)	(6)	(7)

*Attach certificate(s) from the Engineer(s)-in-Charge.

** Immediately proceeding the financial year in which bids are received.

Availability of key items of Contractor's Equipment essential for carrying out the Works [Ref. Clause 4]. The Bidder should list all the information requested below.

Item of Equipment	Description, make, and age (Years), and capacity	Condition (new, good, poor) and number available	Owned, Hire (from whom?), or to be purchased

Note :

Required documents regarding Proof of Ownership/Hires for above Machinery should be submitted.

1.6 Qualifications of technical personnel proposed for the Contract. Refer also to Clause 4.2 (B) of the Instructions to Bidders and Clause 9.1 of Part-I General Conditions of Contract.

Position	Name	Qualification	Years of experience		
			Road Works	Building Works	Other

1.7 Proposed Sub-contractors and firms involved for construction. Refer to Clause 7 of Part-I General Conditions of Contract.

Section of the works	Value of Subcontract	Sub-contractor (name and address)	Experience in similar work

Note

The capability of the sub-contractor will also be assessed (on the same lines as for the main contractor) before according approval to him.

1.8 Financial reports for the last Five years: balance sheets, profit and loss statements, auditors' reports, etc. List below and attach copies.

1.9 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit. etc. List them below and attach copies of support documents.

1.10 Name, address, and telephone, telex, and facsimile numbers of banks that may provide references if contacted by the Employer.

1.11 Information on current litigation in which the Bidder is involved.

Name of Other party(s)	Employer	Cause of dispute	Litigation where (Court / arbitration)	Amount involved (Rs. In Lakh)	Remarks Showing present status

1.12 Statement of compliance under the requirements of Sub Clause 3.2 of the instructions to Bidders.

Name of Architectural Consultant engaged for project preparation and execution is-

M/s Structwel Designers & Consultants Pvt.Ltd.
Structwel, Plot No 15, Sector-24,
 Off Sion Panvel Highway, Turbhe,
 Navi Mumbai- 400705

1.13. Proposed work method and schedule. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents. [Refer ITB Clause 4.1 & 4.2A (18)]

(Note : Supporting certificates of Govt. works should be signed by not below the rank of Executive Officer. Certificates of Non Govt. work will be accepted subject to supporting certificates should be signed by not below the rank of Executive Officer/Chartered Engineer/Registered Architect. The work done shown in these certificates shall tally with the certificate issued by the Chartered Accountant. The value of existing or in case of Private work certificates from equivalent officers shall be countersigned by the Chartered Accountant. The contractor shall submit a self certified calculation of bid capacity based on above documents. Also for private works bidder have to submit the supporting agreement copy of between owner/ agency and contractor without which certificate for non Govt. works will not be considered (Scanned copy of Certificates/ Copies of supporting agreements should be uploaded/ Submitted)

AFFIDAVIT

1. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.
2. The undersigned also hereby certifies that neither our firm MIs----- have Abandoned any works on National Highways, Government/Semi Government/ Government Undertaking in India nor any contract awarded to us for such works have been rescinded, during last five years prior to the date of this bid.
3. The undersigned hereby authorise(s) and request(s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding my (our) competence and general reputation.
4. The undersigned understand and agrees that further qualifying information may be requested, and agrees to furnish any such information at the request of the Department Project implementing agency.

(Signed by an Authorised Officer of the Firm)

Title of Officer

Name of Firm

Date :

UNDERTAKING

I age years is resident of do hereby certified that given undertaking that I am the proprietor / Partner / Owner of the Company / Firm and has submitted the Tender for the work (Name of work) The documents uploaded (in Envelope No. 1) on <http://pwdmaharashtraetenders.in> are TRUE, CORRECT & COMPLETE (in all respect) to the best of my knowledge.

It is ought to have been held that there are no errors and / or mistakes in the uploaded documents.

It there is any wrong, false misleading, information I will be liable for legal action against me

Contractor's Signature

[The Bound of the above affidavit should be submitted along-with the Tender Fee's DD / Pay order & EMD)

TENDER FOR WORKS

I/We hereby tender for the execution, for the Governor of Maharashtra (here-in-before and here-in after referred to as “Government”) of the work specified in the underwritten memorandum within the time specified in such memorandum for a Item Rate Contract of Rs. _____

and in accordance in all respects with the specifications, designs, drawing and instructions as per conditions of this contract.

MEMORANDUM

A)	Name of Work : Proposed Structural, Civil & Interiors including Electrification, Fire Fighting, HVAC of the Existing Main Temple and Pratikshalaya Structure at Siddhivinayak Temple, Prabhadevi.		
B)	Estimated Cost	Rs. _____ /-	
C)	Earnest Money/Bid security	Rs. 14,00,000/- to be via online using NEFT/ RTGS or payment gateway mode	
D)	Security Deposit	Rs. 14,00,000/-	1% of amount put to Tender rounded to next Rs 1000.
E)	Percentage, if any, to be deducted from bills and by cash so as to make up the total amount required as security deposit by the time, half the work, as measured by the costs, is done.	2 (Two) Percent	
F)	Retention Money		The proportion of payments retained (retention money) shall be 1% from each bill.
G)	Time allowed for the work from date of written order to commence	24 (Twenty Four) calendar months (Including Monsoon)	Give schedule where necessary showing dates by which the various items are to be completed.

Should this tender be accepted I / We here by agree to abide by and fulfil all the terms and provisions of the conditions of contract annexed hereto so far as applicable, and in default thereof to forfeit and pay to Govt. the sums of money mentioned in the said conditions.

Amount to be specified in Words and in Figures : Receipt No.dated from Govt. Treasury or Sub-Treasury at in respect of sum of Rs. is herewith forwarded representing the earnest money, the full value of which is to be absolutely forfeited to the Govt. should I/ We not deposit the full amount of Security Deposit specified in the above Memorandum otherwise the said sum of Rs. shall be refunded.

Date :

✚ Signature of Contractor ✚Contractor.....
before submission of tender. Address.....

*Signature of witness to Date the..... the day of2025.
contractor's signature. (Witness).....
Address:.....
(Occupation).....

The above tender is hereby accepted by me for and on behalf of the Governor of Maharashtra Datedthe day of 2025

.....
.....
.....
.....
.....

Executive Officer,
Shree Siddhivinayak Ganapati Temple Trust

SECTION 3

CONDITIONS OF CONTRACT

Conditions of Contract

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CONDITIONS OF CONTRACT

A. GENERAL

1. Definitions

- 1.1** Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Capital initials are used to identify defined terms.

The **Adjudicator** (synonymous with **Institutional Arbitration Policy**) is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in Clauses 24 and 25. The name of the Adjudicator is defined in the Contract Data.

The **Accepting Authority** shall mean the officer competent to accept the tender.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Bid.

Bid Security shall mean same as **Earnest Money Deposit** wherever mentioned in the bid.

Compensation Events are those defined in Clause 44 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Engineer in accordance with Sub Clause 55.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.3 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Bid to carry out the Works has been accepted by the Employer.

The **Contractor's Bid** is the completed Bidding document submitted by the Contractor to the Employer and includes Technical and Financial bids.

The **Contract Price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; **months** are calendar months.

A **Defect** is any part of the Works not completed in accordance with the Contract.

The **Defects Liability Period** is the period named in the Contract Data and calculated from the Completion Date.

Drawings shall mean the drawings referred to in the specifications and any modifications of such drawings approved in writing by Engineer and such other drawings as may from time to time furnished or approved in writing by the Engineer.

Employer as used in the tender papers shall mean the Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi, Mumbai 400028

The **Engineer** is the person named in the Contract Data (or any other competent person appointed and notified to the contractor to act in replacement of the Engineer-In-Charge) who is responsible for supervising the Contractor, administering the

Contract, certifying payments due to the Contractor, issuing and valuing Variations to the Contract, awarding extensions of time, and valuing the Compensation Events.

Engineer-in-charge as used in the tender papers shall mean **Shree Siddhivinayak Ganapati Temple Trust, Mumbai-1** or any authorized person/agency appointed by Executive Officer.

Equipment is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

Government as used in the tender papers shall mean the Public Works Department of the Government of Maharashtra

The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Engineer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the Works.

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

Project Management Consultant or **PMC** or **Architect** as used in the tender papers shall mean the agency appointed by the Engineer-in-charge as consultant for the said project

P.W.D. or **Department** as used in the tender papers shall mean the Public Works Department of the Government of Maharashtra.

Wherever there is mention of **Schedule of rates** of the Division or simply **D.S.R.** in this tender, it will be taken to mean as “the Schedule of the rate of the Division in whose jurisdiction the work lies”.

The **Site** is the area defined as such in the Contract Data.

Site Investigation Reports are those which were included in the Bidding documents and are factual **interpretative** reports about the surface and sub-surface conditions at the site.

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Engineer.

The **Start Date** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.

Technical Review Committee as used anywhere in the tender shall mean a committee formulated to review, accept/reject materials and installations that are being executed by contractor including certification of RA bills.

Temporary Works are works designed, constructed, installed, and removed by the Contractor which are needed for construction or installation of the Works.

A **Variation** is an instruction given by the Engineer, which varies the Works.

The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

Urgent works shall mean any measure which, in the opinion of the Engineer-in-charge, become necessary during the progress of the works to obviate any risk or accident or failure or which become necessary for security of the work or the persons working, thereon.

2. Interpretation

- 2.1. In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Engineer will provide instructions clarifying queries about the Conditions of Contract.
- 2.2. If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion date for the whole of the Works).
- 2.3. The documents forming the Contract shall be interpreted in the following order of priority:
 - 1) Agreement
 - 2) Contractor's Bid
 - 3) Complete Bid document comprising Section 1 through 9 including Invitation for Bid
 - 4) Contract Data
 - 5) Conditions of Contract including Additional & Special Conditions of Contract
 - 6) Specifications
 - 7) Bill of Quantities
 - 8) Drawings
 - 9) Any other document listed in the Contract Data as forming part of the Contract.

3. Language and Law.

- 3.1. The language of the Contract and the law governing the Contract are stated in the Contract Data.

4. Engineer's Decisions

- 4.1. Except where otherwise specifically stated, the Engineer will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

5. Delegation

- 5.1. The Engineer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

- 6.1. Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Sub-contracting

- 7.1 The Contractor may sub contract any portion of work, up to a limit specified in Contract Data, with the approval of the Engineer but may not assign the Contract without the approval of the Employer in writing. Sub-contracting does not alter the Contractor's obligations-

8. Other Contractors

- 8.1. The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of other Contractors. The Contractor shall as referred to in the Contract Data, also provide facilities and services for them as described in the Schedule. The employer may modify the schedule of other contractors and shall notify the contractor of any such modification.

9. Personnel

- 9.1. The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the Contract Data to carry out the functions stated in the Schedule or other personnel approved by the Engineer. The Engineer will approve any proposed replacement of key personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.
- 9.2. If the Engineer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's Risks

- 10.1. The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's Risks

- 11.1.** The Employer is responsible for the excepted risks which are (a) in so far as they directly affect the execution of the Works in India, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor's employees), and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive, or (b) a cause due solely to the design of the Works, other than the Contractor's design.

12. Contractor's Risks

- 12.1.** All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance

- 13.1.** The Contractor shall take out Insurance Policy/Policies (viz. Contractor's All Risks Insurance Policy, Erection All Risks Insurance Policy etc. as directed by the Directorate of Insurance) so as to vide adequate insurance cover for execution of the awarded contract work for total contract value and complete contract period COMPULSORILY from the "Directorate of Insurance, Maharashtra State, Mumbai" only. Its postal address for correspondence is "264, MHADA, First Floor, Opposite Kalanagar, Bandra (East), Mumbai 400 051 " (Telephone No. 022 –26590403 / 26590690 and Fax No.is 022-26592461 /26590403). Similarly all workmen's appointed to complete the contract work are required to insure under workmen's compensation Insurance Policy. Insurance Policy/ Policies taken out from any other company will not be accepted. If any contractor has not taken out the Insurance Policy from the Directorate of Insurance, Maharashtra State Mumbai or have effected insurance with any Insurance Company, the same will not be accepted and one percent (1%) of the tender document or such amount of premium calculated by the Government Insurance Fund will be recovered directly from the amount payable to the Contractor for the executed contract work and paid to the Directorate of Insurance Fund, Maharashtra State, Mumbai. The Director of Insurance reserves the right to distribute the risks of insurance among the other insurers.
- 13.2** Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.
- 13.3** If the Contractor does not provide any of the policies and certificates required, the Employer may affect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.
- 13.4** Alterations to the terms of insurance shall not be made without the approval of the Engineer-In-Charge.

13.5 Both parties shall comply with any conditions of the insurance policies.

13.6 CESS ON BUILDING & CONSTRUCTION LABOUR WELFARE

An amount of equal to one percent on amount of tendered amount shall be deducted from the payment of contractor as a cess on building & construction labour welfare.

14. Site Investigation Reports

14.1 It's is contractor's responsibility to evaluate surface & subsurface conditions at site on his own at his own expenses and shall quote accordingly. No claim shall be entertained with regard to surface or subsurface conditions.

15. Queries about the Contract Data

15.1 The Engineer will clarify queries on the Contract Data.

16. Contractor to Construct the Works

16.1. The Contractor shall construct and install the Works in accordance with the Specification and Drawings.

17. The Works to be completed by the Intended Completion Date

17.1. The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Engineer, and complete them by the Intended Completion Date.

18. Approval by the Engineer

18.1. The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Engineer, who is to approve them if they comply with the Specifications and Drawings.

18.2. The Contractor shall be responsible for design of Temporary Works.

18.3. The Engineer's approval shall not alter the Contractor's responsibility for design of the Temporary Works.

18.4. The Contractor shall obtain approval of third parties to the design of the Temporary Works where required.

18.5. All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Engineer before their use.

19. Safety

19.1. The Contractor shall be responsible for the safety of all activities on the Site,

20. Discoveries

20.1. Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

21. Possession of the Site

21.1. The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event (compensation will be in terms of prorata time extension of intended completion date ONLY)

22. Access to the Site

22.1. The Contractor shall allow the Engineer and any person authorized by the Engineer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. Instructions

23.1. The Contractor shall carry out all instructions of the Engineer pertaining to works which comply with the applicable laws where the Site is located.

23.2. The Contractor shall permit the Employer to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the Employer, if so required by the Employer.

24. Disputes.

- 24.1. If the Contractor believes that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to the Dispute Review Expert usually within 14 days of the notification of the Engineer's decision.

25. Procedure of Disputes

- 25.1 Deleted

- 25.2 For works costing above Rs.5 Crore the procedure for arbitration will be as per G.R of Law & Judiciary Department issued vide Sankirn-2016/C.R. 20/ Ka-19 dt. 13/10/2016 regarding "Institutional Arbitration Policy".

26. Replacement of Dispute Review Expert

- 26.1 Should the Dispute Review Expert resign or die, or should the Employer and the Contractor agree that the Dispute Review Expert is not fulfilling his functions in accordance with the provisions of the Contract, a new Dispute Review Expert will be jointly appointed by the Employer and the Contractor. In case of disagreement between the Employer and the Contractor, within 30 days, the Dispute Review Expert shall be designated by the Appointing Authority designated in the Contract Data at the request of either party, unusually within 14 days of receipt of such request.

B. TIME CONTROL

27. Programme

- 27.1. Within the time stated in the Contract Data the Contractor shall submit to the Engineer for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works along with monthly cash flow forecast.
- 27.2. An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.
- 27.3. The Contractor shall submit to the Engineer, for approval, an updated Program at intervals no longer than the period stated in the Contract Data. If the Contractor does not submit an updated Programme within this period, the Engineer may withhold the amount stated in the Contract Data from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Programme has been submitted.
- 27.4. The Engineer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Engineer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

28. Extension of the Intended Completion Date

- 28.1. The Chairman of the Trustee shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work and which would cause the Contractor to incur additional cost.
- 28.2. The Chairman of the Trustee shall decide whether and by how much to extend the Intended Completion Date as per the actual requirement of the work.
- 28.3. The Chairman of the Trustee shall take decision after receiving full justification from the contractor & Engineer In Charge, for extension of Intended Completion Date.

29. DELETED

30. Delays Ordered by the Engineer

- 30.1 The Engineer may instruct the Contractor to delay the start or progress of any activity within the Works.
- 30.2 If at any time after the execution of the contract documents the Engineer-in-charge shall for any reason whatsoever (other than default on the part of the Contractor for which the Government is entitled to rescind the contract) desire that the whole or any part of the work specified in the tender should be suspended for any period or that the whole or part of the work should not be carried out at all, he shall give to the Contractor a notice in writing of such desire and upon the receipt of such notice the Contractor shall forthwith suspend or stop the work wholly or in part as required, after having due regard to the appropriate stage at which the work should be stopped or suspended so as not to cause any damage or injury to the work already done or endanger the safety thereof provided that the decision of the Engineer as to the stage at which the work or any part of it could be or could have been safely stopped or suspended shall be final and conclusive against the Contractor. The Contractor shall have no claim to any payment or compensation whatsoever by reason of or in pursuance of any notice as aforesaid, on account of any suspension, stoppage or curtailment except to the extent specified hereinafter.
- 30.3 Where the total suspension of work ordered as aforesaid continued of a continuous period exceeding 90 days the Contractor shall be at liberty to withdraw from the contractual obligations under the contract so far as it pertains to the unexecuted part of the work by giving a 10 days prior notice in writing to the Engineer, within 30 days of the expiry of the said period of 90 days, of such intention and requiring the Engineer to record the final measurements of the work already done and to pay final bill. Upon giving such notice the Contractor shall be deemed to have been discharged from his obligation to complete the remaining unexecuted work under his contract. On receipt

of such notice the Engineer shall proceed to complete the measurement and make such payment as may be finally due to the Contractor within a period of 90 days from the receipt of such notice in respect of the work already done by the Contractor. Such payment shall not in any manner prejudice the right of the Contractor to any further compensation under the remaining provisions of this clause.

- 30.4 Where the Engineer required the Contractor to suspend the work for a period in excess of 30 days at any time or 60 days in the aggregate the Contractor shall be entitled to apply to the Engineer within 30 days of the resumption of work after such suspension for payment of compensation to the extent of pecuniary loss suffered by him in respect of working machinery remained idle on the site or on the account of his having had to pay the salary or wages of labour engaged by him during the said period of suspension, provided always that the Contractor shall not be entitled to any claim in respect of any such working machinery, salary or wages for the first 30 days whether consecutive or in the aggregate of such suspension or in respect of any suspension whatsoever occasioned by unsatisfactory work or any other default on his part. The decision of the Engineer in this regard shall be final and conclusive against the Contractor.

- 30.5 In the event of -

- i. Any total stoppage of work on notice from the Engineer under sub-clause 30.2 in that behalf.
- ii.
- iii. Withdrawal by the Contractor from the contractual obligation to complete the remaining unexecuted work under sub-clause 30.3 on account of continued suspension of work a period exceeding 90 days.

OR

- iv. Curtailment in the quantity of item or items originally tendered on account of any alteration, omission or substitution in the specifications, drawings, designs, or instructions under clause 38 where such curtailment exceeds 25% in quantity and the value of the quantity curtailed beyond 25% at the rates for the item specified in the tender is more than Rs. 5,000/-

It shall be open to the Contractor, within 90 days from the service of (i) the notice of stoppage of work or (ii) the notice of withdrawal from the contractual obligations under the contract on account of the continued suspension of work or (iii) notice under clause 38 resulting in such curtailment, to produce to the Engineer satisfactory documentary evidence that he had purchased or agreed to purchase material for use in the contracted work, before receipt by him of the notice of stoppage, suspension or curtailment and require the Government to take over on payment such material at the rates determined by the Engineer, provided, however, that such rates shall in no case exceed the rates at which the same was acquired by the Contractor. The Government shall thereafter take over the material so offered, provided the quantities offered, are

not in excess of the requirements of the unexecuted work as specified in the accepted tender and are of quality and specifications approved by the Engineer.

- 30.6 The Contractor shall not be entitled to claim any compensation from Government for the loss suffered by him on account of delay by Government in the supply of materials entered in Schedule A where such delay is caused by
- i. Difficulties relating to the supply of railway wagons.
 - ii. Force majeure.
 - iii. Act of God.
 - iv. Act of enemies of the State or any other reasonable cause beyond the control of Government.

In the case of such delay in the supply of materials, Government shall grant such extension of time for the completion of the works as shall appear to the Executive Officer to be reasonable in accordance with the circumstances of the case. The decision of the Executive Officer as to the extension of time shall be accepted as final by the Contractor.

31. Management Meetings

- 31.1. Either the Engineer or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.
- 31.2. The Engineer shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken is to be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

32. Early Warning

- 32.1. The Contractor is to warn the Engineer at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price or delay the execution of works. The Engineer may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate is to be provided by the Contractor as soon as reasonably possible.
- 32.2. The Contractor shall cooperate with the Engineer in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Engineer.

C. QUALITY CONTROL

33. Identifying Defects

- 33.1. The Engineer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Engineer may instruct the Contractor to search for a Defect and to uncover and test any work that the Engineer considers may have a Defect.

34. Tests

- 34.1. If the Engineer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples.

35. Correction of Defects

- 35.1. The Engineer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.
- 35.2. Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Engineer's notice.

36. Uncorrected Defects

- 36.1. If the Contractor has not corrected a Defect within the time specified in the Engineer's notice, the Engineer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.
- 36.2. If at any time before the security deposit or any part thereof is refunded to the Contractor it shall appear to the Engineer-in-charge or his subordinate in charge of the work that any work has been executed with unsound, imperfect or unskillful workmanship or with materials of inferior quality, or that any materials or articles provided by him for the execution of the work are unsound or of a quality inferior to that contracted for, or are otherwise not in accordance with the contract, it shall be lawful for the Engineer-in-charge to intimate this fact in writing to the Contractor and then notwithstanding the fact that the work, materials or articles complained of may have been inadvertently passed certified and paid for, the Contractor shall be bound forthwith to rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or if so required shall remove the materials or articles at his own charge and cost and in the event of his failing to do so within a period to be specified by the Engineer-in-charge in the written intimation aforesaid, the Contractor shall be liable to pay compensation at the rate of one percent on the amount of the

estimate for everyday not exceeding 10 days during which the failure so continues and in the case of any such failure the Engineer-in-charge may rectify or remove and re-execute the work or remove, and replace the materials or articles complained of as the case may be at the risk and expense in all respects of the Contractor. Should the Engineer-in-charge consider that any such inferior work or materials as prescribed above may be accepted or made use of, it shall be within his discretion to accept the same at such reduced rates as he may fix therefore.

- 36.3 If during the period of defect liability period the said work is defective in any manner whatsoever the Contractor shall forthwith on receipt of notice in that behalf from the Executive Officer, duly commence execution in every respect all the work that may be necessary for rectifying and setting right the defects specified therein including dismantling and reconstruction of unsafe portions strictly in accordance with and in the manner prescribed and under the supervision of the Executive Officer. In the event of the Contractor failing or neglecting to commence execution of the said rectification work within the period prescribed therefore in the said notice and/or to complete the same as aforesaid as required by the said notice, the Executive Officer may get the same executed and carried out departmentally or by any other agency at the risk, on account and at the cost of the Contractor. The Contractor shall forthwith on demand pay to the Government the amount of such cost, charges and expenses sustained or incurred by the Government of which the certificate of the Executive Officer shall be final and binding on the Contractor. Such costs, charges and expenses shall be deemed to be arrears of land revenue and in the event of the Contractor failing or neglecting to pay the same on demand as aforesaid without prejudice to any other rights and remedies of the Government the same may be recovered from the Contractor as arrears of land revenue. The Government shall also be entitled to deduct the same from any amount which may then be payable or which may therefore become payable by the Government to the Contractor either in respect of the said work or any other work whatsoever or from the amount of security deposit retained by Government. The defect liabilities period in particular for water proofing and anti termite treatment (building work) shall be 10 years.

D. COST CONTROL

37. Bill of Quantities

- 37.1. The Bill of Quantities shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.
- 37.2. The Bill of Quantities is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

38. Changes in the Quantities

- 38.1 **Excess Quantity if required to be executed only after permission of the authority granting approval to the work from the Temple Trustee. It shall be paid at tender rate only.**

38.2 Deleted

38.3. Deleted

39. Variations (Extra Items) - DELETED

In the event of such situation arises in the interest of the project where it becomes absolute necessary to introduce any item(s) that are completely new and are in addition to the items contained in the BOQ, such item(s) shall be termed as “Extra Item”.

Contract shall obtain prior approval of Engineer-in-Charge for executing such extra item(s). Extra item(s) executed without approval of Engineer-in-Charge shall not be considered for payment.

The contractor may within 15 days of receipt of approval of Engineer-in-Charge submit rates of such extra item(s), supported by proper analysis which shall include invoices, vouchers etc. and Manufacturer's specification for the work, failing which the rate approved later by the Engineer- in-charge shall be binding. The contractor shall consider 15% on the cost of materials & labour to cover all overheads and profit

40. Payments for Variations

40.1. The employer shall call for competitive quotations (with breakdown of unit rates) for carrying out the Variation for Non-DSR items. The Engineer shall assess the quotations. The variation shall be paid as per current DSR rates for DSR items. The approved rates shall be further adjusted by the percentage of tendered rate with respect to the department's estimated rate for particular item. Changes in specifications, whenever required by the work shall not vitiate the contract.

40.2. If the work in the Variation corresponds with an item description in the Bill of Quantities and if, in the opinion of the Engineer, the quantity of work above the limit stated in Sub Clause 38.1 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.

40.3. Deleted

40.4. If the Engineer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given.

40.5. The Contractor shall not be entitled to additional payment for costs which could have been avoided by giving early warning.

41. Cash Flow Forecasts

- 41.1. When the Program is updated, the contractor is to provide the Engineer with an updated cash flow forecast.

42. Payment Certificates/ Running Account Bill

- 42.1. The Contractor shall submit to the Engineer monthly statements of the estimated value of the work completed less the cumulative amount certified previously in the department's format for R.A. Bill.
- 42.2. The Engineer shall check the Contractor's monthly statement within 14 days and certify the amount to be paid to the Contractor after taking into account any credit or debit for the month in question in respect of materials for the works in the relevant amounts and under conditions set forth in clause 51 of the Contract Data (Secured Advance).
- 42.3. The value of work executed shall be determined by the Engineer.
- 42.4. The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.
- 42.5. The value of work executed shall include the valuation of Variations and Compensation Events.
- 42.6. The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
- 42.7 Submission of monthly bill in prescribed form:**
1. It is responsibility of the contractor to submit the bill monthly to the Engineer-In-charge.
 2. To discharge his responsibility the contractor shall submit the bill in prescribed form.
 3. In doing so he shall use sanctioned copy of Tender paper.
 4. In support of the bills, required measurements, drawings, quality control reports, site supervision data (SCADA) shall be submitted. The data so submitted shall have a facility to Tightly integrate it with the contract conditions, provisions in the Maharashtra Public Works manual, Maharashtra Public Works Account Code (updated to date of submission of this tender) and current general engineering practices (issued through various govt. resolutions, govt. circulars, Chief Engineer's Circulars etc. issued up to date of submission of this tender) followed in Public Works Department.
 5. The submission of bill shall be in the standard P.W.D. format.

43. Payments

- 43.1. Payments shall be adjusted for deductions for advance payments, retention, other recoveries in terms of the contract and taxes at source, as applicable under the law. The Employer shall pay the Contractor the amounts certified by the Engineer normally within 15 days of the date of each RA Bill, subject to availability of funds and subject to quality and quantities of work done are acceptable to Engineer-In-Charge. However delay in payment for whatsoever reason, contractor shall not be entitled for any monetary claims.
- 43.2. The rates for several items of works estimated to cost more than Rs.1,000/- agreed to within shall be valid only when the items concerned is accepted as having been completed fully in accordance with the sanctioned specifications. In cases where the items of work are not accepted as so contemplated by the Engineer-in-charge he may make payment on account of such items at such reduced rates as he may consider reasonable in the preparation of final or on account bills.
- 43.3. Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.
- 43.4. Contractor shall submit a certificate to the effect that **“All the payments to the labour/staff are made in bank accounts of staff linked to Unique Identification Number (AADHAR CARD)”**. The certificate shall be submitted by the contractor within 60 days from the commencement of contract. If the time period of contract is less than 60 days then such certificates shall be submitted within 15 days from the date of commencement of contract.
- 43.5. Its sole responsibility of Contractor to pay GST to Govt. from time to time. Contractor shall produce all relevant details & up to date statement of GST payments. And amount paid by Contractor on account of GST shall be reimbursed to Contractor after due verification by Engineer In Charge.

44. Compensation Events

- 44.1. The compensation shall be given only in terms of time extension as Extension of Time of intended completion date.
If the Contractor shall desire an extension of the time for completion of work on the ground of his having been unavoidably hindered in its execution or on any other grounds, he shall apply in writing to the Executive Officer before the expiration of the period stipulated in the tender or before the expiration of 30 days from the date on which he was hindered as aforesaid or on which the cause for asking for extension occurred, whichever is earlier and the Executive Officer or in the opinion of Chairman of the Trustee as the case may be if in his opinion, there were reasonable grounds for

granting an extension, grant such extension as he thinks necessary or proper, the decision of the Executive Officer in this matter shall be final.

- 44.2. If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Intended Completion Date is extended. The Engineer shall decide whether and by how much the Intended Completion Date shall be extended proportionately.
- 44.3. As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast has been provided by the Contractor, it is to be assessed by the Engineer. If the Contractor's forecast is deemed unreasonable, the Engineer shall adjust the extension of time based on Engineer's own forecast. The Engineer will assume that the Contractor will react competently and promptly to the event.
- 44.4. The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Engineer.

45. Tax

- 45.1. The rates quoted by the contractor shall be deemed to be inclusive of all tax other than Goode and Service Tax 2017 that the contractor will have to pay for performance of this contract. The rate quoted by the contractor shall be exclusive of Goods and Service tax 2017 which shall be paid extra by the employer at prevailing rates. The employer will perform such duties in regard to the deduction of such taxes at sources as per applicable law.
- 45.2. The CGST & SGST each at 1.00% (Total 2.0%) including surcharge or percentage in force from time to time shall be deducted from bill amount whether measured bill, advance payment or secured advance.
- 45.3. It is binding on the contractor to execute the agreement on non Judicial Stamp Paper purchased by him amounting to value applicable to tender cost.

46. Currencies

- 46.1. All payments shall be made in Indian Rupees.

47. Price Adjustment

- 47.1. Contract Price shall be adjusted for increase or decrease in rates and prices of Bitumen, Steel and Cement in accordance with the following principles and procedures and as per formula given in the Contract Data (Appendix A.)
 - (a) The price adjustment shall apply for the work done from the start date given in the Contract Data upto end of the initial intended completion date or extensions granted

By the Engineer and shall not apply to the work carried out beyond the stipulated time for reasons attributable to the Contractor.

- (b) The price adjustment shall be determined during each month from the formula given in the contract data

48. Retention

- 48.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the Contract Data until Completion of the whole of the Works.
- 48.2. On Completion of the whole of the works half the total amount retained is repaid to the contractor and half when the defects liability period has passed and the Engineer has certified that all defects notified by the Engineer to the Contractor before the end of this period have been corrected.
- 48.3. On completion of the whole works, the contractor may substitute retention money with an "on demand" Bank guarantee.

49. Liquidated Damages

- 49.1. The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day during the circumstances where progress of work is lagging behind milestones as defined in contract data and bar chart or the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the contract data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect Contractor's liabilities.
- 49.2. If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate.
- 49.3. If the contractor fails to comply with the time for completion as stipulated in the tender, then the contractor shall pay to the employer the relevant sum stated in the Contract Data as Liquidated damages for such default and not as penalty for everyday or part of day which shall elapse between relevant time for completion and the date stated in the taking over certificate of the whole of the works on the relevant section, subject to the limit stated in the contract data.

The employer may, without prejudice to any other method of recovery deduct the amount of such damages from any monies due or to become due to the contractor. The payment or deduction of such damages shall not relieve the contractor from his

obligation to complete the works on from any other of his obligations and liabilities under the contract.

- 49.4. If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking - Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking Over Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

50. DELETED

51. Secured Advance

The Engineer if he thinks fit to do so, may make advance payment in respect of materials brought by the contractor on work site intended for immediate utilization on works but not yet incorporated in the Works in accordance with conditions stipulated in the Contract Data. Form 31 as set forth in Section-8 of shall be submitted along with secured advance.

- a) The materials are in accordance with the specification for Works.
- b) Such materials have been delivered to site, and are properly stored and protected against damage or deterioration to the satisfaction of the Engineer. The contractor shall store the bulk material in measurable stacks.
- c) The Contractor's records of the requirements, orders, receipt and use of materials are kept in a form approved by the Engineer and such records shall be available for inspection by the Engineer.
- d) The contractor shall submit with his monthly statement the estimated value of the materials on site together with such documents as may be required by the Engineer for the purpose of valuation of the materials and providing evidence of ownership and payment thereof.
- e) Ownership of such materials shall be deemed to vest in the Employer for which the Contractor has submitted an Indemnity Bond in an acceptable format; and
- f) The quantities of materials are not excessive and shall be used within a reasonable time as determined by the Engineer.

52. Securities

- 52.1. The Performance Security (including additional security for unbalanced bids) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and denominated in Indian Rupees. The Performance Security shall be valid until a date 28 days from the date of expiry of Defects Liability Period and the additional security for unbalanced bids shall be valid until a date 28 days from the date of issue of the certificate of completion.

53. DELETED

54. Cost of Repairs

- 54.1. Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

55. Effectiveness of Contract

This Contract shall come into force and effect on the date on which the LOA / Work Order is issued.

56. Expiration of Contract

Unless terminated earlier pursuant to Clause 62 hereof, this Contract shall terminate when, pursuant to the provisions hereof, the Services have been completed, and the payments of remuneration and reimbursable expenditures have been made. This contract shall automatically expire at the end of contract period unless extended expressly by both the parties in writing. In case the services have been rendered to mutual satisfaction by both the parties and necessary payments are made, the contract shall automatically expire even if the contract period is not over.

57. Force Majeure

- a) For the purposes of this Contract, "Force Majeure" means an event which is beyond reasonable control of a Party, and which makes a Party's performance of its obligations hereunder impossible or so impractical as reasonably to be considered impossible in the circumstances, and includes, but is not limited to, war, riots, civil disorder, earthquake, fire, explosion, storm, flood or other adverse weather conditions, strikes, lockouts or other industrial action (except where such strikes, lockouts or other industrial action are within the power of the Party invoking Force Majeure to prevent), confiscation or any other action by government agencies.
- b) Force Majeure shall not include-

- 1) any event which is caused by the negligence or intentional action of a Party or such Party's agents or employees, nor
- 2) Any event which a diligent Party could reasonably have been expected to both
 - i. take into account at the time of the conclusion of this Contract, and
 - ii. Avoid or overcome the carrying out of its obligations hereunder.

E. FINISHING THE CONTRACT

58. Completion

- 58.1 The Contractor shall request the Engineer to issue a Certificate of Completion of the Works and the Engineer will do so upon deciding that the Work is completed.

59. Taking Over

- 59.1. The Employer shall take over the Site and the Works within seven days of the Engineer issuing a certificate of Completion.

60. Final Account

- 60.1. The Contractor shall supply to the Engineer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Engineer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Engineer shall decide on the amount payable to the Contractor and issue a payment certificate, within 56 days of receiving the Contractor's revised account.

61. Operating and Maintenance Manuals

- 61.1. "As built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.
- 61.2. If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract Data, or they do not receive the Engineer's approval, the Engineer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

62. Termination

62.1. The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

62.2. Fundamental breaches of Contract include, but shall not be limited to the following:

- (a) The Contractor stops work for 15 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Engineer;
- (b) Deleted
- (c) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
- (d) Deleted
- (e) the Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer;
- (f) The Contractor does not maintain a security which is required;
- (g) the Contractor has delayed the completion of works by the number of days for which the amount of liquidated damages becomes equal to security deposit amount; and
- (h) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

For the purpose of this paragraph: "corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition."

62.3. When either party to the Contract gives notice of a breach of contract to the Engineer for a cause other than those listed under Sub Clause 62.2 above, the Engineer shall decide whether the breach is fundamental or not.

62.4. Notwithstanding the above, the Employer may terminate the Contract as per Clause 30.

62.5. If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

63. Payment upon Termination

63.1 In any case in which under any clause of this contract of the Contractor shall have rendered himself liable to pay compensation amounting to the whole of this security deposit whether paid in one sum or deducted by installments or in the case of abandonment of the work owing to serious illness or death of the Contractor or any other causes, the Executive Engineer, on behalf of the Governor of Maharashtra

shall have power to adopt any of the following courses, as he may deem best to the interest of Government.

- a) To rescind the contract (for which recession notice in writing to the Contractor under the hand on Executive Officer shall be conclusive evidence) and in that case the security deposit of the Contractor shall stand forfeited and be absolutely at the disposal of the Government.
- b) To carry out the work or any part of the work departmentally debiting the Contractor with the cost of the work, expenditure incurred on tools and plant, and charges of additional supervisory staff including the cost of work-charged establishment employed for getting unexecuted part of the work completed and crediting him with the value of the work done departmentally in all respects in the same manner and at the same rates as if it had been carried out by the Contractor under the terms of his contract. The certificate of the Executive Officer as to the costs and the other allied expenses so incurred and as to the value of the work so done departmentally shall be final and conclusive against the Contractor.
- c) To order that the work of the Contractor be measured up and to take such part thereof as shall be unexecuted, out of his hands and to give it to another Contractor to complete, in which case all expenses incurred on advertisement for fixing a new contracting agency, additional supervisory staff including the cost of work-charged establishment and the cost of the work executed by the new contract agency will be debited to the contractor and the value of the work done or executed through the new contractor shall be credited to the contractor in all respects and in the same manner and at the same rates as if it had been carried out by the Contractor under the terms of his contract. The certificate of the Executive of the Executive Officer as to all the costs of the work and other expenses as aforesaid for or in getting the unexecuted work done by the new contractor and as to the value of the work so done shall be final and conclusive against the Contractor.

In case the contract shall be rescinded under clause (a) above the Contractor shall not be entitled to recover or be paid, any sum for any work therefore actually performed by him under this contract unless and until the Executive Officer shall have certified in writing the performance of such work and the amount payable to him in respect thereof and he shall only be entitled to be paid the amount so certified. In the event of either of the courses referred to in Clause (b) or (c) being adopted and the cost of work executed departmentally or through a new contractor and other allied expenses exceeding the value of such work credited to the Contractor, the amount of excess shall be deducted from money due to the Contractor, by Government under the contract or otherwise howsoever or from his security deposit or the sale proceeds thereof provided, however that the Contractor shall have no claim against Government even if the certified value of the work done departmentally or through a new contractor exceeds the certified cost of such work and allied expenses, provided always that whichever of the

three courses mentioned in clauses (a), (b) or (c) is adopted by the Executive Officer, the Contractor shall have no claim to compensation for any loss sustained by reason of his having purchased, or procured any materials, or entered into any engagements or made any advances on account of, or with a view to the execution of the work or the performance of the contract.

- d) If the progress of any particular portion of the work is unsatisfactory, the Executive Officer shall notwithstanding that the general progress of the work is in accordance with the conditions mentioned in clause 49 (liquidated damages), be entitled to take action under clause 60.1(b) after given the Contractor 10 days notice in writing. The contractor will have no claim for compensation, for any loss sustained by him owing to such action.

- 63.2. If the Contract is terminated at the Employer's convenience or work is withdrawn as per clause 30 of the contract, the Engineer shall issue a certificate for the value of the work done, the cost of balance material brought by the contractor and available at site, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract and less taxes due to be deducted at source as per applicable law.

64. Property

- 64.1 All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor's default.

65. Release from Performance

- 65.1. If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made.

F. SPECIAL CONDITIONS OF CONTRACT

The contractor's offer shall be inclusive of all costs of abiding by the laws and regulations of statutory authorities. Some of the laws are as follows:

1. LABOUR:

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Engineer may require.

2. COMPLIANCE WITH LABOUR REGULATIONS:

During continuance of the contract, the Contractor and his sub-contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that are applicable to construction industry are given below. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, the Engineer/Employer shall have the right to deduct any money due to the Contractor including his amount of performance security. The Employer/Engineer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

SALIENT FEATURES OF SOME MAJOR LABOUR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTION WORK

- a) **Workmen Compensation Act 1923:** The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- b) **Payment of Gratuity Act 1972:** Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years service or more on death, the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- c) **Employees P.F. and Miscellaneous Provision Act 1952:** The Act Provides for monthly contributions by the employer plus workers @ 10% or 8.33%. The benefits payable under the Act are:
 - (i) Pension or family pension on retirement or death, as the case may be.

- (ii) Deposit linked insurance on the death in harness of the worker, (iii) Payment of PR accumulation on retirement/death etc.
- d) **Maternity Benefit Act 1951:** The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- e) **Contract Labour (Regulation & Abolition") Act 1970:** The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by Law. The Principal Employer is required to take Certificate of Registration and the Contractor is required to take licence from the designated Officer, The Act is applicable to the establishments or Contractor of Principal Employer, if they employ 20 or more contract labour.
- f) **Minimum Wages Act 1948:**The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act, if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employments.
- g) **Payment of Wages Act 1936:** It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- h) **Equal Remuneration Act 1979:** The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against Female employees in the matters of transfers, training and promotions etc.
- i) **Payment of Bonus Act 1965:** The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs.3500/-per month or less. The bonus to be paid to employees getting Rs.2500/- per month or above up to Rs.3500/- per month shall be worked out by taking wages as Rs.2500/ -per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.
- j) **Industrial Disputes Act 1947:** The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- k) **Industrial Employment (Standing Orders) Act 1946:** It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.
- l) **Trade Unions Act 1926:** The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.
- m) **Child Labour (Prohibition & Regulation) Act 1986:** The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides

for regulation of employment of children in all other occupations and processes. Employment of Child Labour is prohibited in Building and Construction Industry.

- n) **Inter-State Migrant workmen's (Regulation of Employment & Conditions of Service) Act 1979:**The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home upto the establishment and back, etc.
- o) **The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996:**
As per Government of Maharashtra, Industry, Energy & Labour Deptt. G.R. No. BLA 2009/Pra.Kra.108/Kamgar-7A, dt. 17/6/2010 & Public Works Department Circular No. BDG-2010/Pra.kra.277/Building-2, dated 28/09/2010, Building and Other Construction Workers Welfare Cess at one percent (1%) or at the rates amended from time to time as intimated by the competent authority under Building and Other Constructions Worker Welfare Act 1996 will be deducted from the Bill amount, whether measured Bill, advance payment or Secured Advance.
- p) **Factories Act 1948:**The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

3. **Arbitration**

- 3.1 The Employer proposes that [name of proposed Dispute Review Expert as indicated in Appendix] be appointed as Dispute Review Expert under the Contract, at a daily fee as indicated in Appendix plus reimbursable expenses. If the Bidder disagrees with this proposal, the Bidder should so state in the Bid. If in the Letter of Acceptance, the Employer has not agreed on the appointment of the Dispute Review Expert, the Dispute Review Expert shall be appointed by the Council of Indian Roads Congress at the request of either party.
- 3.2 For works costing above Rs.5 Crore the procedure for arbitration will be as per G.R of Law & Judiciary Department issued vide Sankirn-2016/C.R. 20/ Ka-19 dt. 13/10/2016 regarding "Institutional Arbitration Policy".

4. **Goods and Services Tax (GST)**

As per Section 51 of the CGST and MGST Act, TDS will be deducted from Running Account Bills as per the notified rates and from the notified dates by the Government. Bidders are required to submit Registration Number as supplier under GST.

5. **Payment Through electronic medium**

The contractor will have to provide his Bank Account details and Income Tax PAN for effecting electronic payment in the required Format.

6. **Unique Identification Number (AADHAR) linked Payment by Contractor**

Vide GR No. Govt. Of Maharashtra , Public Works Department. Mantralaya Nagpur No. Tender 2016/CN20/ shikana /Bldg -2 dated 09/12/2016 Contractor shall submit a certificate to the effect that all the payments to the labour / staff are made in bank accounts linked to Unique Identification Number (AADHAR). The certification shall be submitted by the contractor within 60 days from the commencement of the contract. If the time period of contract is less than 60 days then such certificate shall be submitted within 15 days from the date of commencement of contract.

7. Original Invoice for Asphalt issued by the Manufactures will be retained with the Bills and will not be returned to the contractors.
8. Bills to be submitted in the format provided by the Dept. Viz. E-Bills Form-47 etc.

G. Project Specific Special Conditions of Contract :

- 1.0 Siddhivinayak Temple, Mumbai being high secured premises, contractor shall visit the site & assess the prevailing working conditions.
- 2.0 All the workers proposed to be deployed at site must have good character & contractor shall ensure the same. Contractor has to ensure identity of the labour and other staff as per the requirement the Siddhivinayak Temple authority as and when required for security reasons.
- 3.0 Contractor is expected to study the same before bidding. This will not be entertained as cause of delay for execution of the work. Contractor shall deploy his machinery, resources, sound dampening devices & safety measures accordingly.
- 4.0 No labour camp is allowed in Siddhivinayak Temple Mumbai premises. Contractor has to arrange at his own cost all the arrangement for labour camp, their movements from site to labour camp etc.
- 6.0 All the construction and its allied activities to be done from sunrise to sunset only.
- 7.0 The Contractor shall be a devotee of 'Lord Siddhivinayak' and a Hindu with prior experience in executing works associated with Hindu religious temples..

SECTION 4

GENERAL DESCRIPTION

Name of Work: Proposed Structural, Civil & Interiors including Electrification, Fire Fighting, HVAC of the existing Main Temple and Pratikshalaya Structure at Siddhivinayak Temple, Prabhadevi.

General Description

A. MAIN TEMPLE BUILDING

- a. Balance civil & structural repairs of the internal area including staircase & exterior mezzanine to ground floor.
- b. Waterproofing of the open terraces at mezzanine level and bath area at 2nd floor
- c. Complete replacement of internal flooring (basement, ground + 5 floor)
 - i. Makrana Marble to the Flooring and Vitrified for the Staircase area
 - ii. Pink Makrana Marble for the Internal floor
 - iii. Granite cladding to the ground floor ghabaara
 - iv. Vitrified tile for bathroom cladding/flooring
- d. Complete replacement of granite dado/cladding, FRP brackets/moulding for the ground floor ghabaara (Except for providing new glass roof and FRP cladding for columns)
- e. Providing sound proof DGU glass partitions for the mezzanine floor level
- f. Complete replacement of exterior windows with UPVC window
- g. Complete re-planning of the interiors with new partitions having block/brick masonry, glass with frosted and light weight partition board as per interior architectural planning
- h. Complete electrification, fire fighting, fresh-air ventilation including HVAC.

B. PRATIKSHALAYA BUILDING

- a. Civil & structural repairs of the internal area including staircase & internal floor.
- b. Waterproofing of the open (pocket) terraces
- c. Complete replacement of internal flooring (basement, ground + 5 floor)
 - i. Makrana Marble to the Flooring for the Staircase area
 - ii. Granite / vitrified cladding and flooring to the lift lobby area.
 - iii. Vitrified tile for bathroom cladding/flooring
- d. Complete replacement of granite dado/cladding, FRP brackets/moulding for the ground floor ghabaara (Except for providing new glass roof and FRP cladding for columns)
- e. Complete re-planning of the interiors with new partitions having block/brick masonry, glass with frosted and light weight partition board as per interior architectural planning
- f. Complete electrification, fire fighting, fresh-air ventilation including HVAC.

SECTION 5
CONTRACT DATA

CONTRACT DATA

Clause reference

With respect to

Section 3

Items marked “N/A” do not apply in this Contract.

1. The Employer is (Cl.1.1.)
Name: **Shree Siddhivinayak Ganapati Temple Trust, Mumbai**
2. The Architectural Consultant appointed by the Employer: (Cl.1.1.)
Name: M/s Structwel Designers & Consultants Pvt.Ltd. & M/s. SSA
3. The Defect Liability Period is **Five year** from the date of completion. (Cl.1.1.&35)
4. The Start Date shall be fifteen days from the date of issue of the notice to proceed with the work (Cl.1.1.)
5. The Intended Completion date for the whole of the work is **Twenty Four Months** after start of work with the following milestones. (Cl.1.1, 17 &28)

Milestones dates (Cl.2.2 & 49.1)

Cost of work to be completedPeriod from the start date**Mile Stone 1 i.e. 20 %****Two months****Mile stone 2 i.e. 40 %****Four months****Mile stone 3 i.e. 60 %****Six months****Mile stone 4 i.e. 50 %****Nine months****Mile stone 5 i.e. 100 %****Twelve months**

6. The site is located: **Prabhadevi, Mumbai** (Cl.1.1)
7. The name and identification number of the Contract is:
Tender Notice No. ____ for 2024-2025 (Cl.1.1)

8. Proposed Structural, Civil & Interiors including Electrification, Fire Fighting, HVAC of the existing Main Temple and Pratikshalaya Structure at Siddhivinayak Temple, Prabhadevi consist of:

➤ **MAIN TEMPLE BUILDING**

- Balance civil & structural repairs of the internal area including staircase & exterior mezzanine to ground floor.
- Waterproofing of the open terraces at mezzanine level and bath area at 2nd floor
- Complete replacement of internal flooring (basement, ground + 5 floor)
 - Makrana Marble to the Flooring and Vitrified for the Staircase area
 - Pink Makrana Marble for the Internal floor
 - Granite cladding to the ground floor ghabaara
 - Vitrified tile for bathroom cladding/flooring
- Complete replacement of granite dado/cladding, FRP brackets/moulding for the ground floor ghabaara (Except for providing new glass roof and FRP cladding for columns)
- Providing sound proof DGU glass partitions for the mezzanine floor level
- Complete replacement of exterior windows with UPVC window
- Complete re-planning of the interiors with new partitions having block/brick masonry, glass with frosted and light weight partition board as per interior architectural planning
- Complete electrification, fire fighting, fresh-air ventilation including HVAC.

➤ **PRATIKSHALAYA BUILDING**

- Civil & structural repairs of the internal area including staircase & internal floor.

- Waterproofing of the open (pocket) terraces
- Complete replacement of internal flooring (basement, ground + 5 floor)
 - Makrana Marble to the Flooring for the Staircase area
 - Granite / vitrified cladding and flooring to the lift lobby area.
 - Vitrified tile for bathroom cladding/flooring
- Complete replacement of granite dado/cladding, FRP brackets/moulding for the ground floor ghabaara (Except for providing new glass roof and FRP cladding for columns)
- Complete re-planning of the interiors with new partitions having block/brick masonry, glass with frosted and light weight partition board as per interior architectural planning
- Complete electrification, fire fighting, fresh-air ventilation including HVAC.

(A) Other Items

Any other items as required to fulfill all contractual obligations as per the Bid documents.

10. The following documents also form part of the Contract: Common set of condition/deviation of pre-bid meeting. (Cl. 2.3(9))
11. The law which applies to the Contract is the law of Union of India (Cl. 3.1)
12. The language of the Contract documents is English (Cl. 3.1)
13. Limit of Sub-contracting - 50 % of the Initial Contract Price (Cl. 7.1)
14. The Schedule of Other Contractors—It is responsibility of bidder to coordinate with all existing & future contractors to be appointed on this project (Cl. 8)
15. The Schedule of Key Personnel - As per Annex. II to Section I (Cl. 9)
16. The minimum insurance cover for physical property, injury and death is Rs.5 lakhs 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. :- (Cl.13)
17. Site Investigation / Evaluation Report - to be assessed by bidder (Cl. 14)

18. The Site Possession Dates shall be fifteen days from the date of issue of notice to proceed with work. (Cl. 21)
19. Fees and types of reimbursable expenses to be paid to the Dispute Review Board (to be inserted later) (Cl. 25)
20. Appointing Authority for the Dispute Review Expert - Competent Authority Of P.W.D, Govt. Of Maharashtra (Cl 26)
21. The Period for submission of the program for approval of Engineer shall be **10 days** from the issue of Letter of Acceptance. (Cl. 27.1)
22. The period between program updates shall be **15 days**. (Cl. 27.3)
23. The amount to be withheld for late submission of an update program shall be **Rs. 1,00,000.00** (Cl. 27.3)
24. The following events shall also be Compensation Events: [Cl. 44]
Substantially adverse ground conditions encountered during the course of execution of work not provided for in the bidding document :-
i)Removal of underground utilities detected subsequently
ii)Significant change in classification of soil requiring additional mobilisation by the contractor e.g. ordinary soil to rock excavation
iii)Removal of unsuitable material like marsh, debris dumps etc. not caused by the contractor
iv)Artesian conditions
v)Seepage, erosion, landslide
vi)River training requiring protection of permanent work
vii)Presence of historical, archaeological or religious structures, monuments interfering with the works
viii)Restriction of access to ground imposed by civil. judicial, or military authority.
25. The currency of the Contract is Indian Rupees. (Cl. 46)
26. The proportion of payments retained (retention money) shall be 2 % from each bill subject to a maximum of 2 % of final contract price. (Cl. 48)
27. Amount of liquidated damages for per day delay in completion of works.:- (Cl. 49)
To be decided by the Employer/Engineer from time to time to the extent of 1/2000 of contract price per day (subject to maximum 10% contract price.)

28.	The amount of the Secured Advance payment are:		[Cl. 51]
Nature of Advance			Amount (Rs. Conditions to be fulfilled)
i.	Secured advance for non perishable materials brought to site		75% of Invoice value

30. **Repayment of secured advance:** (Cl. 51)

The advance shall be repaid from each succeeding monthly payments to the extent materials [for which advance was previously paid pursuant to Clause 51 of Conditions of Contract] have been incorporated into the Works.

31. The Securities shall be for the following minimum amounts equivalent as a percentage of the Contract Price (Cl. 52)

Performance Security for 2 percent of contract price plus Rs. _____ (to be decided after evaluation of the bid) as additional security in terms of ITB Clause 29.5

The standard form of Performance Security acceptable to the Employer shall be an unconditional Bank Guarantee of the type presented in Section 8 of the Bidding Documents.

32. Deleted

33. The date by which “as built” drawings (in scale as directed) in 5 sets are required is within 28 days of issue of certificate of completion of whole or section of the work, as the case may be. (Cl. 58)

34. The total amount to be withheld for failing to supply “as built” drawing by the date required is **Rs. Ten lakhs.** (Cl.58)

35. Deleted

36. The percentage to apply to the value of the work not completed representing the Employer’s additional cost for completing the Works shall be 20 percent.

(Cl. 60)

ADDITIONAL GENERAL CONDITIONS

ADDITIONAL GENERAL CONDITIONS

1.0 These are to apply as additional specifications and conditions unless already provided for contradictorily elsewhere in this contract.

2.0 CONTRACTOR TO STUDY SITE CONDITIONS:

The contractor shall be deemed to have carefully examined the work and site conditions including labour, the general and the special conditions, specifications, schedules and drawings and shall be deemed to have visited the site of the work and to have fully informed himself regarding the local conditions and carried out his own investigation to arrive at rates quoted in the tender. In this regard, he will be given necessary information to the best of knowledge of Department but without any guarantee about it. If he shall have any doubt as to the meaning of any portions of these general conditions or the special conditions, or the scope of work or the specifications and drawings or any other matter concerning the contract, he shall in good time., before submitting his tender, set forth the particulars thereof and submit them to the **Shree Siddhivinayak Ganapati Temple Trust, Mumbai** in writing in order that such doubts may be clarified authoritatively before tendering. Once a tender is submitted, the matter will be decided according to tender conditions in the absence of such authentic pre-clarification.

3.0 DELETED

4.0 INDEMNITY:

The contractor shall indemnify the Government against all actions, suits, claims and demands brought or made against him in respect of anything done or committed to be done by the contractor in execution of or in connection with the work of this contract and against any loss or damage to the Government in consequence of any action or suit being brought against the Contractor for anything done or committed to be done in the execution of the works of this contract.

5.0 DELETED

6.0 ERRORS, OMISSION AND DISCREPANCIES:

- a. In case of errors, omissions and / or disagreement between written and scaled dimensions on the drawing or between drawings and specifications etc. The following order of preference shall apply.
 - i. Between actual, scaled and written dimensions or descriptions on a drawing the later shall be adopted.
 - ii. Between the written or shown description or dimensions in the drawing and corresponding one in the specifications, the later shall apply.
 - iii. Between the quantities shown in schedule of quantities and those arrived at from the drawings, the later shall be preferred.
 - iv. Between the written description of the item in the schedule of quantities and the

detailed description in the specifications of the same items, the later shall be adopted.

- b. In case of discrepancy between item rate quoted in figures and words, the lowest of the two will be considered for acceptance of tender.
- c. In all cases of omissions and / or doubts or discrepancies in the dimensions or description of any item or specification, reference shall be made to the **Executive Officer, Shree Siddhivinayak Ganapati Temple Trust**
- d. whose elucidation, elaboration or decision shall be considered as authentic. The contractor shall be held responsible for any errors that may occur in the work through lack of such reference and precaution.
- e. The special provisions in detailed specifications and wording of any item shall gain precedence over corresponding contractor provisions (if any) in the standard specifications of public works department Hand Book where reference to such specifications is given without reproducing the details of contract.

7.0 PROGRAMME OF WORK

- A.** The work is required to be completed within a period of as specified in tender document. The tentative programme may be as per Bar-Chart enclosed in this tender document.

- B. METHODOLOGY OF CONSTRUCTION AND CONSTRUCTION EQUIPMENTS:** Contractor shall furnish at least 15 days in advance his programme of commencement of item of work, the details of actual methods that would be adopted by the Contractor for the execution of various items of work. The Engineer-in-charge reserves the right to suggest modifications or make complete changes in the method proposed by the Contractor, where accepted previously or not at any stage of the work, to obtain the desired accuracy, quantity and progress of the work which shall be binding on the Contractor, and no claim on account of such change in method of execution will be entertained by Government so long as specifications of the item remain unaltered. The sole responsibility for the safety and adequacy of the methods adopted by the Contractor, will however, rest on the Contractor, irrespective of any approval given by the Engineer.

- C. CONSTRUCTION EQUIPMENT AND LOCATION:**

The Contractor shall be required to give a trial run of the equipment for establishing their capability to achieve and laid down specifications and tolerance to the satisfaction of the engineer before commencement of the work. All equipment provided shall be of proven efficiency and shall be operated and maintained at all lines, in a manner acceptable to the Engineer and no equipment or personnel will be removed from site without permission of the Engineer.

- D. PROGRESS SCHEDULE:**

The Contractor shall furnish within the period of one month of the order to start the work, the programme of work in CPM / PERT charts in quadruplicate indicating the date of actual start, the monthly / progress expected to be achieved and the anticipated completion date of each major item of work to be done by him, also indicating dates of procurement and setting up of materials, plant and machinery. The schedule is to be such as is practicable of achievement towards the completion of whole work in the time limit, the particular items, if any, on the due dates specified in the contract and shall have the approval of the Engineer-in-charge. No revised Schedule shall be operative

without such acceptance in writing. The Engineer is further empowered to ask for more detailed schedule or schedules say; week by week for any item or items, in case of urgency of work as will be directed by him and the Contractor shall supply the same as and when asked for.

The Contractor shall furnish sufficient plant, equipment and labour as maybe necessary to maintain the progress of schedule. The working and shift hours restricted to one shift a day for operations to be done under the Government supervision shall be such as may be approved by the Engineer-in-charge. They shall not be varied without the prior approval of the Engineer. Night work which requires supervision shall not be permitted except when specifically allowed by Engineer each time, if requested by the Contractor. The Contractor shall provide necessary lighting arrangements etc. for night work as directed by Engineer without any extra cost to Government.

Further, the Contractor shall submit the progress report of work in prescribed form and charts etc. at periodical intervals, as may be specified by the

Engineer-in-charge. Schedule shall be in the form of progress charts, forms, progress statement and for reports as may be approved by the Engineer.

The Contractor shall maintain proforma, charts, details, regarding machinery, equipment, labour, materials, personnel etc. as may be specified by the Engineer and submit periodically returns thereof as may be specified by the Engineer-in-charge.

Priorities of Works to be Executed:

Priorities for items to be executed shall be determined periodically keeping in view of the final time limit allowed for the work and all the time schedule fixed for intermediate stages of work.

8.0 AGENT AND WORK-ORDER BOOK:

The contractor shall himself manage the work or engage an authorized all-time agent on the work capable of managing and guiding the work and understanding the specifications and contract condition. A qualified and experience, Engineer shall be provided by the Contractor as his agent for technical matters in case the Engineer-in-charge considers this as essential for the work and so directs contractors. He will take orders as will be given by the Executive Officer or his representative and shall be responsible for carrying them out. This agent shall not be changed without prior intimation to the Executive Officer and his representative on the work site. The contractor shall supply to the Engineer the details of all supervisory and other staff employed by the Contractor and notify changes when made, and satisfy the unquestionable right to ask for change in the quality and numbers of contractor's supervisory staff and to order removal from work of any of such staff. The contractor shall comply with such orders and effect replacements to the satisfaction of the Engineer.

A work-order book shall be maintained on site and it shall be the property of Government and the Contractor shall promptly sign orders given therein by Executive Officer or his representative and his superior officers, and comply with them. The compliance shall be reported by the contractor to the Engineer in good time so that it can be checked. The blank work order book with machine numbered pages will be provided by the Department free of charge for this purpose. The contractor will be allowed to copy out instructions therein from time to time.

9.0 SETTING OUT FOR

i. SETTING OUT FOR (BUILDING WORKS)

The Engineer-in-charge shall furnish the Contractor with only the four corners of the work site and a level bench mark and the Contractor shall set out the works and shall provide an efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.

The Contractor shall provide, fix and be responsible for the maintenance of all stacks, templates, level marks, profiles and other similar things and shall take all necessary precautions to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The Contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and centre line marks, either existing or supplied and fixed by the Contractor. The work shall be set out to the satisfaction of the Engineer-in-charge. The approval thereof or joining with the Contractor by the Engineer-in-charge in setting out the work, shall not relieve the Contractor of any of his responsibilities.

Before beginning of the work, the Contractor shall at his own cost provide all necessary reference and level posts, pegs, bamboos, flags, ranging rods, strings and other material for proper layout of the work in accordance with the scheme for bearing marks acceptable to the Engineer-in-charge. The centre, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct mark at the centre to enable the theodolite to be set over it. No work shall be started until all these points are checked and approved by the Engineer-in-charge in writing but such approval shall not relieve the Contractor of any of his responsibilities. The Contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points of works under construction.

Pillars bearing geodetic marks located at the sites of units of works under construction should be protected and fenced by the Contractor.

On completion of works, the Contractor must submit the geodetic documents according to which the work was carried out.

ii. RESPONSIBILITIES FOR LEVEL AND ALIGNMENT

The Contractor shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectually any errors or imperfections therein, such rectifications shall be carried out by the Contractor, at his own cost, when instructions are issued to that effect by the Engineer-in-charge.

10.0 LEVELLING INSTRUMENT

If measurements of items of the work are based on volumetric measurements calculated from levels taken before and after construction of the item, large number of leveling staves, tapes etc. will have to be kept available by the Contractor at the site of work for this purpose. Lack of such leveling staves, tapes, etc. in required numbers may cause

delay in measurements and the work. The Contractor will have, therefore, to keep sufficient number of these readily available at site.

11.0 AUTHORITIES OF THE ENGINEER IN CHARGE's REPRESENTATIVE

The duties of the representative of the Engineer In Charge are to watch and supervise the work and to test and examine any material to be used or workmanship employed in connection with the works.

The Engineer In Charge may from time to time, in writing delegate to his representative any powers and authorities vested in the Engineer In Charge and shall furnish to the Contractor a copy of all such delegations of powers and authorities. Any written instructions of

Approval given by the representative of the Engineer In Charge to the Contractor within the terms of such" delegations (but not otherwise) shall bind the Contractor and the department as through it had been given by the Engineer In charge, provided always as follows.

Failure of the representative of the Engineer In Charge to disapprove any work or materials shall not prejudice the power of the Engineer In Charge thereafter to disapprove such work or materials and so order the putting down, removal or breaking up thereof.

12.0 CO-ORDINATION

Contractor has to coordinate with existing contractors (civil/electrical etc.) who are already appointed or will be appointed in future on the said project. Contractor shall take all precautions to ensure that no damage is caused to the existing structure / finishes / services etc., during construction. Any damages to existing structure / finishes / services etc., during construction shall be repaired and restored to their original condition by contractor to the complete satisfaction of Engineer In Charge and consultant. No extra payment will be done for such repairs.

When several agencies for different sub-works of the Project to work simultaneously on the Project site, there must be full co-ordination between different Contractors to ensure timely completion of the whole Project smoothly. The scheduled dates or completion specified in each contract shall therefore, be strictly adhered to. Each Contractor may make his Independent arrangement for water, power, housing etc. if any so desire. On the other hand the Contractors are at liberty to mutual agreement in this behalf and make Joint arrangements with the approval of the Engineer. No single Contractor shall take or cause to be taken any steps or action that may cause, disruption, discontent, or disturbance of work, labour or arrangement etc. of the other Contractor in the Project localities. Any action by any Contractor which the Engineer in his unquestioned discretion may consider as infringement of the above code, would be considered as a breach of the Contract Conditions and shall be dealt with accordingly.

In case of any dispute, disagreement between the Contractors, the Engineer's decision regarding the co-ordination, co-operation and facilities to be provided by any of the Contractors shall be final and binding on the Contractors concerned and such a decision or decisions shall not vitiate any Contract nor absolve the Contractor(s) of his / their obligations under the contract nor consider for the grant for any claim or compensation. Co-ordination with other Govt. / semi-Govt. departments / Govt. corporation / Boards required for smooth execution of this contract shall be the responsibility of Contractor. Failure of contractor to co-ordinate shall not entitle him for any extension of time limit.

The Contractor to assist Engineer In Charge in obtaining completion and occupation certificate for building from all local authorities / statutory bodies as per statutory rules.

13.0 ASSISTANCE IN PROCURING PRIORITIES, PERMITS, ETC.:

The Engineer, on a written request by the Contractor, will, if in his opinion, the request is reasonable and in the interest of work and its progress, assist the Contractor in securing, the priorities for deliveries transport permits for controlled material etc. where such are needed. The Government, will not, however, be responsible for the non-availability of such facilities or delay in this behalf and no claims on account of such failures or delays shall be allowed by the Government.

The Contractor shall have to make his own arrangement for machinery required for the work. However, such machinery conveniently available with the Department may be spared as per the rules in force on recovery of necessary Security Deposit and rent with agreement in the prescribed form Such an Agreement shall be independent of this contract and the supply of machinery shall not form a ground for any claim or extension of time limit for this work.

14.0 QUARRIES :

14.1 No P.W.D. quarries are available with this Department. The Contractor(s) shall have to arrange himself/themselves to procure the quarry. However, necessary assistance without any extra cost to Government will be rendered by the Department for procuring the quarries if required by the Contractor.

14.2 The quarrying operations shall be carried out by the Contractor with proper equipment such as compressors, Jack-hammers, drill bits, explosives etc. and sufficient number of workmen shall be employed so as to get required out turn.

14.3 The Contractor shall carry out the works in the quarries in conformity with all the rules and regulations already laid down or that may be laid down from time to time by Government. Any cost incurred by Government due to non-compliance of any rules or regulations or due to damages by the Contractor shall be the responsibility of the Contractor. The Engineer-in-charge or his representative shall be given full facilities by the Contractor for inspection at all times of the working of the quarry, records maintained, the stocks of the explosives and detonators, etc., so as to enable him to check that the working records and storage are all in accordance with the relevant rules. The Engineer-incharge or his representative shall at any times be allowed to inspect the works, buildings, and equipment at the quarters.

14.4 The Contractor shall maintain at his own cost the books, registers etc. required to be maintained under the relevant rules and regulations and as directed by the Engineer-incharge. These books shall be open for inspection at all times by the Engineer-in-charge or his representative and the Contractor shall furnish the copies or extracts of books or registers as and when required.

14.5 All quarrying operations shall be carried out by the Contractor in organized and expeditious manner, systematically and with proper planning. The Contractor shall engage licensed blasters and adopt electric blasting and/or any other approved method which would ensure complete safety to all the men engaged in the quarry and its surroundings. The Contractor shall himself provide suitable magazines and arrange to procure and store Explosives etc. as required under the rules at his own cost. The

designs and the location of the magazine shall be got approved in advance from the Chief Inspector of Explosives and the Rules & Regulations in this connection as laid down by the Chief Inspector of Explosives from time to time shall be strictly adhered to by the Contractor. It is generally experienced that it take time to obtain the necessary licence for blasting and licence for storage of materials from the concerned authorities. The Contractor must, therefore, take timely advance action for procuring all such licences so that the work progress may not be hampered.

14.6 The approaches to the quarrying place from the existing public roads shall have to be arranged by the Contractor at his own cost, and the approaches shall be maintained by the Contractor at his own cost till the work is over.

14.7 The quarrying operations shall be carried out by the Contractor to the entire satisfaction of the Engineer-in-charge and the development of the quarry shall be made efficiently so as to avoid wastage of stones. Only such stones as are of the required quality shall be used on the work. Any stone which is in the opinion of the Engineer-in-charge , not in accordance with the specifications or of required quality will be rejected at any time, at the quarry or at the site of work. The rejected stones shall not be used on the work and such rejected materials shall be removed to the place shown at the Contractor's cost.

14.8 Since all stones quarried from Government quarry (if made available) by the Contractor including the excavated over burden are the property of the Government. No stones or earth shall be supplied by the Contractor to any other agencies or works allowed to be taken away for any other works. All such surplus quarried materials not required for work under this contract shall be the property of the Government and shall be handed over by the Contractor to Government free of cost at quarry site duly heaped at the spots indicated by the Engineer-in-charge. The rates for several items shown in the Schedule 'B' are inclusive of royalties to be paid to the Government on minor minerals and metals under relevant Acts. Full rate for any and every item shall be paid only after production of sufficient proof of having paid the royalty to Government. In absence of such proof, the item shall be paid at such reduced rates as the Engineer-in-charge may deem fit. If ,however, the Government, does not require such surplus materials , the Contractor may be allowed to dispose off or use such material elsewhere with prior written permission of the Engineer-in-charge. Leaving off a quarry face or opening of new quarry face shall be done only on the approval of the Engineer-in-charge.

14.9 Quarrying permission will have to be directly obtained by the Contractor, from the Collector of the District concerned for which purpose the Department will render necessary assistance. All quarry fees, royalty charges, Octroi duties, ground rent for stacking materials etc. , if any, to be paid , shall be paid directly by the Contractor as per rules in force.

14.10 The Contractor will be permitted to erect at his own risk and cost at the quarry site if suitable vacant space in Government area is available for the purpose, his own structures for stores, offices, etc. at places approved by the Engineer-in-charge. On

completion of the work, the Contractor shall remove all the structures erected by him and restore the site to its original condition.

14.11 The Contractor shall not use any land in the quarry either for cultivation or for any other purpose except, that required for breaking or stacking or transporting stones.

15.0 DELETED

16.0 TEMPORARY QUARTER AND SITE OFFICE:

- A. The contractor shall at his own expense maintain sufficient experienced supervisory staff etc. required for the work and shall make his own arrangement, provide housing outside temple premises for them with all necessary arrangements, including fire preventive measures etc. as directed by the Engineer-in-charge..
- B. The Contractor shall at his own cost and to satisfaction of the Engineer-in-Charge provide a water-proof air-conditioned temporary office Porta cabin type comfortably accommodating 6 people at the work-site which will include tables, chairs, light, fan and lockers for keeping the records to host Engineer-in-charge's team. The site office design and location shall be finalized in consultation with Engineer-In-Charge. Contractor shall also make necessary arrangements for purified drinking water, latrines, with doors, windows, locks, bolts and fastenings sufficient for security for the Engineer and his subordinates, as close to the works from time to time in progress as can be conveniently arranged, and shall at his own cost furnish the office with such chairs, tables, lockers, locks, fastenings and incidental accessories as may be required by the Engineer, and no expense of any kind in connection with the erection or upkeep of the offices or fittings shall be borne by the Employer. The Contractor shall also make water connections and fit up stand pipe with a bib tap at each office. The latrines and the water connections shall be subject to all the conditions herein elsewhere laid down for temporary water connection and latrines generally. Contractor shall also make arrangement for conference room accommodating minimum 12 people at a time with conference table and chairs including white writing board for routine progress meeting. This space can be shared by contractor as well as Engineer-In-Charge from time to time. The cost for the same shall be all inclusive in the quoted price.
- C. Contractor shall provide 1 number of Photocopy Machine cum printer, 2 number of minimum 8 GB ram laptop with AutoCAD (version 2014) installed including internet connection etc. for Site Office at no additional cost. The equipment's supplied shall be returned back to contractor at the end of the project.

17.0 DELETED

18.0 PATENTED DEVICE, MATERIALS AND PROCESSES:

Whenever the Contractor desires to use any designed devices, materials or process covered by the letter of patent or copy right, the right for such use shall be secured by suitable legal arrangement and agreement with patent owner and the copy of their agreement shall be filed with the Engineer-in-charge if so desired by the letter.

19.0 EXPLOSIVES:

The Contractor shall at his own expense construct and maintain proper magazines. If such are required for the storage of explosives for use in connection with the work and such magazine being situated, constructed and maintained in accordance with the Government Rules applicable in that behalf. The Contractor shall at his own expenses obtain such license or licenses as may be necessary for storing the using explosives. Notwithstanding that the location etc. or storage of explosives are approved by the Engineer, the Government, shall not be incurring any responsibility whatever in connection, therewith, all operations in or for which explosives are employed being at the risk of the Contractor and upon his sole responsibility and the Contractor hereby gives to Government an absolute indemnity in respect thereof.

20.0 DAMAGE BY FLOODS OR ACCIDENT:

The Contractor shall take all precautions against damage by floods or like or from accident etc. No compensation will be allowed to the Contractor on this account or for correcting and repairing any such damage to the work during construction. The Contractor shall be liable to make good at his cost any plant or materials belonging to the Government lost or damaged by floods or from any other cause which is in his charge.

21.0 POLICE PROTECTION:

For the Special Protection of camp and of the Contractor's work, the Department will help the Contractor as far as possible to arrange for such protection with the concerned authorities, if so required by the Contractor in writing. The full cost of such protection shall be borne by the Contractor.

22.0 SUPERVISION AND INSPECTION OF WORKS AND QUALITY CONTROL:

A. SUPERVISION:

The Contractor shall either himself supervise the execution of the works or shall appoint the competent agent approved by the Engineer In Charge, to act on his behalf. If in the opinion of the Engineer In Charge, the Contractor has himself no sufficient knowledge and experience of receiving instructions or cannot give his full attention to the works, the Contractor shall at his own expenses employ as his accredited agent & qualified Engineer approved by the Engineer In Charge. Orders given to the Contractor's agent shall be considered to have the force as if these had been given to the Contractor himself. If the Contractor fails to appoint a suitable agent as directed by the Engineer In Charge, the Engineer In Charge shall have full power to suspend the execution of the work until such date a suitable agent is appointed and the Contractor shall be responsible for the delay so caused to the works and the Contractor shall not be entitled for any compensation on this behalf.

B. INSPECTION:

The Contractor shall inform the Engineer In Charge in writing when any portion of the work is ready for inspection giving him sufficient notice to enable him to inspect the same without affecting the further progress of the work. The work shall not be considered to have been completed in accordance with the terms of the contract until the Engineer In Charge shall have certified in writing to that effect. Approval of

materials or workmanship or approval of part of the work during the progress of execution shall not bind the Engineer In Charge or in any way affect him even to reject the work which is alleged to be completed and to suspend the issue of his certificate of completion until such alteration and modifications or reconstruction have been effected at the cost of the Contractor as shall enable him to certify that the work has been completed to his satisfaction. The Contractor shall provide at his cost necessary ladders and such arrangements as to provide necessary facilities and assistance for proper inspection of all parts of the work at his own cost.

23.0 INITIAL MEASUREMENTS FOR RECORD:

Where for proper measurement of the work, it is necessary to have an initial set of levels or other measurements taken, the same as recorded in the authorized field book or measurement book of Government by the Engineer or his authorized representative will be signed by the contractor who will be entitled to have a true copy of the same made at his cost. Any failure on the part of the contractor to get such levels etc. Recorded before starting the work, will render him liable to accept the decision of the Engineer as to the basis of taking measurements.

Like-wise the contractor will not cover any work which will render its subsequent measurements difficult or impossible without first getting the same jointly measured by himself; and the authorized representative of the Executive Officer. The record of such measurements on the Government side will be signed by the Contractor and he will be entitled to have a true copy of the same made at his cost.

24.0 SAMPLES AND TESTING OF MATERIALS:

A. SAMPLING OF MATERIALS

Samples provided to the Engineer or his representative for their retention is to be in the labeled boxes suitable for storage. Materials or workmanship not corresponding in character and quality with approved samples will be rejected by the Engineer or his representative and shall be removed from the site as directed by the Engineer at the Contractor's cost. Samples required for approval and testing must be supplied well in advance by at least 48 hours to allow for testing and approval. Delay to work arising from the late submission of sample will not be acceptable as a reason for delay in the completion of work. For all materials brought from outside, the cost of sampling, testing whether in India or outside India shall be borne by the contractor.

All materials to be used on work shall be got approved in advance from the Engineer In charge and shall pass the test and or analysis required by him which will be as follows:

- a) B.I.S. specification (whichever and wherever applicable)
- b) Such recognized specifications accepted to Engineer In Charge or equivalent hereto or in absence of such recognized specifications.
- c) i) Wherever required, the Contractor shall set up Field Laboratory with necessary equipment for testing of all materials / finished products, and get it checked and certified from the Executive Officer.
 - ii) Such requirement test and or analysis as may be specified by the Engineer In - charge in order of precedence given above.
 - iii) The contractor shall at his risk and cost make all arrangement and/or shall provide for all such facilities as the Engineer In Charge may require for collecting preparing required number of samples for tests or for analysis at such time and to such places

may be directed by the Engineer and bear all charges and cost of testing. Such samples shall also be deposited with the Engineer In Charge.

iv) The contractor shall if and when required submit at his cost the samples of materials to be tested or analysis and if, so directed shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and the materials, finally accepted by the Engineer-in-charge. Samples provided to the Engineer In Charge for retention purpose are to be in labeled boxes suitable for storage.

v) The contractor shall not be eligible for any claim or compensation at either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of the materials.

vi) The contractor or his authorized representative will be allowed to remain present in the department laboratory, if applicable while testing samples furnish by him. However the results of all the tests carried out in the department laboratory in the presence or absence of the contractor or his authorized representative will be binding on the contractor.

vii) Cost of routine day-to-day quality control testing charges for tests required as per specifications will be borne by the contractor by sending the same to the concerned Government laboratories.

viii) Test shall be carried out at approved Government Laboratories or Government institutions or approved private agencies as directed by Engineer In Charge and all testing charges shall be borne by the Contractor.

ix) The contractor shall at his own cost arrange to carry out the routine tests of materials which are to be used on the work. The tests will have to be carried out either in the field laboratory or in an approved laboratory.

The responsibility of assuring the quality of work shall be on the contractor who shall take actions as stipulated in standard specification as per Technical Specifications & Bill of Quantities.

B. A) Contractor shall follow all material specifications and tests as detailed out in Technical Specifications of this tender. It is binding on contractor to submit requisite test certificates for all items as detailed out in specification.

B) The tests which cannot be carried out both in field laboratory and Vigilance & Quality Control Circle's laboratories shall be carried out 100% in the laboratories of Government Engineering College / Government Polytechnic or any other laboratories approved by Technical Review Committee at the entire cost of Contractor or provide, whenever directed to do so.

C. INSPECTION OF MATERIAL/SAMPLES AND ACCEPTANCE:

Materials, its sample approval, its procurement and storage:

All materials and its samples, mock ups, floor plans and alignments for all works including turnkey works shall be approved by Technical Review Committee. The Technical Review Committee will consists of following members

- i. Engineer In Charge/Executive Officer, Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi, Mumbai 400028

ii. Architectural Consultant

The Contractor should make his own arrangement to obtain all materials required for the work, except otherwise stated. All materials shall, so far as procurable, be of the respective kinds described in the Bill of Quantities and/or specifications and as directed by Engineer In-Charge. Contractor shall upon the request of the Engineer In-Charge furnish him with all invoices, accounts, receipts and other vouchers to prove that the materials comply therewith with regard to brand, make, model, country of origin, shipping vouchers and so on. The Contractor shall at his own cost arrange for and/or carry out any test of any materials which the Engineer In-Charge may direct. The Contractor shall submit, samples of all the materials, to the Technical Review Committee, for approval, much in advance, so as to avoid any complications regarding availability. Also, whenever samples are to be prepared for approval the same shall be prepared immediately on receipt of the drawings and got approved by the Technical Review Committee. Approval of the samples of various materials given by the Technical Review Committee shall not absolve the Contractor from the responsibility of replacing defective material brought on site or materials used in the work found defective at a later date. The Contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the Technical Review. No collection of material shall be made before it is approved by the Technical Review Committee. The Engineer In-Charge, during the progress of the works, have to order in writing from time to time the removal from the works, within a period specified in the order, of any materials which in his opinion are not in accordance with the specifications or his instructions, the substitution of proper materials, and the removal and proper re-execution of any work executed with materials or workmanship not in accordance with the drawings, specifications or instructions; and the Contractor shall forthwith carry out such order at his own cost. In case of default on the part of the Contractor to carry out such order, the Technical Review Committee shall have the power to employ and pay other persons to carry out the same; and all expenses consequent thereon, or incidental thereto, as certified by the Technical Review Committee shall be borne by the Contractor, or may be deducted by the Employer from any moneys due, or that may become due, to the Contractor. Inspect and approve, if found appropriate, samples (loose & installed) to be prepared as per the list already prepared during starting of work and subsequent to approval of same, give clearance for commencement of construction works at site.

A Technical Review Committee will assess the product supplied/installed for its quality and conformity to the specifications provided by the bidder. Any item(s) identified by the Committee to be not as per the specifications or are found to be of inferior quality will be rejected, and the bills towards the supply will not be processed for payment till proper replacements are provided.

D. ADDITIONAL CONDITION FOR MATERIAL TESTING

It is mandatory on the part of Contractor to carry out all the required tests of various construction materials as mentioned in Technical Specifications & Bill of Quantities of the Tender.

If the contractor fails to submit required Test Results of the various construction materials as mentioned in the items of Technical Specifications & Bill of Quantities, he will be liable to deposit the amount at penal rate of 5% of amount of relevant item cost test which he has not carried out. Contractor will be informed by the Engineer In Charge by letter. On receipt of letter, contractor will have to either deposit the said amount or to carry out the required test within 10 days. If he again failed to carry out the required tests in stipulated time limit, the said tests will be carried out by the

department and total expenditure incurred on the testing charges plus five times amount of testing charges will be recovered from the Contractor's bill.

As this recovery is only due to the negligence on the part of contractor to carry out work as per Tender Conditions and Executive Officer's decision will be final and binding on the Contractor and it cannot be challenged by the Contractor by way of Appeal, Arbitration or in the Court of Law.

For partition work, furniture, signages & equipment all quality compliance certificates shall be attached from original manufacturer.

Contractor shall follow respective specifications attached under Technical Specifications for material testing, system testing, commissioning, and third party validation. All Testing & Procedures to follow as per prevailing Codal Provisions & as per directions of Engineer- In-Charge. All testing should be done from IIT Mumbai/ KITI Mumbai/VQCC labrotary Navi Mumbai as directed by Egnineer-In-Charge.

25.0 DELETED

26.0 DELETED

27.0 MISCELLANEOUS:

- A. DELETED.
- B. For providing electric wiring or water lines etc. recesses shall be provided if necessary, through walls, slabs, beams etc. and later on refilled up with bricks or stone chipping, cement mortar without any extra cost.
- C. In case it becomes necessary for the due fulfillment of contract for the Contractor to occupy land outside the Dept. Limits, the Contractor will have to make his own arrangements with the land owners and to pay such rents if any are payable as mutually agreed between them. The Department will afford the Contractor all the reasonable assistance to enable him to obtain Govt. Land for Such purpose on usual terms and conditions as per rules of Government, if such land is available, however cannot guarantee the same. It is made explicitly clear to contractor that subject project site has very limited open space and it is complete responsibility of contractor to make his own arrangement for additional land, wherever required
- D. The special provision in detailed specifications or wording of any item shall gain precedence over corresponding contradictory provision (if any) in the standard specifications or P.W.D. Hand book where reference to such specifications is given without reproducing the details in contract.
- E. It is presumed that the Contractor has gone carefully through the Standard Specifications of P.W.D. Hand Books and the Schedule of Rate of the Division including all other specifications mentioned in tender documents and studied the site condition before arriving at rates quoted by him. Decision of the Engineer In Charge shall be final as regards interpretation of specifications.
- F. The stocking a storage of construction material at site shall be in such a manner as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality, properties and fitness of the work. Suitable precautions shall be taken by the Contractor to protect, the material against atmospheric actions, fire and other hazards. The materials likely to be carried away by wind shall be stored in suitable stores or with suitable barricades and where there is likely hood of subsidence of soil,

- such heavy materials shall be stored on approved platform.
- G. The Contractor shall be responsible for making good the damages done to the existing property during construction by his men.
 - H. If it is found necessary from safety point of view to test any part of the structure, the test shall be carried out by the Contractor with the help of the Department at his own cost.
 - I. The contractor shall provide, maintain, furnish and remove on completion, temporary shed for office on work site for the use of Executive Officer's representative.
 - J. Defective work is liable to be rejected at any stage. The contractor, on no account can refuse to rectify the defects merely on reasons that further work has been carried out No extra payment shall be made for rectification.
 - K. General directions or detailed description of work, materials and items coverage of rates given in the specification are not necessarily repeated in the Bill of Quantities. Reference is however, drawn to the appropriate section clause(s) of the General Specifications in accordance with which the work is to be carried out.
 - L. In the absence of specific directions to the contractor, the rates and prices inserted in the items are to be considered as the full inclusive rates and prices for the finished work described there under and are to cover all labour materials, wastage, temporary work, plant, overhead charges and profits, as well as the general liabilities, obligations and risks arising out of the General conditions of contract.
 - M. All measurements will made in accordance with the methods indicated in the specification, and specification read in conjunction with the General Conditions of Contract.
 - N. The details shown on drawings and all other information pertaining to the work shall be treated and provisional only and are liable to variation as found necessary while preparing working drawing which will be supplied by the Government during execution. The contractor shall not, on account of such variation be entitled to any increase over the ones quoted in the tender which are on quantity basis.
 - O. The recoveries if any from contractor will be effected as arrears of land revenue through the Collector of the District.
 - P. Protection of underground/above ground/in corridor telephone cable and aerial telephone wires and poles, transmission towers, electrical cables, ELV line, BBT, HVAC ducts, Medical Gas pipelines, fire fighting and fire alarm, sewer, storm drain, rain water, water supplying lines. It will therefore be the responsibility of the contractor to protect then carefully all such cases should be brought to the notice of the Engineer In Charge by the contractor and also the concerned department, any damage what so ever done to these cables and pipe lines by the contractor shall be made good by him at his cost.
 - Q. Contractor has to submit mock up / samples of all the items prior to procurement / execution.
 - R. It is successful bidder's responsibility to submit detailed shop drawings of all the items prior to procurement/execution and got it duly approved by Engineer In Charge
 - S. Contractor may propose substitute / alternate makes / models of strictly equivalent specification, if required. The proposed substitution shall be evaluated by Technical Review Committee and if the committee finds substitution acceptable then and only

then substitution shall be permitted. The decision of the Technical Review Committee shall be final regarding acceptance of substitute make & model. If suggested substitute make is not acceptable to Technical Review Committee, then it will be binding on bidder to supply one of the approved makes listed in Bill of Quantities & Technical Specifications.

- T. Contractor shall provide shop drawings/working drawings before starting any work or placing any order for any of the services like furniture, partitions, Signages, etc. These shop drawings shall be got approved from Engineer In Charge/Technical Review Committee before implementation and this shall be binding on the contractor.
- U. The drawings provided are for tendering purpose only. Contractor should visualize the nature and type of work to be completed and ensure that the rates and prices quoted by him in the bill of quantities take due consideration of the complexities of work involved during actual execution / construction.
- V. The dimensions shown on any tender drawings may vary during execution. However no claim whatsoever shall be entertained due to such changes in dimensions.
- W. The tendered rates / prices for the work shall be deemed to include the cost of preparation, supply and delivery of all necessary drawings, prints, tracings and photocopies which the Contractor is required to provide in accordance with the Contract.
- X. **PROTECTION OF UNDERGROUND TELEPHONE CABLE AND AERIAL TELEPHONE WIRES AND POLES, TRANSMISSION TOWERS, ELECTRICITY CABLES, SANITARY, STORM WATER, WATER SUPPLY LINES ETC.**

During the execution of work it is likely that the Contractor may meet with telephone cable, electrical cables, water supply lines, storm drain lines, sanitary lines etc. it will, therefore, be the responsibility of the Contractor to protect them carefully. All such cases should be brought to the notice of the Engineer-in-charge by the Contractor and also to the concerned Department. Any damages whatsoever done to these cables and pipelines by the contractor shall be made good by him at his cost.

28.0 MEDICAL AND SANITARY ARRANGEMENTS TO BE PROVIDED FOR LABOUR EMPLOYED ON THE CONSTRUCTION BY THE CONTRACTOR

- a) The contractor shall provide an adequate supply of potable water for use of labourers on work and in Camps.
- b) The contractor shall construct trench or semi-permanent latrines for the use of the Labourers. Separate latrines shall be provided for men and women.
- c) The contractor shall build sufficient number of huts on a suitable plot of land for use of the Labourers according to the following specifications:
 - i. Huts of Bamboos and Grass may be constructed. A good site not liable to submergence shall be selected on high ground remote from jungle but well provided with trees, shall be chosen where it is available. The neighborhood of tank, jungle, grass or woods should be particularly avoided. Camps should not be established close to large cuttings of earth work. The lines of huts shall have open spaces of at least ten meters between rows. When a good natural

site cannot be procured, particular attention should be given to the drainage. There should be no overcrowding. Floor space at the rate of 30 Sq.ft. Per head shall be provided. Care should be taken to see that the huts are kept clean and in good order.

The Contractor must find his own land and if he wants Government land, he should apply for it and pay assessment for it, if made available by Government.

The contractor shall construct a sufficient number of bathing places. Washing places should also be provided for the purpose of washing clothes. The Contractor shall make sufficient arrangements for draining away the surface and sullage water as well as water from the bathing and washing places and shall dispose off this waste water in such way as not to cause any nuisance.

The contractor shall engage a Medical officer with a traveling dispensary for a Camp containing- 500 or more persons if there is no Government or other private dispensary situated within 8 kilometers from the Camp. In case of emergency the contractor shall arrange at his cost for transport for quick medical help to his sick worker.

The Contractor shall provide the necessary staff for effecting a satisfactory drainage system and cleanliness of the camp to the satisfaction of the Engineer. At least one sweeper per 200 persons should be engaged.

- ii. The Assistant Director of Public Health shall be consulted before opening a labour camp and his instruction on matters such as water supply sanitary conveniences, the camp site accommodation and food supply shall be followed by the Contractor.

The contractor shall make arrangement for all anti-malaria measures to be provided for the labour employed on the work. The anti-malaria measure shall be provided as directed by the Assistant Director of Public Health.

29.0 SAFETY CODE

While executing the work, necessary precautions regarding safety of labour, supervisory staff, public and traffic users shall be taken by the agency according to rules and regulations specified by the Government of India / Government of Maharashtra and as directed by competent authorities. Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period works as can be done safely from ladders. When ladder is used an extra mazdoor shall be engaged for hold the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1 to 4 (1 horizontal and 4 vertical Scaffolding or staging more than 3.25 m. above the ground or floors, swing or suspended from an overhead support or erected with stationary support, shall have a guard rail properly attached, bolted, braced and otherwise assured at least 1 m. 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.

Working platform, gangways and stairways shall be so constructed that they do not sag unduly or is more than 3.25 m. above ground level or floor level, it shall be closely boarded, have adequate width and be suitably fenced as described in 2 above

Every opening in floor of the building or in a working platform shall be provide with suitable protection to prevent fall of persons or materials by providing suitable fencing or railing with minimum height of 1 meter.

Safe means of access shall be provided to all working platform and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m. in length, width between side rails in a rung ladder shall in no case be less than 30 cm. for ladders up to and including 3 m. in length. For longer ladders with width shall be increased at least 6 mm. for each additional 30 cm. of length. Uniform step spacing shall not exceed 30 cm.

Adequate precautions shall be taken to prevent danger from electrical equipments. No materials on any of the site shall be stacked or placed as to cause danger or inconvenience to any person or the public. The Contractor shall provide all necessary fencing and lights to protect public from accidents and shall be bound to bear expenses of defense of every suit, action or other proceedings at law that may be brought by any person for Injury sustained owing to negligence of the above precaution and to pay any damages and costs which may be awarded in any such suit, action or proceeding to any such person or which may with the consent of the Contractor, to be paid to compromise any claim by any such person.

EXCAVATION AND TRENCHING:

All trenches, 1.5 meter or more in depth, shall at all times be supplied with at least 1 ladder for each 30 meter in length or fraction thereof. Ladder shall be extended from bottom of trench to at least 1 meter above surface of the ground, sides of trench which is 1.5 M. or more in depth shall be stepped back to give suitable slope, or security held by timber bracing, so as to avoid the danger of sides collapsing. Excavated materials shall not be placed with 1.3 M. of edge of trench or half of depth of trench whichever is more. Cutting shall be done from top to bottom under no circumstances shall undermining or undercutting be done.

DEMOLITION:

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

- a. All roads and open areas adjacent to the work site shall either be closed or suitably protected.
- b. No electric cable or apparatus which is liable to be a source of danger or a cable or apparatus used by operator shall remain electrically charged.
- c. All practical steps, shall be taken to prevent danger to person employed from risk or fire or explosion or hooding. No floor, roof or other part of building shall be so overloaded with debris of materials as to render it unsafe.

All necessary personal safety equipments as considered adequate by the Engineer-in-charge shall be available for use of persons employed on the site and maintained in condition suitable for immediate use and the Contractor shall take adequate step to ensure proper use of equipment by those concerned.

- a. Workers employed on mixing asphaltic materials, cement and lime mortars concrete

shall be provided with protective footwear and protective goggles.

- b. Those engaged in handling any materials, which is injurious to eyes shall be provided with protective goggles.
- c. Those engaged in welding works shall be provided with welder's protective eye-shields.
- d. Stone breakers shall be provided with protection goggles and protective clothing and seated at sufficiently safe intervals.
- e. When worker are employed in sewers and manholes which are in use, the Contractor shall ensure that manhole covers are opened and manholes are ventilated at least for an hour before worker are allowed to get into them. Manholes opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to public.
- f. The Contractor shall not employ, men below the age of 18 and women on the work of painting with products containing lead in any form wherever men above the age of 18 are employed on the work of lead painting the following precautions shall be taken.
 - a. No paint containing lead or lead product shall be used except in the form of paste or ready-made paint.
 - b. Suitable face masks shall be supplied for use by workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.
 - c. Overalls shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable working painters to wash during and on cessation of work.
- g. When work is done near any place where there is risk of drowning all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision made for prompt first aid treatment of all injuries likely to be sustained during the course of work
 Use of hoisting machines and shackles including the attachments, anchorage supports shall conform to the following:
 - a. i) These shall be of good mechanical construction, round materials and adequate strength and free from potent defect and shall be kept in good repair and in good working order.
 - ii) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and of adequate strength and free from potent defects.
 - b. Every crane driver or hoisting appliance operator shall be properly eyes qualified and no person under the age of 21 years shall be in-charge of any hoisting machine including any scaffolding.
 - c. In case of every hoisting machine and of every chain ring hook, shackle ownel and pulley block used in hoisting or lowering or as means of suspension safe working load shall be ascertained by adequate means. Every hoisting machines and all gear referred to above shall be plainly marked with safe working loads. In case of hoisting machine having a variable safe working load, each safe se, working load and the conditions under which it is applicable shall be clearly indicated .No part of any machine or of any gear referred to above in this

paragraph shall be loaded beyond safe working load except for the purpose of testing.

- d. In case of departmental machines safe working load shall be notified by the Engineer-in-charge. As regards Contractor's machines the Contractor shall notify safe working load of each machine to the Engineer-in-charge whenever, he brings it to site of work and get it verified by the Engineer-in-charge.

Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with such means as will reduce to the minimum risk of accidental descent of load. Adequate precaution shall be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced, when worker are employed. On electrical installations which are already energise insulating materials wearing approved such as gloves, sleeves and coats as may be necessary shall be provided. Workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities shall be provided at or near place of work. These safety provisions shall be brought to the notice of all concerned by display on a notice board at a prominent place at the work spot. Person's responsible ensuring compliance with the safety code shall be named therein by the Contractor.

- i. To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the Contractor shall be open to inspection by the Engineer-in-charge or his representatives and the inspecting officers.
- ii. Failure to comply with the provisions hereunder shall make the Contractor liable to pay to the Department as penalty an amount not exceeding Rs 50/- for each default and decision of the Engineer-in-charge shall be final and binding

Notwithstanding the above conditions, the Contractor is not exempted from the operation of any other Act or rules inforce.

30.0 SCOPE OF RATES FOR DIFFERENT ITEMS OF WORK:

For item rate contracts, the contract unit rates for different items of work shall be payment in full for completing the work to the requirements of the specifications including full compensation for all the operations detailed in the relevant sections of these specifications under "Rates". In the absence of any directions to the contrary the rates are to be considered as the full inclusive rate for finished work covering all labour materials, wastage, temporary work, plant, equipment, overhead charges and profit as well as the general liabilities, obligations and risks arising out of the General of Contract. The item rates quoted by the Contractor shall unless otherwise specified, also included compliance with / supply of the following:

- i. General works such as setting out, clearance of site before setting out and clearance of works after compliance.

- ii. A detailed programme for the construction and completion of the work (using CPM / PERT techniques) giving, in addition to construction activities, detailed network activities for the submission and approval of materials, procurement of critical materials and equipment, fabrication of special products / equipments and their installations and testing and for all activities of the employer that are likely to effect the progress of work, etc. including updating of all such activities on the basis of the decisions taken at the periodic site review meeting or as directed by the Engineers.
- iii. Samples of various materials proposed to be used on the work for conducting tests thereon as required as per the provisions of the contract.
- iv. Designs of mixes as per the relevant clauses of the specifications given proportions of ingredients, sources of aggregates and binder along with accompanying trial mixes as per the relevant clauses of these specifications to be submitted to the engineer for his approval before use of the works.
- v. Detailed design calculations and drawings for all temporary works (such as formwork, staging, centering, specialized constructional handling and launching equipment and the like).
- vi. Detailed drawings for templates, support and end anchorage, details for prestressing cable profiles, bar bending and cutting schedules for reinforcement, material lists for fabrication of structural steel etc.
- vii. Laboratory test reports for all mild and high TMT steel as per relevant provisions of the specifications.
- viii. Testing of various finished items and materials including bitumen, cement concrete, bearings as required under these specifications and furnishing test reports / certificates.
- ix. Inspection reports in respect of formwork, staging, reinforcement and other items of work as per the relevant specifications.
- x. Any other data which may be required as per the specifications or the conditions of contract or any other annexures / schedules forming part of the contract.
- xi. Any item of work which is not specifically provided in the Bill of Quantities but which is necessary for complying with the provisions of the contract; and
- xii. All temporary works, formwork and false works.

Other agencies employed by the employer may be working in the vicinity of the work being executed by the Contractor. The Contractor shall liaise with such agencies and adjust his construction programme for the completion of the work accordingly and no claim or compensation due to any reason whatsoever will be entertained on this account. The employer will be indemnified by the Contractor for any claims from other agencies on this account.

31.0 PAYMENT

- A. The contractor must understand clearly that the rates quoted are for completed work and include all cost due to labour, scaffolding, plant, machinery, supervision, power, royalties, prevailing taxes (as applicable), wastages including all leads and lifts at all levels/floors etc. and should also include all expenses to cover the cost of work at

heights as and when required and no claim for additional payment beyond the prices or rates quoted will be entertained. The mode of measurement has been indicated in the specifications. If there is any ambiguity or doubt in this respect, the decision of Superintending Engineer will be final.

The mode of measurements has been indicated in the specification and in the schedule of payments, if there is any ambiguity or doubt in this respect the decision of Superintending Engineer will be final.

- B. **RUNNING BILLS:** Two payments in a month will be granted by the Engineer In Charge, if the progress is satisfactory. Contractor should submit bills in appropriate forms to Executive Officer, Shree Siddhivinayak Ganapati Temple Trust, Mumbai, Prabhadevi, Mumbai 400028. The Bill will process after receipt of certificate of Architect in token of satisfactory completion of works.
- C. **FINAL BILL:** The Contractor should submit final bill certificate mentioning along with satisfactory completion of work from Siddhivinayak Temple, Mumbai within one month after completion of the work and there after final bill will be paid within 3 months if it is in order as per availability of funds. Disputed item and claims if any, shall be excluded from the final bill and settled separately later on.
- D. Contractor can have copies of the measurements and of the bills paid to him at his own cost and his own responsibility.
- E. No advance payment will be made.
- F. For imported items following documentation shall be submitted along with bills
 - a) Six Copies of packing list identifying contents of each package;
 - b) Original and six copies of the negotiable clean, on-board Bill of Lading/ Airway bill, marked freight pre-paid and six copies of non-negotiable Bill of Lading/Airway bill;
 - c) Six copies of Manufacturer's/Supplier's warranty certificate;
 - d) Six copies of valid transit insurance
 - e) Six Copies of Manufacturer's own factory inspection report and
 - f) Six copies of Certificate of origin by the chamber of commerce of the concerned country for imported equipment
- G. Payment against material receipt at site does not means acceptance of quality or integrity of material. Any damage in transport or during storage or due to any reason whatsoever, the responsibility completely lies with contractor and if material found defective during installation, contractor has to replace the damaged material at no cost to client.
- H. It is complete responsibility of contractor to carry any transit insurances or any other insurance which may deemed fit for imported or indigenous materials. No claim for damaged equipment, material shall be entertained at any stage of the contract.

32.0 HANDING OVER OF WORK:

All the work and materials before finally taken over by Government will be the entire liability of the Contractor for guarding, maintaining and making good any damages of any magnitude interim payments made for such work will not alter this position. The handing over by the Contractor and taking over by the Executive Officer or his authorized representative will be always in writing, copies of which will go to the Executive Officer or his authorized representative and the contractor. It is, however

understood that before taking over such work, Government will not put it into regular use as distance from casual or incidental one, except as specially mentioned elsewhere in this contract, or as mutually agreed to.

33.0 CLAIMS:

Bills for extra work or for any claim shall be paid separately apart from the interim bills for the main work. The payment of bills for the main works shall not be withheld for want of decision on the extras or claims not covered in the appendices. Claims for extra work shall be registered within 30 days of the occurrence of the event. However, bills for these claims including supporting data / details may be submitted subsequently at his own cost.

34.0 DEFECT LIABILITY PERIOD:

- A. The Contractor shall maintain the finished and completed item of work as per Bill of Quantities and specification for a period as specified in tender document after the completion of work without any extra cost to Government irrespective of the designs, standards and specifications etc. The Contractor shall get done the work as per specifications and drawing and keep the work/furniture in good condition throughout the maintenance period.
- B. On completion of the work in all respects, necessary certificate will be issued by the concerned Executive Officer and the defects liability period will be counted from the date of issue of such certificates.
- C. Defective work is liable to be rejected at any stage. The Contractor on no account can refuse to rectify the defects merely on reasons that further work has been carried out. No extra payment shall be made for such rectification.

35.0 DELETED

36.0 RELATION WITH PUBLIC AUTHORITIES:

The contractor shall comply with all rules, regulation, bye-laws and direction given from time also by any local public authority in connection with this work and shall himself pay fees or charges which are leviable on him without any extra to the Department.

37.0 PRELIMINARY & DURING CONSTRUCTION ARRANGEMENTS:

- A. The Contractor if necessary construct temporary access roads and maintain these in proper condition till the completion of the work at his own cost. If necessary, he shall also, at his own expenses make necessary arrangements for acquisition of land required by him in connection with the execution of the work.
- B. The contractor shall have to makes at his own cost all arrangements for labour, water, electricity and materials etc. immediately after getting the work order. No claim for any extra payment or application for extension of time on the grounds of difficulty in connection with the above matter, will be entertained,
- C. The contractor shall at his own expenses, engage watchmen for guarding the materials and plant and machinery and the work during-day and night against any pilferage of damages and also for prohibiting trespassers or damage to them.

- D. The contractor shall have to make his own arrangement for water and power required for any purpose on the work.

38.0 ITEM / PRODUCT SPECIFICATIONS:

- A. Contractor may propose substitute / alternate makes/models of strictly equivalent specifications for item categorically specified in tender document. The proposed substitution shall be evaluated by Technical Review Committee and if the committee finds substitution acceptable then and only then substitution shall be permitted. The decision of the Technical Review Committee shall be final regarding acceptance of substitute make & model. If suggested substitute make is not acceptable to Technical Review Committee, then it will be binding on bidder to supply one of the approved makes as listed in tender document. Even if approved makes are mentioned above, the approved make has to meet all specifications as mentioned in tender document.
- B. The whole work shall be carried out strictly in accordance with the approved detailed drawing (unless otherwise directed) description of the items, detailed specification with Indian/International Standard specification indicated therein and of P.W. Department, Government of Maharashtra subject to the additional specification given for the relevant items and in the best workmen like manner.
- C. It is to be definitely and clearly understood that the specifications stipulated shall be rigidly enforced and no relaxations shall be allowed. Extra charges or claims in respect of extra works shall not be entertained unless they are clearly outside the scope of the item and its specifications to which they relate or unless such works are ordered in writing by the Executive Officer and claimed for in specified manner before the same is taken in hand.

39.0 QUALITY ASSURANCE AND MAINTENANCE:

- A. The contractor to ensure the specified quality of work which will also include necessary surveys, temporary works etc. The contractor shall prepare a quality assurance plan and get the same approved from the Engineer In Charge within one month from the date of work order. The contractor shall submit an organization chart of his technical personnel to be deployed on the work along with their' qualification, job descriptions defining the functions of reporting, supervising inspecting and approving. The contractor shall also submit a list of tools, equipment and the machinery and instruments which he proposes to use for the construction and for testing in the field and or in the laboratory and monitoring. The contractor shall modify/supplement the organization chart and the list of machinery, equipment etc. as per the directions by the Engineer In Charge and shall deploy the personnel and equipment on the field as per the approved chart and list respectively.

The contractor shall submit written method statements detailing his exact proposals of execution of the work in accordance with the specification. He will have to get those approved from the Engineer In Charge. The quality of the work shall be properly documented through certificate, records, check-lists and logbooks of results etc. Such records shall be compiled from the beginning of the work and be continuously update and supplemented and this will be the responsibility of the contractor. The forms should be got approved from the Executive Officer In Charge.

- B. Contractor shall prepare a Quality Assurance Plan (QAP) for this work. The QAP shall include the following.
- a. Bar chart and CPM/ PERT
 - b. Personnel deployment with their responsibilities.
 - c. Schedule of weekly / Monthly Meeting at site office involving all functions
 - d. Use of Computer for Project Management through MS Project or Primavera software
 - e. Monthly Progress Reports.
 - f. Quality Procedures.
 - g. Calibration of instruments used on site
 - h. Material sources and testing frequency and reports.
 - i. Safety measures.
 - j. Reference to appropriate approved drawings.
 - k. Defect Liability: how the contractor going to deal with this.
 - l. Reference to specification, codes etc.

The contractor shall give the above plan to Engineer-in-charge within 21 days from the date of issue of letter of acceptance. The Engineer-in-charge will approve the plan at the earliest. The contractor shall adhere to the procedure stipulated in the tender document and quality assurance plan prepared by him.

- C. Contractor shall submit weekly progress report as well as monthly progress reports in printed form.
- D. Contractor shall prepare and submit Minutes of Meeting (MoM) of all the meeting.
- E. The contractor shall provide scheduling through MS Project/Primavera (scheduling through Microsoft excel sheets will not be acceptable). Deployment of planning engineer on site with experience in MS Project/Primavera is mandatory.
- F. During the progress of the work the contractor is expected to adhere to the time schedule on milestone and total completion and this adherence will be a part of Contractor's performance under the contract. During execution of the work, contractor is expected to participate in the review and updating of the CPM/BAR CHART. These reviews may be undertaken at the discretion of Engineer In Charge either as a periodical appraisal measure or when the quantum of work order on the contractor is substantially changed through deviation orders or amendments. The review shall be held at site or any of the offices of client at the sole discretion of client. The contractor will adhere to the revised schedule thereafter. The approval to the revised schedule resulting in a completion date beyond the stipulated date of completion shall not automatically amount to a grant of extension of time to the contractor.
- G. The contractor shall prepare detailed completion drawing after completion of the work. He shall also prepare and submit a maintenance manual giving procedure for maintenance, including inspection, tools and equipment to be used, means of accessibility for all parts of the structure. He shall also include in the manual, the specification for maintenance work that would be appropriate for his design and technique of construction. This manual shall be submitted within the contract period.
- H. The contractor shall make comprehensive inspection of the structure every six months after completion of the work till the end of defect liability period. The defects noticed if any shall be rectified at his own cost under the supervision of Engineer-in- charge.

- I. Where the work is to be done on Contractor's design, the Contractor shall also prepare and submit a maintenance manual giving procedure for maintenance, with the periodicity of maintenance works including inspections, tools and equipment to be used, means of accessibility for all parts of the structure. He shall also include in the manual the specifications for maintenance work that would be appropriate for his design and technique of construction. This manual shall be submitted within the contract period.
- J. Photographs and Video Shooting : So as to observe the progress of work at different stage of execution of works, the Contractor shall take out coloured photograph at 3 stages i.e. 1) Before execution, 2) During execution, and 3) After completion of work. Contractor shall take out at least 15 photographs of different location of each sub works at each stage. The photographs and Video Shooting will be of post card size and the same shall be submitted along with the running bill in triplicate. No extra cost shall be paid to the Contractor on this account.
- K. All the required equipment/connectivity/software/hardware should be supplied by the Contractor to his personnel as well as to Engineer In Charge's team at site. The system of software should be compatible with the, then PWD Software and interface.
- L. The contractor shall also prepare and submit an operation & maintenance manual giving procedure for operation & maintenance with the periodicity of maintenance works including inspections, tools and equipment to be used, means of accessibility for all parts of the structure. The maintenance manual shall be approved by the Engineer In Charge. Contractor shall also include in the manual, the specifications for maintenance work that would be appropriate. This manual shall be submitted with the final bill.

40.0 TECHNICAL COMPLETION REPORT

The contractor shall submit Technical Completion Report along with his final bill, which shall include:

- a) Detailed measurements
- b) Detailed design Basis report for all turnkey works including all supporting calculations
- c) Working drawing
- d) As-built drawings for all the systems/items installed under this contract
- e) Details of material brought on site and consumed in the work, which shall also indicate standard consumption and deviation if any, with reasons.
- f) Test Results of all materials used in the work with an abstract of total tests carried out wherever required including all third party validations/tests
- g) Do's & Don't for equipment/systems while operation & Maintenance

41.0 CLAUSES IN THE CONDITION OF CONTRACT

- A. All materials and workmanship shall be of the respective type described in the contract and in accordance with the Engineer's instructions and shall be subjected from time to time to such tests as the Engineer may direct at the place of manufacture or fabrication, or on the site. All samples shall be supplied by the Contractor.
- B. No work is to be covered up or put out of view without the approval of the Engineer for his examination and measurements.

- C. During the progress of the works, the engineer shall have the power to order the removal from the site of any unsuitable material, substitution or proper suitable material and the removal and proper re-erection notwithstanding any previous test or interim payment therefore, and of any work which is in respect of materials or workmanship is not, in the opinion of the Engineer In Charge accordance with the contract.

42.0 AVAILABILITY OF SUPERVISION STAFF OF CONTRACTOR AT SITE DURING CONSTRUCTION

- A. Contractor shall ensure that technical personnel for this work shall be deployed at site as specified in Annexure II, when the work is in progress. The Frequency of Attendance shall be as described in Annexure II.
- B. The contractor shall adhere to staff as specified in Annexure II and Section 2, Sr. No. 1.6 and the same shall not be changed without his prior approval of Engineer-In-Charge. The list of approved key personnel with their required data shall be entered in the attendance machine prescribed below.
 To ensure Attendance of above key personal the contractor shall install face / thumb recongnisation based GPS AND SCADA ENABLED attendance machine on site and plant. The location of such machine shall be got approved from the engineer in charge. Key personal shall register their attendance as many times as instructed by engineer in charge. The attendance so registered shall be uploaded to the PWD e-governance server/portal in real time, if directed by Engineer-In-Charge. The analysis of attendance of these key personal so registered shall be presented/mailed to engineer in charge and his representative in the format and frequency prescribed by Engineer-In-Charge. The attendance sheet generated by method mentioned above shall be submitted on monthly basis to Engineer-In-Charge.
- C. If any of the technical key personnel as specified in Annexure II and Section 2, Sr. No. 1.6 of tender document is not in present at site during work, then the contractor will be liable to deposit the amount at penal rate of two times of the amount of particular key personnel's salary on pro-rata basis. Contractor will be informed by the Engineer-in-charge by letter so such penalty. If contractor defaluts on 2 such occasions, Engineer-In-Charge may deploy a substitute key personnel of his own choice and salary incurred for such deployed key personnel plus five times amount of salary will be recovered from the Contractor's bill.
- D. As this recovery is only due to the negligence on the part of contractor to carry out work as per Tender Conditions and Engineer-In-Charge's decision will be final and binding on the Contractor and it cannot be challenged by the Contractor by way of Appeal, Arbitration or in the Court of Law.

44. COLLECTION OF MATERIALS:

- I) Where suitable and approved P.W. Department's quarries exist, the contractor or piece worker will be allowed if otherwise there is no objection to obtain the materials to the extent required for the work from the quarry. He will be however, liable to pay compensation, if any damage is caused to the quarry either deliberately or through negligence or for wastage of materials by himself or his staff or labour. The contractor shall pay necessary royalty in advance.

(ii) Where no suitable P.W. Department's quarries exist or when the quantity of the material required cannot be obtained from P.W. Department quarry the contractor or piece-worker shall make his own arrangement to obtain the material from existing or a new quarry in Government waste land, private land or land belonging to other states or talukas, etc. After opening the quarry but before starting collection, the quarry shall be got approved by the Engineer-in - charge or his representatives. The contractor or piece workers shall pay all royalty charges compensation etc. No claims or responsibility on account of any obstructions caused to execution of the work by difficulties arising out of private owners of land, will be entertained.

(iii) The rates in the tender includes all incidental charges such as opening of a new quarry, opening out a new portion in an existing quarry, removing top soil and the unsuitable material, dewatering a quarry, cost of blasting powder and fuse, lift, lead, repairs to existing cart tracks, making new cart tracks, control charges, Central / State Government or Municipal Taxes.

(iv) The rates in the tender are for the delivery of approved material at site, properly stacked at the places specified by Engineer - in - charge and are inclusive of conveyance charges in respect of the leads and lifts. No claims on account of changes in lead will be entertained.

(v) No material shall be removed from the land within the road boundary or from the land touching it without the written permission of the Engineer or his authorized agent. If any material is unauthorized obtained from such places, the contractor or piece worker shall have to make good the damages and pay such compensation, in addition as may be decided by the Executive Officer and will have to stop further collection.

(vi) Any material that falls on any P.W.D. Road from the cart etc. during conveyance shall be immediately picked up and removed by the contractor or piece worker, failing which it will be got removed departmentally at his cost. No heap shall be left prior to stacking even temporarily on the road surface or in any way so as to cause any obstruction or danger to the traffic. The contractor or the piece worker shall be liable to pay for any claims of compensation etc. arising out of any accident, etc. Any such material causing obstruction or danger etc. will be got removed departmentally at his cost and no claims for any loss or damage to the material, thus removed, will be entertained. The contractor shall also be responsible for the damage or accident etc. arising out of any material that falls on the road or track, not in charge of the Department and shall attend to any complaints which may be received.

(vii) The materials shall not be stacked in place where it is liable to be damaged or lost due to traffic passing over it, to be washed away by rain or flood, to be buried under the land slide etc. or to slip down on embankment or hill side etc. No claims for any loss due to these and similar causes will be entertained.

(viii) Before stacking, the materials shall be free from all earth rubbish, vegetable matter and other extraneous substance and in the case of metal, screened to gauge, if so directed. When ready, it shall be stacked entirely clear of the road way, on ground which has been cleaned of vegetation and leveled. On high banks, Ghat roads etc. where it may not be practicable to stack it entirely clear of the roadway, it may be stacked with the permission of the Engineer - in - charge on berms in such a way as to cause minimum danger and obstruction to the traffic or as may be directed by him.

(ix) No deduction will be made for voids.

45. TREASURE - TROVE :

In the event of discovery by the contractor or his employees, during the progress of the work of any treasure, fossils, minerals or any other articles of value or interest, the contractor shall give immediate intimation thereof to the Engineer and forthwith hand over to the Engineer. Such treasure or things which shall be the property of the Government.

46. CHANGE OF CEMENT CONTENTS ETC :

The tendered rates for any item, involving the use of cement shall apply to the quantity of cement specified for the mix for that item in the specifications. If for any reasons, expect those required for compensating the deficiencies in the components, the cement content and properties are altered by the Engineer (Engineer - in - charge) at any time or from time to time the tendered rates for that particular item and quantity or quantities, shall be duly enhanced or reduced only to account for the addition or reduction in cost of the cement content from that laid down in the specification at the rates. Specified in D. S. R. of the district on which the estimate is based plus 10 % to cover all other incidental change whatever. Likewise if any additives compounds, water proofing materials etc. are ordered by the Engineer to be added to the mortar or concrete, no extra rate shall be payable for this change which shall be carried out as per directions of the Engineer - in - charge, provided cost of such additives etc. is borne by Government or these are supplied free of costs to contractor at site by the Government.

47. CEMENT CONCRETE :

a) The contractor shall carry out all preliminary tests to work out grading and proportioning of aggregates in order to obtain and maintain uniform quality of work. The contractor shall supply all materials, labour and testing cost for preparing and testing samples as required by the Engineer. Unless otherwise specified in the detailed itemwise specifications, 3 cubes 150 mm. x 150 mm. x 150mm. will be tested for every 15 cubic metre of concrete or per day whichever is higher.

The contractor shall make field arrangements for slump test, density and bulkage testing and also prepare concrete cubes 150 mm. x 150 mm. x 150 mm. for testing compressive strength, at his cost. The cubes shall be got tested at approved laboratory and the test results shall not fall below those prescribed in P.W.D. Hand Book (Table CV P.412) or as laid down in the specifications. The cost of such cubes and tests shall be entirely borne by the contractor.

b) All concrete shall be machine mixed, unless otherwise directed by the Engineer - in - charge, for controlled or high grade concrete, the grading of aggregate shall be got approved from the Engineer. The correct proportions and the total amount of water for the mix will be determined by means of preliminary tests and shall be got approved by the Engineer - in - charge, however, such approval does not relieve the contractor from his responsibility regarding the minimum works strength requirements. Work test shall be taken in accordance with relevant codes and specifications. The proportioning of aggregate shall be done by weight, if so ordered by the Engineer.

- c) All mixing shall be done by mechanical means in approved mixers. The Engineer may at his discretion, allow in writing hand mixing of concrete for minor items where in small quantities are involved but in that case the Contractor shall increase the cement content of the mixture by 10 % without any extra cost.
- d) The form work used shall be made invariably of steel / with lining of steel or with plywood lining, wooden shutters may be allowed at the discretion of the Engineer e.g. lintels , small slabs and beams, copping etc.
- e) The concrete shall be mechanically vibrated for proper compaction by the method approved by the Engineer.
- f) The concrete shall be cured only by a sweet potable water for full 21 days after the time of its placement or as may be directed by Engineer-in-charge.
- g) The cement to be used in the various Items must be of ordinary Portland Cement grade for the concrete work.
- h) Contractor must have shuttering and formwork of Marine Ply , Acrospan., Aluminum Formwork, The Maximum eight repetitions will be allowed for all types of wooden shuttering material. Contractor shall use adjustable metal props for supporting all R.C.C. elements. The form work design shall be approved by the Engineer In Charge / Officer appointed by Engineer-in- Charge before erection

48. REINFORCED CONCRETE WORK :

- a) The work included in this contract shall be carried out in addition to this specifications detailed herein, in accordance with specifications and regulations as laid down in the following standard specifications. Standard specifications published by Government of Maharashtra 1985 Edition:
 I.S. 8112 :- 1989 - Specification for 43 grade ordinary Portland cement.
 I.S. 383 :- 1976 - Specification for coarse and fine aggregate from natural courses for concrete.
 I.S. 1786 - 1985 - Specifications for cold twisted bars.
 I.S. 432 - 1982 - Specifications for mild steel and medium steel bars.
 I.S. 456 - 2000 - Code of practice for plain and reinforced concrete,
 Note – 1- 43 grade ordinary Portland cement (Confirming I.S. 8112) shall be used for all RCC and other items where cement is used.
 2 Steel for reinforcement shall be procured only from reputed companies.
 I.S. 4926-2003 Specifications for Ready Mix Concrete.

If the Standard specifications quoted above fall short for the items quoted in these schedules of this contract, reference shall be made to the latest British Standard Specifications. If any of the items of contract do not fall in reference quoted above, the decision and specifications of the Engineer shall be final. Steel to be used shall be invariably from the integrated plant steel more specifically TATA, SAIL, JINDAL and the cement to be used shall be of ACC,ULTRATEK or equivalent Pozolana Portland Cement. Any imported material regarding steel,cement will not be allowed.

49. ADDITIONAL GENERAL SPECIFICATION FOR ORDINARY AND HIGH

GRADE CONCRETE.

1. If the concrete strength falls below that specified for the items and if the use can be permitted under clauses 303.3.7 of the I.R.C. Bridge Code Section - III given below, the unit may be accepted at the discretion of the Superintending Engineer concerned as a substandard work at a suitable reduced rate. Reduced rate will be determined by the Executive Officer concerned according to circumstances of the case and the concerned Superintending Engineer's approval to the reduced rate as mentioned above, is necessary.

“Standard Specification and code of Practice for Road Bridges “Section III Cement concrete 303.3.7 standard of acceptance.”

I) Full payment should be made when 75 % of the test cube results are equal and above specified strength. Cases failing outside the above limits should be examined and decided by the Engineer - in - charge on merits on each case.

ii) The test specimen should be taken by representative of the contractor in presence of a responsible officer of the rank of not lower than an Assistant Engineer / Deputy Engineer.

iii) The test specimen should be formed carefully and no claim shall be entertained later on, on the ground that the casting of the test specimen were faulty and that the results of the test specimen did not give correct indication of the actual quality of concrete.

iv) The minimum quantity of cement per one Cubic metre of M -15 grade and above concrete should be as per Standard Specification Book Specification B 7 - 4 on page 39 (1979 Edition).

v) Payment : (a) The payment of such concrete work will not be made till the strengths are ascertained.

(b)The payment of reinforcement of such affected items will not be made till the strength of the concrete are ascertained.

vi) The centering to be used for execution of any concrete items shall be strictly in accordance with specifications for form work and steel Centering given on page 148 to 151 of this documents. No concreting shall be executed without prior approval to the centering from the Engineer-in-Charge.

SECTION 6

TECHNICAL SPECIFICATIONS

SPECIFICATIONS FOR GENERAL CIVIL WORK

1. CEMENT:

All Portland cement for use on the works shall comply in every respect with the requirements of the Indian Standard Specification for Portland cement as issued and amended from time to time by the Indian Standards Institution.

The Portland cement used in the works shall manufacture in India and shall be of a make and quality to be approved by the Engineer.

Tests : No other make of cement but the one approved by the Engineer will be allowed on the works and the contractor shall not change his source of supply without the approval of the Engineer in writing. The contractor shall produce test certificates to show that the cement is fully upto the specifications and notwithstanding this, the Engineer may at his discretion order that the cement delivered on the work, and which he may consider damaged or of doubtful character for any reason whatever, must be retested by approved testers and fresh certificates of its soundness produced by the contractor at his specification cost. Cement ordered for retesting shall be withdrawn from the work pending the results of retesting. The Decision of the Engineer in this respect shall be final and binding on the contractors.

If at any time the Brand or Make of cement specified by the Engineer be not available in the market, the contractor shall use the cement from the Municipal Stores which will be supplied to him at the rate specified delivered ex-Municipal Stores.

Stores: Large stocks of cement shall not be kept at the works but only sufficient quantities to ensure continuity of the work. The contractors shall provide and material proper and efficient storage sheds for the cement on the works. The floor of the stores shall be raised at least 230 M.M. from the ground in order to protect the bags from moisture. No cement damaged by exposure or otherwise will be allowed to be used in work but shall be removed at once from the site.

Package: The cement shall be supplied in sound and properly secured and sealed bags weighing 50 Kg. of cement. The rates entered in the Bill of quantities and rates must be held to include the cost of haulage to the work, housing and protecting from the weather, risks of every kind, and all expenses connected with preparing the cement for use and with using it in the work.

2. SAND:

All the fine aggregate shall consist of clean, hard strong, durable, uncoated, wellgraded particles. When incorporated in the concrete mixture, the fine aggregate shall be free from frost, frozen, lumps injurious amount of dust, mica shells, soft or flaky particles, shale, alkali organic matter loan or other deleterious substances.

The sand shall be taken from a source approved by the Engineer.

If the Engineer considers it necessary it shall be washed. The cost of washing must be included in this price for the concrete work. All sand shall pass through a sieve having meshes not more than 1/4th inch wide and if the Engineer shall require it, it shall be screened before use at the expense of the contractor.

In no case shall fine aggregate be accepted containing more than two percent, by dry weight, not more than three and half per cent, by dry volumes, not more than five percent, by wet volume of clay, loan of silt. If any sample of fine aggregate shown more than five percent of clay, loan silt in one hour's settlement, after shaking in an excess of water, the material represented by the sample will be rejected. If necessary, silt test shall be taken by the Engineer.

All fine aggregate shall be stored on the works in such a manner as to prevent the intrusion of foreign matter.

Storage.

The fine aggregates shall conform as nearly as possible to the following sieve analysis.

S-Sieve.

Designation	Percentage retained
480	Nil
120	0 to 13
120	13 to 37
60	33 to 85
30	80 to 90
15	90 to 98

A mixture having the lowest possible void content shall be used.

This description of the fine aggregate shall not be interpreted as admitting the use of stone or slag screenings unless authorized.

3. COARSE AGGREGATE:

Quality of coarse aggregate: -

The whole of the ingredients of the coarse aggregate shall consist of rock, gravel or Quality of coarse other inert material. The particles of aggregate, coarse aggregate shall be of clean, hard tough, durable material, free from vegetable or other deleterious substances, and shall contain no soft flat or elongated pieces.

All coarse aggregate shall be stored on the works in such a manner as to prevent the intrusion of foreign matter.

If it is considered necessary, the Engineer may order it to be washed and screened. The contractor shall state in his tender the source from where he will obtain the aggregate and he shall also include in his price for concrete the cost of washing.

If screening is necessary the cost shall be borne by the contractor.

The coarse aggregate shall consist of: -

Grading of coarse aggregate	1. Metal no.2.... 20 to 25 mm
	2. Metal no.1....3 to 12 mm

The whole of the aggregate shall pass a screen having meshed not greater than 25 mm. square and shall be retained on a screen having meshes 6 mm.square. The materials may be tested for voids before the work is commenced and at intervals during the course of construction, as may be necessary and the proportion of the different grades in the coarse aggregate fixed by the Engineer so as to secure a well grade material varying from 6 mm to 25 mm. The different grades of the coarse aggregate shall be measured by mean of suitable boxes and in such proportions as may be approved by the Engineer.

4. WATER:

The water shall be clean and free from injurious amounts of oil, acid, alkali, organic or other deleterious substances. The quantity of water added to the materials for making concrete shall be properly under control and must be measured.

5. MILD STEEL REINFORCEMENT:

The mild steel to be used in reinforcement concrete work shall be of tested quality and shall comply with the requirements of Indian Standard Specifications No.432-1966 as amended from time to time. The result of the test made in accordance with the provisions of the Indian Standard Specifications, as amended from time to time show that the steel does not comply with this specification the Employer will reject the lot or lots from which the sample or samples were taken and the same shall not be used in the works but shall be removed there from and the work already executed with such bars may be ordered to be demolished.

All reinforcement shall be free from loose scales of rust which must be removed with stiff wire brush; bars must also be free from oil or paint. The steel shall be properly braced, supported and otherwise held in position so as to prevent displacement while concrete is put in. The correct number and sizes of reinforcing bars, stirrups and binders shall be provided and placed in position strictly according to the drawing or as may be ordered by the Employer from time to time. This must be looked after with proper care and checked over by a competent foreman personally and finally before placing the concrete.

All protruding bars from columns, beams and slabs to which other bars are to be spliced later, must be protected from rusting by a coat of thin neat cement paste. All bending shall be done cold, gradually evenly and without jerks. All steel shall be fixed in position with binding wires not thinner than 18 gauges. Special PVC cover blocks shall be used for covering purpose. No plastic spacer blocks shall be allowed to be used between two layers of steel.

Weight of reinforcing bars should be as per standard IS table. If there is any deviation, it should be brought to the notice of the Employer well in advance before actual placement of the reinforcement in position, and decision obtained for the same.

6. HIGH YIELD STRENGTH DEFORMED BARS (TOR):

The High Yield Strength Deformed Bars (Tor) to be used in reinforced concrete work shall be of tested quality and shall comply with the requirements of Indian Standard Specification No. IS: 1139 or 1786 as amended from time to time. If the result of the test made in accordance with the provisions of the IS does not comply with the specifications the Employers will reject the lot or lots from which the sample or samples were taken and the same shall not be used in the works, but, shall be removed there from and the work already executed with such powers may be ordered to be demolished. All other requirements for these reinforcement bars shall be same as these mentioned for mild steel reinforcement.

7. MIXING AND PLACING OF CONCRETE:

The concrete shall be comprised of water, Portland cement, sand and coarse aggregate. If required by the Employer the Contractor shall have to add approved brand of plasticizer and anti washout additives in required quantities to facilitate easy flow of concrete. No extras shall be paid for providing and adding plasticizer and anti washout additives.

All sand and coarse aggregate used on the works shall be carefully and accurately measured in suitable gauge boxes and in quantities to the entire satisfaction of the Employer and the cement to be added to the aforesaid mix shall be either by one or two full scale bags, the water being added to the dry mix in a manner in which it can be properly controlled and measured. The cement shall be measured by weight or by bags. One bag of cement weighing 50 kg. shall be considered equal to 0.034 Cu. m. (1.20 c ft) in volume. Volumetric measurement of cement will not generally be permitted. If loose cement is used it shall be weighed and 40.8 kg. shall be considered as 0.0283 Cu. m (1 c ft). The contractor shall provide an accurate weighing apparatus on the work for this purpose. If he wants to use volumetric batching, he would have to prove the correct weights of cement bags.

The maximum quantity of mixing water per 50 kg. bag of cement shall be 25 liters which shall include free water carried by the Aggregate, corrections being made to this quantity of water according to the wetness of aggregate, as instructed by the Employer. The

consistency of the concrete shall be tested by the standard slump for concrete and shall be between 38mm to 64mm (1.5" to 2.5") or as directed. Contractor shall have to use approved plasticizer in required quantity at his own cost to achieve necessary workability.

The proportioning of concrete as per design mix shall be used for mixes of grade M-20 and above. For this the Contractor shall supply the different ingredients such as cement, sand, aggregate, admixtures etc. and the required slump approved by Engineer In charge. If any of the ingredients are altered in respect of the source of production, quality or any other parameter the same will be got approved by the Engineer In charge and fresh design mix shall be done for the proportioning of the different ingredients to the satisfaction of the Engineer In charge and no parameters of the design mix for the concrete ingredients shall be altered from that submitted for the design of the concrete mix.

The concrete shall be mixed in an efficient power driven batch mixer. The capacity of the drum shall as far as possible be such that only whole bags of cement are used in each batch. Mixing shall continue for at least 1.5 minutes after all the materials including water, are placed in the drum and before any part of the batch is discharged. The drum shall be revolved not less than 14 and not more than 18 revolutions per minute. The drum shall be completely emptied before receiving materials for each batch shall not exceed the mixer manufacture's rated capacity of the drum. The drum shall be thoroughly washed out when mixing operation cease for any period longer than one hour. Hand mixing of concrete, if permitted by the Employer shall be carried out in the following manner.

The specified quantity of sand shall be spread out first making a level heap about 150mm deep on a water tight platform or trough, at least 2.7m x 3.7m in size, with 3 sides of sufficient depth to prevent the material being shoveled off during the operation of mixing. On the top of sand the specified quantity of cement, with an addition of 10% to allow for hand mixing, shall be spread. All the dry sand and cement shall be turned over with square ended shovels at least 3 times until the mixture is of uniform color. Each shovel full should leave the shovel with a spreading action as well as turning. The specified quantity of coarse aggregate shall now be added and the whole mixture shall be turned over as before. The mixing shall be continued until the whole batch has reached an even consistency and the mortar is spread evenly through the batch. The mixing should not take more than 15 minutes after the addition of water. One whole bag of cement with an addition of 10% shall be used in each batch. Ready mix concrete of specified grade and consistency namely water cement ratio, slump, cement content etc. shall be used to the extent possible particularly where the quantity of concrete required at one time is sufficiently large. The source of supplier and specifications of the concrete including the admixtures, re-traders, setting time, transit time, method of placement of concrete on the job such as pumping etc., quality assurance from the supplier etc. should be got approved from the Engineer In charge before ordering of the ready mix concrete for the job. The test cube strength specified in the drawings shall be closely monitored for ensuring the required strength of the concrete.

Mortar or concrete which has partially set before having been placed in-site shall not be taken into use again either by itself or after mixing with additional materials or water. All concrete shall be deposited in the forms within 15 minutes after leaving the mixer and shall be worked round the various reinforcement carefully by means of tamping and rodding as well as suitable vibrations.

As far as possible no joints shall be provided in any RCC work. However, if need arises the same shall be provided as per the instructions of Employer, in which case the face of the construction joints shall be made rough by hacking and thoroughly cleaned and which before proceeding with further concrete work it shall be wetted and covered over with thick cement paste or "Hack-aid-plast" as directed by the Employer.

Concrete after it has been placed in the forms should be allowed to set and should not be disturbed. The concrete shall be thoroughly cured by ponding or inundation or by means of hezzian cloth covered, maintain in a wet condition. Where 53 grade cement is used curing of exposed surface of concrete shall commence within 4 hrs. of its placing. In no case shall the centering to any concrete work be removed without obtaining the permission of the Employer. Great care shall be exercised while removing the centering to avoid jarring the structure or throwing away the forms on the floor.

The stripping time of form work shall be generally followed as per relevant I.S. Specification. However, the discretion of the Employer shall be final. The form work of all RCC and PCC work shall be as to bring out the exposed surfaces to a smooth and clean finish. Immediately after the removal of the form work the exposed surface of all such RCC work shall be thoroughly roughened by making deep and closely spaced indentations with a pointed steel tool (Basuli) to the entire satisfaction of the Employer. The exposed surface of RCC and concrete work wherever directed shall be finished with cement and sand plaster - smooth sand faced or rough cast as directed.

8. TESTING OF CONCRETE:

(a) All concrete used in Municipal works shall be tested for compressive strength at the Municipal Materials Testing Laboratory generally as specified under I.S. No. 456 of 1957. The above specifications do not cover leaner mixes such as 1:3:6 and below. Ordinarily it is not necessary to test the compressive strength if tested in the same manner as given under I.S.S. referred to above. The minimum strength required for 1:3:6 concrete shall be 70 kg/Sq. cm. for 7 days and 100 Kg./ Sq. cm. for 28 days.

(b) If the quantity of concrete to be laid on any day is less than 3 brass, the testing of concrete may not be insisted upon by the Engineer at his own discretion. If however, the quantity exceeds 3 brass test specimens must be taken and sent to the Municipal Laboratory for testing.

(c) 15 cms. specimen shall be made for every sample and 3 of them tested for 7 days strength. If the average of these 3 specimens gives the specified compressive strength, no further tests after 28 days shall be carried out. In case the 7 days test is unsatisfactory, the remaining 3 specimen shall be rested at the age of 28 days and on only the average strength of the 3 specimens at 28 days shall be taken into consideration for further action, if any. The average of the strength of the 3 specimen shall be accepted as the compressive strength of concrete provided the difference between the minimum and the maximum strength of the three specimen does not exceed tests shall be made unless the minimum strength is greater than the strength specified, i.e., 100 kgs./ Sq. cm., for 7 days and 150 Kgs./ Sq.cm. for 28 days. If the averages of the results of the tests carried out at the age of 28 days are also unsatisfactory, the contractors shall be required to take immediate steps as will be directed by the Engineer in respect of such works at the risk and cost of the contractors. The steps may include partial or whole demolition of such works, heavy penalty, blacklisting of the contractors concerned and such others. The results of tests conducted at Material Testing Laboratory shall be taken as final and binding on the contractors concerned. In case of any dispute the decision of the Municipal Commissioner shall be binding on the Contractors.

(d) A record showing the location of the test specimen and daily progress of the work done should be kept by the Engineer-in-Charge and should be countersigned by the Contractor or his representatives. In case this record is not countersigned by the contractor or his representative the record kept by the Engineer-in-charge will be considered as correct and binding on the contractor.

(e) The contractors will have to carry out the necessary tests for different materials to be used on site and also for testing crushing strength of different mixes of concrete at the Municipal Material Testing Laboratory. The Contractors will have to pay the necessary charges, rates or fees for various tests as per the rates or fees as per schedule in force at the time of testing. The rates or fees for various tests will be available with the Laboratory In charge.

9. CEMENT MORTAR:

The cement mortar for all masonry work whether it be of brick or concrete blocks or basalt or for plaster the Portland Pozzolana cement or Portland slag cement shall be used confirming to IS 1489 (Part I) and IS 455 (latest) respectively. The cement and sand to be used for cement mortar shall be carefully gauged in suitably sized boxed thoroughly mixed in a dry state on a clean wooden platform and mixed again after the addition of the requisite quantity as can readily be used up and mortar which has particularly set shall under no circumstances be reused by being mixed with additional materials or water.

10. BLOCK MASONRY

The block masonry of required thickness shall be done in specified cement mortar. The blocks for masonry shall have minimum compressive strength of 50 kg/cm² The concrete

mix used in manufacturing of blocks shall be not leaner than 1:3:6. The blocks shall be solid, sound, well cured and free from cracks and other defects and shall satisfy IS:2185 Part-I, (latest).

11. BRICK MASONRY:

Bricks should have a bearing strength of 35 Kg/ Sq. cm. at least as required by I.S.S.1077 (latest).

Bricks shall be whole, sound, well burnt, and free from cracks, to ring when struck and not to crack or break when soaked in water and to be uniform in size. They shall be of the best description obtainable in the market and of the best quality and color. Brick shall be procured from a source as approved by the Employer, preferably with approved mark of manufacturers, and shall conform to the requirements of Indian Standard Specifications as amended from time to time. No bricks shall absorb more water than one fifth of its own weight when dry. For soaking of bricks before use, IS: 2212 (latest) shall be followed, No broken bricks shall be used except as closers. Cement and sand are to be as described in relevant Clause.

The whole of the brickwork shall be built in plumb and in such bond as the Employer may direct, and shall be carried out in a thoroughly workman like manner and to the entire satisfaction of the Employer. Brick on edge layers shall be provided where directed. For every 1 meter. Height of the brick wall one horizontal RCC patli beam shall be provided.

A good bond must be preserved throughout the work both laterally and transversely. The course shall be kept perfectly horizontal and in plumb. The bricks shall be laid with the frogs facing upwards. The vertical joints shall break joint with course below and above, but they shall be directly over and another in alternate course to prevent the necessity of bats. The joints are not to exceed 10mm in thickness and are to be full of mortar close, well finished up and neatly struck. The work shall be kept wet while in progress to the entire satisfaction of the Employer till the mortar is properly set. On Sundays and other holidays when the work is stopped the top of all unfinished masonry shall be kept flooded with water and laborers shall be employed for the purpose. The Employer shall be at liberty to water the work at the Contractor's expenses should the Contractor fail to do so to the Employer's satisfaction.

As a rule the whole of the masonry work shall be carried out at one uniform level throughout but where breaks are unavoidable the joint shall be made in good long steps so as to prevent cracks arising between the new and old work. All junctions of walls shall be formed at the time the walls are being built and cross walls shall be carefully bonded into the main walls. All joints in brick masonry shall be raked but to a depth of at least 20mm before the mortar has set.

12. CEMENT PLASTER:

All stone and brick masonry shall be thoroughly wetted and raked out to a depth of at least 20 mm each and walls washed and wetted before plastering is done. Render with a mortar of specified parts of Portland cement and fine sand of specified thickness and rough but do not beat. Float or set with a thin coat 3 mm of Portland Cement and polished well immediately with a trowel or flat board. The cement mortar to be used within 30 minutes after it leaves the mixing board or mill. Before work is started patches of plaster 150 x 150 mm. should be put on about 3 meters apart as gauges. By this means an even thickness is ensured. Cement plaster must be in even squares or stripe. Care shall be taken to keep the whole surface thoroughly wetted for at least a week. The finishing surface should be as specified and directed. Nothing extra will be paid if the surface is required to be finished with neeru and three coats of white or colour wash.

13. SAND FACED PLASTER:

All stone and brick masonry surface to be plastered shall be thoroughly wetted for at least 6 hours in case of brick masonry and the joints shall be raked out to a depth of at least 20 mm. before plastering.

The first coat of cement mortar in the proportion as specified in item shall be applied uniformly all over the surface to be plastered to a thickness of 14 mm. with a trowel and flat board in exact plumb. This coat shall be allowed to rest for not less than half an hour. Indentations shall then be made in the form of waves by a wire broom over the surface to form a key for the second coat. The plastered surface shall be allowed to cure for at least four days. First coat will be with addition of water proofing compound in proportion as specified in item.

The second coat of cement mortar shall be applied in the proportion of as specified in item using clean and screened through a mesh of not less than 1.5 mm. and not more than or 3 mm. equal size to a uniform thickness of 6.5 mm by trowel and flat board in exact plumb.

The surface shall be trapped with a cork piece to give a desirable uniform granular appearance.

Care shall be taken to keep the whole surface thoroughly wetted for at least a week.

MARBLE FLOORING / CLADDING WORKS

3.1. MATERIALS

3.1.1. The slabs/tiles shall be of approved selected quality, color, hard, sound, dense and homogenous in texture, free from cracks, decay, weathering and flaws. The

percentage of water absorption shall not exceed 5 percent as per test conducted in accordance with IS:1124.

- 3.1.2. The slabs/tiles shall be hand or machine cut to the required thickness. Tolerance in thickness for dimensions of tile more than 100 mm shall be ± 5 mm. This shall be +2mm on dimensions less than 100mm.
- 3.1.3. Slabs/tiles shall be supplied to the specified size with machine cut edges or fine chisel dressed to the full depth. All angles and edges of the slabs shall be true and square, free from any chipping giving a plane surface. Slabs/tiles shall have the top surface machine polished (first grinding) before being brought to site wherever required as per item. The slabs shall be washed clean before laying.
- 3.1.4. The sample of the slabs/tiles shall be submitted for approval of Engineer-In-Charge and all the slabs/tiles and material incorporated in the work shall conform to the approved samples.

3.2. WORKMANSHIP

3.2.1. Flooring Work

- 3.2.1.1. The type, size, thickness and color/shade etc. of the slabs for flooring/dado/skirting shall be as specified in the respective items of the work and or as directed by Engineer-In-Charge.

STRUCTURAL REPAIRS

1. EXPOSING EXISTING RCC MEMBERS :

Marking of the area to be exposed shall be done by Contractors Engineer and the same shall be counter approved by Engineer in charge / consultant's site representative. Exposing of members shall be carried out with the help of light hammer and sharp chisels.

The rate shall be inclusive of removal of plaster finish beyond main reinforcement. The work shall be measured in SqM. Rate also should be inclusive of removal and carting away debris outside the Refinery premises

Payment shall be made for plane area in square meter.

2. CORROSION TREATMENT FOR M.S. / TOR STEEL :

2.1. Materials:

Rust Remover: Rust Remover shall be “Rusticide” manufactured by M/s. Sunanda Specialty Coatings Pvt. Ltd. or other equivalent.

Rust Preventor : Rust Preventor shall consist of polymer latex of brand Polyalk Fixoprime manufactured by M/s. Sunanda Specialty Coatings Pvt. Ltd. or other equivalent.

2.2. Workmanship:

Mechanical wire brushing / tapping shall be done to all the exposed reinforcement so that mill scales are removed from the main reinforcement, stirrups and their junctions. Phenolphthalein shall be used to check carbonation levels behind the bars. The reinforcement then shall be washed by clean water to remove all rust stains. Rust passivator like Rusticide or equivalent shall be applied to the steel bars. Ensure application of rusticide to back side of the steel also and shall kept for drying at least for 24 hrs.

Then, first coat of rust preventor (Polyalk Fixoprime or equivalent) shall be applied. The seal of the container shall be checked and manufacturing and expiry dates shall be noted before application. Mixing of “Polyalk Fixoprime” with cement shall be done with mechanical stirrers to avoid cement deposition at the bottom of container while application. This shall be ensured properly. Sample shall be taken out and sent for testing before use. Second coat shall be applied after an interval of 4 hours.

Payment shall be made for plane area in square meter.

3.1. Materials:

Rust Remover: Rust Remover shall be “Rusticide” manufactured by M/s. Sunanda Specialty Coatings Pvt. Ltd. or other equivalent.

Rust Preventor: Rust Preventor shall consist of polymer latex of brand Polyalk Fixoprime manufactured by M/s. Sunanda Specialty Coatings Pvt. Ltd. or other equivalent.

3.2. Workmanship :

Mechanical wire brushing / tapping shall be done to all the exposed rolled steel sections so that mill scales are removed from the steel sections and their junctions. Rolled steel then shall be washed by clean water to remove all rust stains. Rust passivator like Rusticide or equivalent shall be applied to the steel sections and shall kept for drying at least for 24 hrs.

The seal of the container shall be checked and manufacturing and expiry dates shall be checked. Sample shall be taken out and sent for testing before use. Apply one coat of approved red oxide and two coats of oil paint.

Payment shall be made for plane area in square meter.

4. PROVIDING AND FIXING M.S. / TOR STEEL REINFORCEMENT:

The tor steel to be used in reinforced concrete work shall be of tested quality and shall comply with the requirements of Indian Standard Specifications No. 1786 - 1985 as amended from time to time. Should the result of the test made in accordance with the provisions of the Indian Standard Specifications No. 1786- 1985, as amended from time to time show that the steel does not comply with this specification the consultant will reject the lot or lots from which the sample or samples were taken and the same shall not be used in the works but shall be removed there from and the work already executed with such bars may be ordered to be demolished.

All reinforcement shall be free from loose scales of rust which must be removed with stiff wire brush, bars must also be free from oil or paint.

All steel shall be fixed in position with G.I. binding wires not thinner than 18 gauges. Weight of reinforcing bars should be as per standard IS table. If there is any deviation, it should be brought to the notice of the Consultant /Client well in advance before actual placement of the reinforcement in position and decision obtained for the same.

5. PROVIDING AND FIXING STRUCTURAL STEEL :

1. Structural steel used in fabrication of the steel work shall conform to IS : 2062-1992.
2. Welding consumables - covered electrodes shall conform to IS:814 and shall be of ``Advani Oerlicon' make or equivalent.
3. Bolts, Nuts, Washers etc. - All bolts, nuts, washers etc. shall be in conformity with IS: 800. The heads of bolts shall be forged and solid, truly concentric and square with the shanks and hexagonal in form and shall be screwed with white worth threads well and cleanly cut in oil in such a way that they hold for the entire length of the screwed parts. The nuts shall fit so tightly on the bolts that they cannot be screwed down without a spanner. All bolts shall be provided with washers under the nuts of such thickness that the thread is clear off the hole in the plate.
4. The shank shall project at least one full thread beyond the nuts. The nuts shall be secured to avoid the risk of their becoming loose. Mechanical Properties:
 - (a) Dimensions And Tolerances : Dimension of rolled steel products shall conform to the relevant Indian Standard as per table 3 of IS: 2062 - 1992
 - (b) Weight : Weight shall be calculated on the basis of steel density 0.00785 Kg / CuM

(c) Testing : The details of test shall be as per IS:1608-1972 and IS:1599-1974 for tensile test

and bend test Fabrication and Erection: The fabrication of structural steel will be carried out by welding, bolting, gas cutting, drilling and machining / grinding as specified in the drawings and according to IS : 7215 – 1974. Welding shall be carried out according to IS : 9595 – 1980. Erection of the steel work shall conform to IS: 7205 – 1974

6. CEMENT GROUTING :

1. Materials :

Cement - 43 grade Portland Cement conforming to IS: 8112

Water - Water used for grout shall conform to the requirements of IS: 456

Additive - “CEBEX-100” manufactured by FOSROC

In case of cracks 12 mm Dia. Aluminium / PVC perforated nipples shall be inserted along crack lines, after making “V” grooves by means of suitable drills. The grooves shall be made dust free by thorough washing and drying. The distance between injection nipples along crack lines shall be sealed with epoxy putty or M - Seal.

The grout holes shall be flushed with water prior to application of grout to prewet the structure. However, the substrate so wetted shall just be moist and there shall not be standing or free water present.

2. Mixing Of Grout & Injection :

The grout shall be mixed in following proportions

Cement 50 kg

CEBEX 100 225 gms

CEBEX-100 additive shall be premixed with dry cement which shall be then gradually added to the water and mixed for 3-5 minutes until thorough dispersion is achieved.

After mixing all grout shall be passed through a 5 mm sieve to remove lumps. For grouting, grouting pump shall be used. The grout shall be pumped using 2-3 kg/cm² pressure, in a continuous fashion. All nipples shall be cut flush and sealed after the grout has hardened.

3. Precautions and Cleaning :

3.1 All eye contamination shall be avoided. In case of eye contamination, the eyes shall be thoroughly washed immediately with plenty of water and medical advice shall be sought.

3.2 All tools shall be washed with clean water immediately after use.

Payment shall be made for cement consumption in Kg.

7. EPOXY GROUTING :

1. Materials:

Aluminium Nipples: These shall be made out of 12mm dia. aluminium pipes with perforation all round.

Approved brand of epoxy resin and hardeners Araldite GY-257, Aradur-21 of M/s. Ciba Geigy, in proportion as per manufacturer's recommendations.

Sealing Compound "M seal" general-purpose epoxy sealing compound shall be used.

2. Workmanship:

Preparations for grouting: The crack shall be opened along crack alignment by making "V" notches or grooves by means of suitable chisel or mechanical saws. The grooves shall be made dust free using mechanical blower / compressed air. Holes of suitable size shall be drilled at interval of 500 mm c/c to accommodate 12 mm dia., 30 to 40 mm long aluminium nipples. The holes shall also be cleaned using blower / compressed air. The distance between injection nipples along crack lines shall be sealed with epoxy putty or M - Seal.

Grouting: - The prepared grout material shall be injected in place within 20 minutes of mixing using suitable mechanical pumps. The operation of grouting shall start from the lowest nipple and proceed in the upward direction. The successive nipple shall be plugged, and the grout shall be allowed to harden after which nipple shall be cut flush with surface grouted.

Payment shall be made for epoxy consumption in Kg.

8. EPOXY MORTAR :

1. Materials:

Approved brand of epoxy resin and hardeners Araldite-GY 257, Aradur-21 of M/s. Ciba Geigy, in proportion as per manufacturer's recommendations. Quartz sand - Mix No. 10.

2. Execution:

Surface Preparation - The surface shall be cleaned off all dust, dirt and loose materials with the help of Vacuum Cleaner. Bonding coat of Epoxy is applied in specified proportion i.e. Araldite GY-257 and Aradur-140 in 2:1 proportions. Epoxy mortar prepared shall be placed immediately after application of bonding coat.

Proportion of Epoxy mortar is 2 : 1 : 18 parts by weight (i.e. Araldite GY-257 : Aradur-140 : Quartz sand mix No.10).

Payment shall be made for epoxy consumption in SqM.

9. POLYMER MORTAR :

The surface shall be cleaned of all dust and loose material with the help of vacuum cleaner and made wet to receive the bond coat .The bonding coat shall be in the proportion of 1:1 or 1:1.5 of cement and polymer.

The quantity by weight of polymer, cement and sand for preparation of polymer mortar shall be checked.

Acrylic Polymer : 1Kg

Cement : 5Kg

Quartz : 15Kg

Water : 1 to 1.5 liters depending on the consistency

(Design mixed quartz sand shall be used). Polymer to be used shall be tested for physical and chemical properties.

The mortar shall be mixed in a mixer and the bonding coat shall be applied only when the mix is ready .The mortar shall be applied by pressing hard and each layer of 10 mm shall be compacted with hand vibrator. The mortar shall be applied to match the existing surface and refuse material should not be used again unless mixed with additional quantity of polymer. No bonding coat is needed if the 2nd layer of mortar is applied within 4 hours. Curing shall be done by sprinkling after 48 hours. No direct splashing of water shall be permitted.

Payment shall be made in SqM.

10. MICRO CONCRETE :

1.0 Materials:

1.1 Micro concrete: “Rendroc RG” of FOSROC Chemicals

OR

POLYCRETE-A of SUNANDA Chemicals

OR

Other equivalent approved brand

1.2 Water :

Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause

efflorescence or attack the steel in R.C.C. Stack for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in I.S. 456-1978.

1.3 Aggregate:

Coarse aggregate shall be machine crushed stone of black trap or equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate is 10mm down for micro concrete and shall comply with the requirement of IS-383.

The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean. Epoxy: Araldite GY-257 and Arudur-140 in 2:1 proportion for bonding coat.

2.0 MIXING :

Provision of form work will be made available before starting the work

2.1 Provision Prepare the micro-concrete as per the manufacturer's specifications and proportion

2.2 Apply bonding coat of epoxy (i.e. Araldite GY-257 and Arudur-140) in 2:1 proportion to the old concrete surface

2.3 The mixed material of micro-concrete should be placed immediately by pouring one side only to avoid air entrapment

2.4 The formwork shall be removed after stripping period as directed by Engineer-in-charge

2.5 Curing shall be done as per the manufacturer's recommendation

3.0 MIXING :

3.1. All eye contaminations shall be avoided. In case of eye contaminations, the eyes shall be thoroughly washed immediately with plenty of water and medical advice shall be sought.

3.2 Clean the tools and tackles after the completion of work with clean water.

Technical specifications for the Interiors

1.0 FLOORING

1.1 CERAMIC TILE / VITRIFIED TILE FLOORING / DADOING / SKIRTING

The ceramic tile shall be of approved quality, make, color, size and shape. On the approval of the sample by the PM, the order for the tiles shall be placed from one source and procurement done preferably from one batch/consignment to prevent any shape variation. Tiles to be sorted out at site before laying.

The floor surface over which the tiles are to be laid shall be properly cleaned and wetted. 3 to 6 mm Solid bed of BALCEM GOLDSTAR (POLYMER MODIFIED CEMENTITIOUS ADHESIVE) & in conjunction with BAL-ADMIX AD1 (POLYMER MODIFIED LIQUID) shall be applied over an area adequate to accommodate about 20 tiles at a time. Tiles shall be washed clean and pressed on to the grout and gently tapped in its proper position. The tiles shall be placed perfectly side by side so as to have fine joints truly vertical and horizontal and in level with adjoining tiles.

The joints shall be as specified in the drawing, if grooves are to be provided, it shall not exceed 1.5mm or as specified in the drawing, and shall be done using spacers of approved quality. The excess content slurry bulging/oozing out in joints shall be removed by wiping immediately. Joints between the tiles to be filled with BAL GROUT to match the color of tiles as per the manufacturers' specifications.

Thereafter, the joints shall be raked out to the required depth and loose cement/mortal shall be revved and joints shall be cleaned. Joints between the tiles to be filled with BAL GROUT to match the color of tiles as per the manufacturers specifications. (color as approved by PM) to match the color of tiles.

In the case of dado the wall surface shall be cleaned and plastered with CM 1:4 to a thickness of not less than 10 mm to form a uniform backing surface and finished rough and allowed to harden.

The tiles, which have been soaked in water, shall be cleaned and cement paste of butter like consistency applied to the backside of tiles and the tiles shall be pressed on the wall face and gently tapped in its position. In this way tiles shall be placed one after another starting from the bottom line and lay upwards.

The joints shall be truly vertical and horizontal, where required spacers – glass strips or ceramic strips – are used to achieve spacing between tiles of width as specified in the drawing, and the tile surface shall be of infirm level in all directions without any depressions and dulling which shall be tested by a straight edge as directed by PMC.

Curing and pointing of tiles in Dado shall be carried out as specified for flooring and as directed by PMC.

1.4 PRE POLISHED/FLAMED GRANITE SLABS IN FLOORING.

The granite shall be of approved color & shall be out of sufficient lot to cover particular area to avoid lot/shade variation.

Granite slab shall be quarried stones, hard, sound, durable and free from weathering and decay and defects like cavities, cracks, holes injurious veins, patches of soft materials and such other defects adversely affecting its strength and its appearance.

The hardness of the Granite slab shall be as per IS. The pre-polished/flamed granite shall be selected and approved by the PMC. The pre-polished/Flamed Granite sample approved shall be brought by the Contractor in adequate quality and from one single batch/source so as to ensure that the grains and shade of entire flooring laid is homogeneous and consistent. The size and shape of the granite slab shall be cut as per the Drawings/instructions of PMC, edges being true and square. The exposed edges of the slab are to be polished at site or in factory. Cutting of Granite slabs shall be done using machines as approved by the PMC.

The rate should include protection coat of POP over polythene till handing over. The rates shall be inclusive of machine-polished edges and groove if ordered.

Mortar shall be composed of cement and sand, unless otherwise specified. All mortar shall be prepared in accordance with IS 2250. The proportions of mortar measured by volume shall be as specified.

A layer of mortar shall be spread on full width over a suitable length of the lower course. Each slab shall be properly bedded and set in position by gently taping with handle or trowel or wooden mallet. The inside faces shall be buttered with mortar before the next slab is laid and pressed against it. The joints may be either paper cut or with spacing width.

In case spacing is provided between slabs, the mortar in the joints shall be raked out and pointed (type of joint as specified by PMC or drawings) with cement slurry mixed with coloring pigment (the color of the pigment and its proportion to be mixed with the cement as specified) to match the shade of the granite. The curing shall be for a minimum period of 7 days after laying and pointing.

1.5 GRANITE LAYING IN STAIRCASE TREADS, LANDING AND RISERS

The laying of granite in Staircase treads, landing and Risers shall be similar to laying of granite flooring as above, except that.

- The slabs cut shall be from one single piece, joints shall be paper joint, the edges shall be treated as shown in drawings.
- Anti skid grooves shall be provided for every Tread and Landing as per Detail drawing. the treads and Landing shall be projecting a minimum of

- 20mm from the top face of the riser.
- The cut is to be polished either in site or at factory.
- The edge of the treads shall be fully bull nosed / chamfered & polished to gloss as per detail dwg.

1.6 GRANITE SKIRTING

The pre polished granite shall confirm to the specification or requirement as that of Granite used in flooring/staircase. The thickness of the Granite used shall be 20mm thick and it is fixed over a backing coat of cement mortar of 1:4 of 12mm thick with a cement paste backed on the back of the granite tile.

The height of the skirting shall be 100mm or as specified the top edge of the skirting shall be treated as shown in the drawing.

The joints of the granite strip used in skirting are to be less in numbers and it shall be paper cut joint. The paste oozing out is wiped in a cloth and washed with water. The curing is to be for a minimum period of 7 days.

1.7 SKIRTING

SS skirting over ply: - fabricating and fixing 50 mm high SS skirting clad over 12mm thick marine ply using epoxy adhesive.

2.1.0 CARPENTRY / JOINERY

Scope of work includes Materials such as wood, labor for joinery of wooden frame and shutter, fixing of the frame and shutter, fixing of laminates or veneer, fittings and fixtures and such other related carpentry works.

2.1.1 MATERIALS.

Wood for Furniture shall be approved, seasoned and I class Steam Beachwood. It shall be fairly uniform in color and texture. It shall be free from blemishes, hollow pockets and knots, spinals or twisted grain, warp and any kind of decay or insect attack, cupcakes, door holes, splits, cracks, pinholes, wormholes etc.

Wood shall be kiln seasoned before being planed to the required sizes, in accordance with IS 401-1982.

Samples of seasoned wood and Commercial Boards/Plywood's shall be submitted to PM for approval, before placing order. The contract shall get the wood and Commercial Board/Plywood sample tested in an approved laboratory. If desired by

the PM, the Contractor shall submit all information such as manufactures/brand name, test certificate etc.,

The contractor shall submit test certificate in support of the kiln seasoning including ASCII treatment for the entire quantity of timber required for the work from the factory where seasoning has been done.

Commercial Flush Shutters of thickness 19/32/33 mm & 45 mm and of size as specified in drawings shall be solid core type with block board core and shall conform to IS 2202 1983 – part I (specification for wooden flush door shutters solid core type) IS 1003 part 1 and 2, IS 3097. Flush door shutters shall be free from twist or warp in plane, and the four edges of the shutter shall be square. Both faces of shutter shall be sand papered to a smooth and even texture. Tolerance on nominal thickness shall be ± 0.8 mm. Thickness of shutter shall be uniform throughout with the variation not exceeding ± 0.8 mm when measured at any two points.

All commercial shutters shall be internally lipped using approved wood, pressed and ready from the Factory directly. In the case of double leafed shutters, rebating shall be as indicated in drawings and directed by the PMC. Where separate lipping is provided, the depth of lipping at the meeting of styles shall not be less than 35mm.

Shutters shall not be damaged during transportation, storage and fixing. Damaged shutters shall be rejected and shall be replaced with new shutter as directed by the PMC whose decisions will be final and binding in this regard. From the time the shutters are procured to the time they are taken up for fixing in position, the shutters shall be stored in a proper manner with adequate supports so as to avoid damages to any part, particularly the edges.

The Flush shutter shall be laminated with plastic laminate sheet or veneer, whose samples shall be submitted along with manufacturers' brand name, test certificate etc to the PMC for approval before placing order. The laminate/veneer sheet is protected with building paper until ready for use.

2.1.2 **MOISTURE CONTENT**

The average moisture content of all the WOODEN samples from a lot shall be within $\pm 4\%$ and moisture content of individual samples $\pm 6\%$ of the maximum permissible moisture content. For this purpose the site of work shall be deemed to fall under climatic zone II. Seasoned wood as per IS 1141 –1973 and IS 287 – 1973 shall be basis of acceptance.

2.1.3 **WORKMANSHIP**

Timber sections for frames shall be planed smoothened to accuracy on all sides to the full dimension, rebated, rounded, chamfered or moulded as shown in drawings or as directed by PM without patching or plugging of any kind before they are framed and jointed. A tolerance of ± 2 mm shall be allowed in the finished cross sectional dimensions.

The joints shall be of mortise and tendon or tongue & groove type simple, neat and strong. Joints shall fit in fully and accurately without wedging or filling. The joints shall be glued, framed, put together and pinned with hardwood or pins not less than 10 mm dia, sash bars if any shall have metered joint with styles. Putty where used shall conform to IS 419-1967 and shall be a homogeneous paste and shall be free of dust, grit and other visible impurities.

After the frames are put together, they shall be pressed in position by means of a press. The contact surfaces of tendon and mortise joints shall be treated (before putting together) with bulk type synthetic resin adhesive of a make approved by the PM. Rails, which are more than 180 mm in width, shall have 2 tenons. Styles and shutters shall be made out of a single piece and shall have a 12 mm groove to receive panels.

Before the frames are fixed in position, these shall be inspected and passed by the PM. The frame shall be placed in proper position, secured to walls or columns as the case may be, with bimetallic fasteners, iron hold fasts etc. as shown in drawings and directed by the PM. In case of doorframes with sills are provided, these sills shall be embedded/sunk in the floor for full thickness of the floor. The doorframes without sills, while being placed in position, shall be suitably strutted and wedged in order to prevent warping during construction. The frame shall be protected for damage during construction.

Where glazed openings are indicated, the size, thickness and type of glazing shall be provided as in the drawings and shall be lipped internally with S. Beech wood. Shutters shall have provision for mortise locks where so indicated on drawings or as directed by the PM.

Shutters shall be checked after fixing for proper location, alignment and swinging. After fixing all the fittings the shutters shall be tried again for proper closure, handling and easy movement etc., and any defects noticed should be immediately rectified as directed.

2.1.4 **PRE LAMINATION / VENEERING TREATMENT**

Before Lamination/Veneering the Commercial Flush board with Laminate/ Veneer sheet, the surface to be laminated/veneered should be thoroughly cleaned, all cracks and nails holes filled as directed. The laminate sheet shall be fixed using approved quality adhesive recommended by the manufacturer and applied strictly in accordance to their instruction/specifications. The adhesive shall be applied in a thin layer and while still tacky, it shall be spread evenly with steel in both directions to assume full contact with the adhesive / Fevicol / SR. A constant and even pressure is applied for not less than 24 hours to ensure good bonding of the sheet to the board. The laminate/veneer surface shall be cleaned as recommended by the manufacturer of all stains/ adhesive marks etc.

2.1.5 **SURFACE TREATMENT**

All Wooden and Veneered surface shall be water cut melamine finished after it has been approved and passed by the PM. All portions of timber built into masonry or abutting a concrete portion of the building or buried in ground shall be coated with boiling coal tar or other type of approved wood preservative or primer before fixing them in position.

2.1.6 **FITTINGS AND FIXTURES**

All fittings and fixtures for the doors, storage and worktops shall be as indicated in the schedule shown in the drawings. The samples along with manufacturer's / brand name, test certificate etc, shall be submitted to the PM for approval before placing order.

2.1.7 **LOUVERS FIXED TO FRAMES.**

The louvers shall be of wood, glass or any other materials as specified in the drawings. These shall be fixed in grooves made in the frame or shutter. The Venetian blades shall slope down towards the outside at an angle of 45° or as shown in drawings. These shall overlap each other by about half of their widths. Beading shall be fixed all around the openings for louvers as indicated in the drawings.

2.2 **PARTITIONS**

2.2.1 **GI CORE PARTITION**

50 X 25 GI sections can be used for framework having vertical members at 600mm c/c fixed with horizontal noggins at floor and soffit and the centers, wherever required in line and level, 12.5mm tapered edge. Gypboard (Conforming to IS -2095-1982) is then screw fixed to either side of timber frame with 25mm long drywall screws at 300mm c/c with joints staggered to avoid through joints.

Finally the face layer of the boards are to be jointed and finished so as to have a flush look which includes filling and finishing with jointing compound, paper tape and two coats of primer suitable for Gypboard (as per recommended practices of India gypsum or equivalent.)

2.2.2 **FULLHEIGHT GYPBOARD PARTITION:**

Full Height Partitions to be fabricated using 25 x 50mm GI section framework @ 600 c/c bothways with horizontal noggings at floor and soffit, on both side skinning with 12.5mm Tapered edge gyp board (IS-2095/1982), in line and level screw fixed to

either side of GI section with 25mm long dry wall screws 300mm c/c with joints staggered to avoid through joints finished so to have flush look with jointing compound paper tape and two coats of primer suitable for Gyp board as per recommended practices. complete and Glass wool insulation of 50mm thk inside the partition filled with Kimco/Rockwool insulation as per dwg. All electrical/network switch boxes, niches to be boxed/packed with adequate reinforcement using plywood. 12mm GI channel to be provided at intersection of two materials.

2.2.3 **FULL HEIGHT- DOUBLE GYPSUM PARTITION:**

Full Height Double Gypsum Partitions of 136mm thk to be fabricated using 25 x 50mm GI section framework @ 600 c/c bothways with horizontal noggings at floor and soffit, on both side skinning with 12.5mm Tapered edge gyp board (IS-2095/1982), in line and level screw fixed to either side of GI section with 25mm long dry wall screws 300mm c/c with joints staggered to avoid through joints finished so to have flush look with jointing compound paper tape and two coats of primer suitable for Gyp board as per recommended practices. complete and Glass wool insulation of 50mm thk inside the partition filled with Kimco/Rockwool insulation as dwg. All electrical/network switch boxes, niches to be boxed/packed with adequate reinforcement using plywood and also 12 mm GI channel to be provided at intersection of two materials.

2.2.4 **FULL HEIGHT HALF- GLAZED PARTITION:**

Same as in full height partition but partly glazed partition with (10mm thk toughened clear glass) above 2100 mm from floor till 3000mm ht. & with Gypsum partition below as per Gypsum partition specifications etc., Complete as directed with in fill of Kimco or Rockwool insulation and also 12 mm GI channel to be provided at intersection of two materials.

2.2.5 **PARTLY HEIGHT DOUBLE GLAZED PARTITION**

Same as in full height double gypsum partition but partly Double glazed partition of 136mm thk. with (10mm thk toughened clear glass) above 2100 mm from floor till 3000mm ht. & with Gypsum partition below as per Gypsum partition specifications etc., Complete as directed with in fill of Kimco or Rockwool insulation and also 12 mm GI channel to be provided at intersection of two materials.

2.2.6 **FULL HEIGHT GLAZED PARTITION**

Full Height Double Glazed Partitions to be provided with 10mm thk toughened glass using 25mm x 25mm x 2mm thk SS C channel on top and bottom, including cutting groove in the floor to fit C channel and the gap is filled with GE silicon gel and top with MS frame work to fix the C channel and painting the MS framework with enamel paint, compete as per dwg., and directions

2.2.7 **FULL HEIGHT LAMINATED GLAZED PARTITION**

Providing and fixing Full Height laminated glass partition in combination of 5mm thk etched glass, 5mm thk clear glass and 2mm thk raisen laminate fixed using glass fins on top and with 25mm x 25mm SS C-Channel in the floor and filling the gap with GE silicon sealant at the bottom, Complete as per dwg., and directed.

2.2.8 **PARTITION ABOVE FALSE CEILING:**

Partition above false ceiling with GI frame of 25mm x50 mm at 600mm x 600mm c/c. Frame to be fixed to ceiling. All internal frame members to be screw fixed. Internal voids to be glass wool in filled for sound proofing. No finishing required. Provide required cutout for Return Air passage.

2.2.9 **MEDIUM HEIGHT PARTITION:**

Medium height partition, 75 mm thick with GI frame of 25mm x50 mm sections at 600mm x 600mm c/c, faced both sides with 12mm thk Gypboard with 10mm x 10mm grooves (made using AL "L" angles) at all ends. Frames to be fixed to the floor. Inside voids to be filled with 50 mm thk panels of glass wool/ rock wool. All gypsum board edges to be protected with aluminum angles. Partition to include Approved skirting at floor level. All internal frame members to be screw fixed.

2.3 **STORAGE:**

2.3.1 **FULL HEIGHT STORAGE: LAMINTED:**

Full height storage with top, bottom to be made out of 19-mm pre laminated board / ply with Approved veneer / laminate lipping. Back to be provided of 8- mm thick pre laminated board. The sides of the storage to be made of 19 mm thk pre laminated. All shelves to be adjustable and made of 19 mm thk commercial ply. Openable shutters to be made out of 19-mm thk board with balanced shutter with 1 mm thk Approved laminate or 4mm thick approved veneer fixed on all sides. Shutters to be fixed complete with all necessary fittings like hinges,brass ball catch, SS cranked tower bolts, locks, handles of specified make and size as per details.

2.3.2 **FULL HEIGHT STORAGE -VENEERED:**

As per item No 9.1.1 but with 19 mm balanced shutter with 4mm thick Approved veneer melamine polished on the outside and all inside surfaces laminated in Approved laminate.

2.3.3 MEDIUM HEIGHT STORAGE:

M.H storage to be formed out 19mm pre laminated board, with Approved veneer lipping finished on all sides. Provide 19 mm pre laminated shelves as directed. The Top, sides and shutters of the storage to be made out of 19 mm thk veneered comm. Ply. All shelves to be adjustable or as directed by Architect. Openable Shutters to be hung with spring loaded hinges of specified make, inside surface to be finished with laminate and fixed complete with all necessary fittings like hinges, brass ball catch, tower bolts, locks, handles of specified make and size as per details. All the surfaces shall be laminated / veneered.

2.3.4 LOW HEIGHT STORAGE (Veneered):

Low height storage of 900 mm ht as per details and specifications of item no. 9.1.3 with approved veneer. Openable Shutters to be hung with spring loaded hinges of specified make, inside surface to be finished with laminate and fixed complete with all necessary fittings like hinges, ball catch, tower bolts, locks, handles of specified make and size as per details.

2.3.5 LOW HEIGHT STORAGE (Granite Top):

Low height storage as per details and specifications of item no 9.1.3 but with top in 19 mm thk granite of approved shade with machine cut and polished edges.

2.3.6 OVER HEAD STORAGE:

As per item 9.1.3 but hung onto wall and with bottom faced with laminate/veneer and detailed as per the drawing.

3.1.0 GLAZING

The following Indian Standards shall be followed

IS 1761 – 1960	Specifications for transparent sheet glass for glazing and framing purposes.
IS 2835 –1975	Specification for transparent sheet glass.
IS 5437 –1969	Specification for wired and figured glass
IS 419 – 1967	Specifications for putty for use on window frames
IS 3548 –1966	Code of practice for glazing in Buildings
IS 1200 – 1970	(Part XIV)

The glass shall be transparent and free from blisters, stones, scratches and bubbles so as to give a clear visibility throughout the glass. The sheet glass should not show any distortion of light when tested according to the method prescribed in Appendix 'B' in IS 1761-1960. The cut size of sheet glass shall be within the following tolerance, on both length and width of the prescribed cut size.

Thickness Mm	Tolerance on cut size
2.5 and below	± 1.5
3.0 and above	± 2.0

The thickness of sheet glass when tested according to the method prescribed in Appendix –C in IS 1761 – 1960, shall be as follows, within the tolerance indicated against each.

The size for glazing shall allow a clearance of 2.5 mm between the edges of the glass and the wood or metal surrounds. The clearance may be increased, provided the depth of the reedit or groove is sufficient to provide not less than 15- mm cover to the glass. The detailed process of glazing shall be as specified in IS3548 –1966 code of practice for glazing in building.

All stains form the surface shall be removed and cleaned with thinner. The edge of glass or glazing sheet when rounded shall render a uniform look throughout the length and shall be neatly finished.

4.1.0 **FABRICATION WORK/ STAINLESS STEEL WORKS**

4.1.1 FABRICATION TOLERANCES

Unless otherwise shown on the drawing, the fabricating tolerances shall generally be as follows:

Straightness: compression members shall not deviate from straightness by more than 1/1000 of the axial length between points, which are to be laterally supported.

Completed members shall be free from twist bends and open joints. Sharp links or bends shall be cause for rejection of materiel.

Length: of 1 mm is permissible in the overall length of members with parts of the structure, shall have a variation for the detailed length not greater than 2 mm for members 10 meters or less in length and not greater than 3 mm for members over 10 meters in length.

4.1.2 **STAINLESS STEEL WORKS**

All stainless steel used should be conforming to BE 316 in brushed finish.

The stainless steel pipes shall be procured from approved manufacture and of approved grade. The quality of stainless steel sheet and pipe shall be approved by PM before proceeding with execution any item of work. The surface finish of the entire component used in executing the item should be brushed finished

4.1.3 **HAND RAIL**

The pipe used for handrail shall be of 14 gauges thick. All joints to be done with welding only of TIG (tungsten inert Gas). The welded links are to be ground and organ buffed to get the original finish of the surface of the material welded. The joints or junctions where two pieces are joined/welded to be precisely cut and then welded, SS Bal Acrylic emulsion s and 10mm thk toughened glass. The fixing details of the handrail shall be as specified in the drawing or instructed by PM / Architect.

5.1.0 **PAINTING**

5.1.1 **CEMENT PRIMER**

The surface shall be thoroughly cleaned of suet etc., and be allowed to dry for at least 48 hours. It shall than be rubbed thoroughly with sand paper to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of Paris mixed with water on the entire surface including filling up the undulation and then sand paper the same after it is dry.

The cement primer shall preferably be applied by brushing and not by spraying. Horizontal strokes shall be given first, and vertical strokes shall be applied immediately afterwards. The entire operation shall constitute one coat. The surface shall be finished as smooth as possible leaving no brush marks.

5.1.2 **ACRYLIC EMULSION PAINTS.**

Acrylic emulsion paint of approved brand and manufacture shall be used. The primer where used as on new work shall be oil-based primer. These shall be of the same manufacture as the plastic emulsion or as approved by PM. Only sufficient quantity of paint required for days work shall be prepared.

The paint and primer shall be brought by the Contractor in sealed tins in sufficient quantities and from one single batch/consignment, and the same shall be kept in the joint custody of the Contractor and the PM. The empty tins shall not be removed from the site of work till this item of work has been completed and passed by the PM.

Preparation of the Surface: the scaffolding used for painting should be erected taking care not to rest on the walls so as to avoid any damage to the wall surface. For new work the surface shall be thoroughly cleaned of dust, old white or color washes by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, (made of ingredients plaster of Paris, chalk powder, primer, paint etc., mixed as specified or directed by the PM) on the entire surface including filling up the undulation and then sand papering the same after it is dry.

One coat of sealer and two coats of Acrylic emulsion paint are to be applied. The application is done using good quality approved make brush. On the final application, roller is used to get a better and acceptable finish (the roller application is done on smooth wall surface only). At places where required, the application of paints is done on granular finished surface, in which case no application of putty and sand papering is required. The work is to be carried out under direct Guinness and instructions from the manufacturers whose expert advice and supervision are to be made available in order to achieve the high- grade finish. The painters employed for this work must be capable of producing the highest standard of workmanship required. If the finish is of doubtful nature, the contractor shall have to rectify the entire, at his own cost, to the satisfaction of the PM.

5.1.3

TEXTURED PAINTING

All textured paint to conform to specific IS. The paints of specific make/manufacture that are mentioned in the specifications are to be used. The textured paints may be of exterior / interior grades as specified.

The surface is prepared free of dust/dirt/grease and other foreign matters. The scaffolding is to be done as for the other type of painting.

Texture finish painting is a wall coating available in different readily available textures finishes and colors and is a substitute to conventional wall finishes. These paints can be texture recessed raised, granular smooth etc. dinettes. The glossy can be achieved by adding marble powder to the required proportion.

As far as possible only ready mixed color/shades is used directly unless until a shade difference is required, which is achieved using strainers of approved make and color, mixed in approved proportion.

The thickness of granule used in the textured paint is 2.5mm. This finish can be applied on any surface of finish like cement plaster, good surface of brick masonry and also already painted surface. The textured finish acts as better fire retardant coat

against the conventional type of painting. This paint is also anti-fungus and anti-corrosive.

The finish needs a minimum of 3 hours to dry and shall be ready to use after 24 hours.

The application is either done with brush or spray gun or trowel (also manual pressure on the trowel) or roller depending on the required finish and as per the manufacturers' instruction.

The applicator should be skilled and specially trained by the manufacturer of the particular texture paint to do such work.

Basically the application process is

- Application of base coat either one or two depending on the required finish of the selected texture. The color of the base coat is to be approved by the PM / Architect.
- Application of ready mixed paint is by any of the already mentioned type i.e. by brush spray trowel, roller etc. depending on the type of finished required.

5.1.4

PAINTING STEEL SURFACES

The contractor shall purchase synthetic enamel paint of approved quality make color and shade.

All steel surfaces shall be thoroughly cleaned of all dirt, grease and rust. Any small areas, which become inaccessible after assembly, shall be painted before assembly. The surface shall be perfectly dry before painting.

The priming coat for steelwork shall be applied after the surface has been prepared. After the priming coat has dried all blowholes and dents shall be filled with metal paste and surface smoothed with sandpaper.

Wherever shop primer painting is damaged, the surface shall be thoroughly cleaned and touched up with corresponding primer.

Site painting shall not be done in frosty or foggy weather or when humidity is such as to cause condensation on the surface to be painted.

The contractor shall take care to clean thoroughly all stains of paint on glasses, walls, fittings, fixtures etc. by applying turpentine or thinner.

5.1.5

POWDER COATING.

The powder coating to be done on steel / aluminum surface shall be epoxy hi bird or pure polyester. The Finish shall be Matt, glossy /semi-glossy, textured or structure types which shall be as approved by the PM. The variation in thickness of coating shade of the color and finishes shall be achieved varying the temperature of heating.

The process of coating is basically.

- Degreasing
- Watering
- Picking/chromatin
- Water rising
- Phosphating
- Oven heating and
- Cooling at room temperature etc.

The quality / color / shade of the powder used shall be of reputed approved manufacturer. The contractor shall submit to the PM a sample for approval before finally placing an order. The thickness of powder coating shall be based on the surface being coated and the resilience to weathering effects required for the particular item. The thickness of coating varies from a minimum 20 microns to maximum to 60 microns. The temperature of oven heating shall be around 185°C.

The specialists/manufacturers' specification in using the product shall strictly be adhered to in preference to the specification in the contract.

5.1.6

VAPOCURING

Vapocuring finish shall be done for Metal surfaces exposed to both interior and exterior atmosphere. The putty material, hardener, base coats material, Polyurethane coat material and the paints used shall strictly be in accordance with the manufacturers' specification.

The quality/color/shade to be applied shall be as per drawings. The Contractor shall submit to the PM a sample for approval before finally placing an order. The quality of coating is based on the surface being coated, the resilience to weathering effects required for the particular item as approved by the PM. The Specialists/Manufacturers' specification in using the product shall strictly be adhered to, in preference to the specification in the contract.

Heating shall be at 70°C. Temperature may be varied depending on the hardener added with the color in specified recommended proportion. The surface to be vapocured should be first made free from dust, dirt, grease or any such foreign material. The porches of Vapocuring shall be done under a dust free environment and basically consist of

- Preparation of the surface
- Putty Work
- Spray coat either mixed with hardener or other wise
- Heat treatment
- Polyurethane coating, etc.

MELAMINE FINISHING

Melamine finishing shall be done on wooden surfaces. The finish shall be Matt, glossy, semi glossy type which shall be as approved by the PM.

All uneven and rough surfaces shall be rubbed-using sandpaper of the required grades till a smooth surface is obtained and the surface shall then be well dusted. The nail marks/ pores in the wood shall be filled with wood filler and the surface shall be rubbed with the required grade of sandpaper so that the entire surface is uniformly smooth.

After preparing the surface as specified above, application of a sealer coat shall be done.

Wherever necessary the pores in the wood shall be again filled with wood filler and the surface shall be rubbed with the required grade of sandpaper in the presence of water so that the entire surface is uniformly smooth. Staining as required shall be done manually, application of second coat of sealers shall be done. Finally 3 coats of Melamine spraying, strictly under dust free condition, shall be done, after which the surface is buffed with Wax & Oil.

The Specialists/Manufacture's specification/instruction in using the product shall strictly be adhered to, in preference to the specification in the contract. It is

preferable to carry out the process under warm weather condition. The spray gun before/after using shall be cleared thoroughly using thinner or spirit.

6.0 FALSE CEILING

6.1.0 SUSPENDED FALSE CEILING: GYPSUM

False ceiling should be carried out with lightweight boards made of basic materials like aerated gypsum treated with special additives, and both sides are covered with a special off white/white color paper. The size, thickness and texture of the board or tile available is as per the manufacturer details.

The Gypsum boards or tiles should confirm to IS 2542-1981 and IS 2095-21982 physical properties of Gypsum board should confirm to:

Density:	nominal in a dry state = 807.10 kg/m
Fire resistance:	12.5mm = ½ hour resistance. Material classified as class 1 surface soared of flame test as per BC476 PART –7 1971
Sound insulation:	The average rate of noise reduction between frequencies of 100 Hz is 35.6 dB for a partition 75 mm or 97 mm thickness with a 12.5mm board on each face 38.5. DB for a partition as above but including 265 mm of mineral wool in the cavity 42.5 BD for a 100mm partition comprising of two layers of 12.5-mm board on each side.

Gypsum board is basically available with the properties as below.

Thickness in mm	Width in mm	Weight kg/Mt	Thermal conductivity	Thermal resistance in m K.W
9.5	610& 1220	8.0	0.16	0.06
12.5	610.1220	10.5	0.16	0.08

Gypsum board should be flexible enough to resist any crack due to limited movement of a building.

False ceiling should present unbroken surface and desirable continuity may be varied by treatment of joints with wood or plastic or PVC or metal or any other such material strips.

Off loading of gypsum is only advisable on small boards and may be carried by one man but generally two men will be required and this will reduce the risk of damage to the boards. Boards are manually carried on edge.

When storing boards, care should be taken to keep in a dried and covered place sheltered from rain and avoid dampness from floors. They should be supported on wooden battens, which should not be more than 45 cm apart on a flat surface.

Deformed gypsum boards (because of poor handling or storage) are difficult to erect. It is suggested that the board is stacked in different piles according to size and thickness so that the work can be carried out more effectively in terms of time. Care should be taken not to stack the piles too high. Gyp board should never be stacked on edge for a long period as this can cause deformation.

Gypboard can easily be either longitudinally or transversally cut. A cut should be made in the face side of the board by means of a retable knife. A line may be ruled prior to cutting or with practice. The rule may be drawn down the board at the required distance from the edge whilst the board is scored with a knife at the edge of the rule. The board should then be pressed with both hands and gypsum score will break in the line with the cut in the side face. The board should then be turned over and the side paper be cut with the knife.

Gypboard may be cut using a normal saw. A fret saw or an electric tool may also be used for the cutting of curves. When large quantities of board are to be cut, the use of a circular handsaw is advisable.

Electrical or manual carpenter's tools as those employed in the cutting of wood may be used for making cutouts in gypsum board. A drill should be used when making holes for electrical installation thermostat boxes, etc. For holes of diameter less than 50mm high speed steel drill should be used.

The edge of the board can be pared off using planes. A file may also be used to level off any irregularities, which may remain after cutting. The edge of both papers, faces may be trimmed by using fine sand paper

Gypboard may also be used to line curved areas. The curvature radius shall be 60cm for 9.5mm board and 100cms for 12.5-mm board. 30 to 60 minutes before application to curved areas, both sides of the gyp board should be sprayed with water until they are damp. The board should then be bent very slowly and carefully, and fixed in to position. Before joining the boards should be completely dry

The ceiling is suspended using systems made of G.I. The suspended ceiling may be heavy duty (load bearing ceiling on which a person can walk over a ladder for maintenance purpose) or light duty (non loading bearing). Both these systems may be either with a layer of vinyl film laminated.

On completion of the erection of the grid work, care should be taken to see to it that the bottom face of the grid work is on true water level or to the required gradient or profile

Where light fittings, access panels and similar components are incorporated as a part of the design requirement, consideration must be given to maintaining the integrity of the ceiling. The fire and sound insulation are also important factors.

The joining treatment of two-gyp board is described below

TAPERED EDGE JOINT: A continuous thin band of jointing compound of gyp board jointing compound is applied to the trough of the tapered edge point. The joint tape is then pressed in to the band of jointing compound, firmly embedded and free from tapered air bubbles with sufficient jointing materials under the tape to ensure good adhesion

Immediately after the tape has been fixed, a new layer of material is applied over it, flush with the surface of the board. Before the material begins to stiffen the jointing sponge should be moistened and surplus material wiped from the edge of the joint without disturbing the main joint filling. The sponge should be rinsed occasionally to prevent material setting in it. Once the material is dried any slight depression in the surface can be filled again and projection cut back

When the material has dried about 1 hour after application, a thin layer of jointing compound is applied in a broad band 200mm wide. The edges of this band should be immediately feathered with a slight damp jointing sponge. When the joint material has completely dried another application is made 250mm wide and feathered out as before. It is important that the first coat of finish is allowed to dry before the final coat is applied

CUT EDGES: A finish similar to that achieved with the tapered edge board can be obtained with cut edge boards or acute edges and tapered edge board. The cut edge should slightly sanded to remove any burrs

The edge of the adjoining boards is cut to make v-groove with a sharp knife. The joints are flush with the face of the board, using gyp board jointing compound. The gap must be filled solidly back to the framework. The coat is applied and joint tape bedded in it as tightly as possible, leaving sufficient material behind the tape to ensure good adhesion and to eliminate air bubble. Gyp board jointing compound is then applied with a sponge. When this has dried a second application of 200mm wide is applied and the edges are feathered out. Wider feathered out of the joint will overcome slight misalignment of cut ends and edge joints.

NAIL AND SCREW SPOTTINGS:

This process fills any indentation left by the hammer or screw head when fixing the board. With the layer of jointing compound which is struck off level with the face of the board and allow drying. The operation is completed with one more similar application.

SURFACE TREATMENT:

When the jointing is dry, one coat of gyp board dry wall topcoat is applied to the entire surface using the medium pile roller, and brush or entirely by brush.

All the accessories like the ceiling section, perimeter channels, intermediate channels, clips, cleats jointing compound jointing tape screws nails etc used in erecting the false ceiling should be recommended by the manufacturer and under the instruction or guidance of the manufacturer

The type of board –size, texture, edge finish or the type tiles used should be strictly as per the approved selection of the PM / Architect.

6.2.0 GYPSUM BOARD WALL LINING

This lining is done either on to masonry insulation natural or any other material using specified thickness Gypsum board manufactured by approved agency. Specified GI section of appropriate gauge is screwed on to the surface to be lined with gypsum board and subsequently board is dry screwed on to the sections. The joining of boards, treating of joints and surface finishing is similar to that the false ceiling.

TECHNICAL SPECIFICATION FOR ELECTRICAL WORKS

A	GENERAL
1.	POWER SUPPLY : Electric Power supply for carrying out his work shall be arranged by contractor on his own cost at the site and energy charges shall be borne by the contractor.
2.	COMPLIANCE OF SAFETY CODE : Successful tenderer shall ensure compliance with statutory provision of Safety regulation & departmental requirements of safety codes in respect of labor employed on the work by the Tenderer. In the event of the contractor falls to observe the same, the Department will be at liberty to make the necessary arrangement at the cost of the contractor and recover this cost from him. The contractor shall be responsible for any compensation to the workmen payable under the Workmen Compensation Act 1923 duly amended as on date or any other statutory Regulations in force. In case of fatal or non-fatal accident occurred to the workers during erection and maintenance of system, the Department will not be liable to pay for any compensation and it is duty of Contractor to observe all Labour Acts and Rules.
3.	CO-ORDINATION WITH OTHER AGENCIES :Successful tenderer shall co-ordinate his work with other agencies engaged in, the construction of Building. And submit weekly progress report of the work carried out by him
4.	COMPLETION OF TENDER SPECIFICATION :All fittings, unit, assemblies, accessories, hardware, foundation bolts, terminal lugs for electrical connection, cable glands and miscellaneous materials or accessories or items of work which are useful and necessary for efficient assembly and working of the equipment shall be deemed to be included in the tender within the over-all cost quoted. The equipment shall be completed in all details whether such details have been mentioned or not. Further I have certified that, I had gone through the detail Specification included in the tender and fully conversant with the Specification laid down for concerned items along with IS code, IE rules & NEC.
5.	TOOLS :The offer shall also include a set of tools required for operation and maintenance as are considered necessary by the tenderer. Details of tools offered shall be stated clearly in the Schedule of the tender.
6.	WORKMANSHIP The entire work of fabrication, manufacture assembly and installation of equipment shall conform of high grade workmanship. All the equipment supplied and erected must be able to withstand the Atmospheric condition of Maximum ambient temperature 45 D.C. Maximum relative humidity 98% Corrosive atmosphere Hot and humid climate closer to sea coast. The Contractor has to carryout holes by chipping/core cuts in the floor slab if necessary for laying pipeline as per the requirements
7.	SITE VISIT BEFORE SUBMISSION OF TENDER. Contractor has to be visit the site, before submission of tender.
8.	CIVIL WORKS: 1) Major Civil works is excluded from the scope however necessary excavations if required, making, closing of cutouts/Core cuts in the wall/Floor, necessary supports and grouting, drilling etc with finishing the same to match the background in all respect are included in the scope. 2) All Civil works like chasing & making good the chases making pockets for grouting

	if necessary, grouting of panels etc. with finishing the same to match the background in all respect are included in the scope. 3) Fabrication and fixing of supports, with finishing the same to match the background in all respect are included in the scope.
9.	DRAWINGS The contractor shall prepare necessary drawings such as panel drawing, single line diagram etc and gets approved from concerned Executive Engineer (Electrical) within seven days after receiving layout of the work. The three sets of hard copy and one soft copy of approved drawings shall be submitted by the contractor and obtaining necessary permissions & licenses if any from the competent authority. The applicable charges/fess if any from the authority shall be borne by the contractor After Completion Of the Work , the Contractor has to submit 6 Sets of As Built Drawings in Hard copy & one Soft copy in autocad +pdf Format
10.	ACTIVITY BAR CHART The contractor should submit activity bar chart for the work tendered to the engineer-in-charge within two days
11.	MATERIAL TESTING I] The material in schedule B / brought at site/ erected at position will be tested from the Government Owned Regional Testing Laboratory. If the accepted tender cost is 10% or more than 10% below the Amount put to Tender then material brought on site will be tested as per direction of Tendering Authority If the report of the material sent for testing is found unsatisfactory, same will have to be replaced by the contractor at his own cost even though already erected. The material to be replaced needs to be brought at site & will have to be get tested before erection. The testing fee/charges and all other associated charges like transportation etc. will be entirely borne by the contractor. However the sampled quantity will be considered in the measurements for first time testing only. II] The necessary testing of the Main panels/machinery/Electrical Appliances etc. shall be done at factory in presence of engineer-in-charge before delivery of the Materials and the factory test reports shall be submitted , the necessary charges and all other associated expenses like transportation etc. will be entirely borne by the contractor.
12	The Contractor has to co ordinate with necessary follow up with the Electric power supply Company as directions of the engineer in charge
13	For commissioning of electrical installations any statutory Permissions required Shall be Born by the Contractor at his own Cost.

1 SCOPE OF WORK

Scope of work covered under this tender shall be as mentioned but not limited to following:-
Supplying, Erecting, Testing & Commissioning of Electrical, Works & its components.

2. Applicable Standards/ Statutory Requirement

All works shall be carried out in accordance with the following standards

Recommended Standards:

The following list is for Indian Standards which are acceptable as good practice and accepted standards;

Development Control Rules : Of concerned Corporation or Local Authority

The Safety Regulation 2010 amended up to date

STANDARDS 2.1 The Conductor shall also comply in all respects with the IS:398 (Part-II) 1996 with latest amendments unless otherwise stipulated in this specification or any other

International Standards which ensure equal or higher quality material. 2.2 The ACSR

Conductor shall also conform to the following standards.

TESTING :

AT MANUFACTURER'S WORKS

The routine tests on Electrical ,HVAC ,FF,etc materials like, HT/LT Cables, switchgears ,etc shall be carried out at manufacturer's work in accordance with applicable Indian standards in front of Supply company's representative & Engineer In Charge during Factory visit.

3 GUARANTEE

The Complete Electrical Installation shall be guaranteed for satisfactory operation for a period of 60 months for LED) from the date of commissioning or. Any defects noticed during this period shall be rectified free of cost.falling which compensation for delay at Rs.1000/-Per day shall be Proposed.

The Agency shall indicate the type of records to be maintained so that the warranty claims if any are honored by the manufacturer.

. DOCUMENTATION

As a part of the equipment supply, following documentation shall be furnished.
Schematic diagram

Complete Electrical Installation drawing.

Test certificates for All materials & Equipment's listed in Schedule B, and for LED fittings
Test Certificate from OEM, stating system efficacy not less than 90 lumens /watt, CRI >70, THD< 10%, operating voltage in the range of 160 V to 270V, Power factor >0.95, withstanding capacity of surge protection upto 3 kV, CCT-2700-6500 and fitting shall have provision of connection to earthing.

Spare parts list.

TAKING OVER

The clients will take over the Entire Electrical installation for operation on completion of the following.

The Entire Installation shall be tested and commissioned as per the specifications.

Original test certificates are furnished for all other bought out items.

6 sets of AS BUILT documentation, maintenance chart and operation and maintenance manual are to be submitted.

The Contractor submit some important events video clips before, during the execution of the work including Training, till the final handing over of the work

7. All the plans / drawings/ layouts shall be got approved from Consultant /Client and final completion report shall also be submitted at no extra cost.

PREFACE

All the Electrical Work shall be carried out as per

The relevant Indian standards formulated by Bureau of Indian Standards

Indian Electricity Rules 1956 amended time to time.

National Electrical Code

Chapter 16 of PWD Hand Book Government of Maharashtra

Bombay Lift Act and Rules amended time to time.

Maharashtra Fire prevention and life safety measure Act 2007.

National Building Code 2016.

The technical specification for electrical services to be provided in New Proposed District & Session Court Building at NAGPUR is detailed out in this particular document. The same to be read in conjunction with the Drawing Volumes & Bill of Quantities.

SCOPE OF WORK

Scope of work covers under this tender are as below

Internal Electrical Installation along with UPS system etc.

External Electrical Installation consisting of Service connection to all buildings, etc.

Supplying, erecting, testing and commissioning of Fire fighting system.

Supplying, erecting, testing and commissioning of Low voltage system consisting of Fire alarm system, Lan/Van, P.A. system etc.

Supplying, erecting, testing and commissioning H.V.A.C. System.

NOTE :-

All codes and standards mean the latest where not specified otherwise installation shall generally follow the Indian Standard codes of practice in the absence of corresponding Indian Standards.

1.2 ELECTRIFICATION WORK

SCOPE

The scope of work generally comprises of supply, installation, testing & commissioning of all Internal Electrification works viz Point wiring, Distribution boards, Cabling, Cable trays, Earthing, Telephone System, Data networking, Television system, fans, and allied electrical equipment's.

The agency shall work in coordination with other agencies. Any damage done to the work of others shall be made good by the agency without any extra cost.

General:

All material shall be conforming to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which ISI mark is not available in market, it shall either carry valid 'Quality Control' certificate issued by the as included in approved list.

Work shall be carried out as per the Method of Construction specified by BIS/IEC/Indian Standard. If there is no reference for particular Method of Construction in IS, such work shall be carried out as per the approved Method of Construction specified in chapter 16 of P.W. Dept. Handbook.

Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of the Engineer in Charge.

Material shall be tested in approved Testing Laboratory and shall qualify the relevant tests as and when directed by Engineer In-Charge.

Seven copies of all submittals shall be submitted - 3 set, Client- 1 set, Design consultant- 1 set, Architect- 1 set and Contractor- 1 set) for review.

Recommended Standards:

The following list is showing Indian Standards, which are acceptable as good practice, and accepted standards.

IS 732: 1989 Code of Practice for Electrical Wiring Installations.

IS 4648: 1968 Guide for Electrical Layout in residential buildings

IS 9537 (Part 1): 1980 Conduits for Electrical Installations: General requirements

IS 9537 (Part 2): 1981 Rigid Steel Conduits

IS 9537 (Part 3): 1983 Rigid Plain Conduits of insulating material

IS 3419: 1989 Specifications for fittings for rigid non metallic conduits

IS 694: PVC insulated cables for working voltages up to and including 1100V

IS 1554 (Part 1): 1988 PVC insulated (heavy-duty) electric cables for working voltages up to and including 1100V

IS 3961 (Part 5): 1968 Recommended current ratings for cables: PVC insulated light duty cables.
 IS 4288: 1988 PVC insulated (heavy duty) electric cables with solid aluminium conductors for voltages up to and including 1100V
 IS 14772: 2000 Specifications for Accessories for household and similar fixed Electrical Installations
 IS 3043: 1987 Code of practice for Earthing
 SP 30: 1984 National Electrical Code
 SP 7 (Group 4): 2005 National Building Code
 IS 14927(Part 1): 2001 Cable Trunking and Ducting systems for electrical installations.
 IEC 61439 Low voltage switchgear and controlgear assemblies

Hybrid Point Wiring

The hybrid point wiring shall be Surface type under false ceiling and concealed type for drops & switch boards on walls in required size of PVC conduit. Other specifications shall be as per point wiring specifications.

Conduits / Trunking(Casing Capping)(Surface type)

PVC Conduits

Specification No (WG-MA/CON)

Scope:

PVC Conduits: Surface

Providing specified PVC Conduits and erecting as per approved Method of Construction; on surface of wall / ceiling, etc. including entries through walls / slabs / flooring as per requirement, and with all necessary hardware, accessories such as Spacers, Saddles, Bends, Tees, Junction boxes, Check-nuts, etc.; making conduits erection work rigid and duly finishing, removing debris from site.

Material:

PVC Conduit:

PVC pipe minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No. 1/2) ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Method of Construction:

Erection PVC Conduits for Surface type wiring:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm, round headed screws for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers. Distance between 2 spacers shall not be more than 600mm. Size of conduit shall be correct depending on number of wires to be drawn (as per Table No.1/2 for PVC conduits). Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance

between pipes shall not be less than 300 mm. or ant electrostatic partition/separate pipe should be used. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface and with colour coding conduit (For visual identification) as per Table No.1/4. Flexible conduits shall be used at expansion joints. Especially for PVC Conduits of surface type wiring:
In addition to general instructions above, all joints shall be made rigid with resin / adhesive. Wherever offsets are necessary, it shall be done with bending spring. Size of conduit shall be as per Table No. ½ for number of wires to be drawn through the conduit.

PVC Trunking (Casing capping)

Specification No (WG-MA/CON)

Scope:

PVC Trunking:

Providing specified PVC Trunking (Casing capping) and erecting as per approved Method of Construction, on surface of wall / ceiling, etc. including entries made with PVC conduit through walls / slabs / flooring as per requirement with all necessary hardware, accessories such as inner / outer Elbows, Tees, Junction boxes, etc. and duly finishing, removing debris from site.

Material:

PVC Trunking (casing capping):

PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No 1/3 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8mm thick push-fit joints/ accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Method of Construction:

Erection of PVC Trunking for surface type wiring:

Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in single phase distribution and for power and light distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300mm shall be maintained between the Trunking or anti electrostatic partition to be provided. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and at required locations.

Conduits (Concealed type)

Specification No (WG-MA/CC)

Concealing PVC Conduits in RCC work

Scope:

Providing specified PVC conduit and laying / erecting in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with of all required material including hardware, binding wire, fish wire; accessories such as deep / long neck PVC junction boxes, PVC / MS junction / draw-in boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages.

Material:

PVC Conduit:

PVC pipe of minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No.1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, deep Junction boxes of required ways and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

‘U’ nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire, steel fish wire etc.

Method of Construction:

Concealing of PVC conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in single phase distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All PVC conduit bending shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC conduits:

In RCC work:

Work shall be commenced after fixing of steel re-enforcement on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.

Concealing PVC Conduits in walls / flooring

Scope:

Providing specified PVC conduit and erecting / laying in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with of all required material including hardware such as ‘U’ nails, binding wire, fish wire; accessories such as PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, glands, drawing fish-wires and making all piping rigid, refinishing the surface with cement mortar, removing debris from site.

Material:

PVC Conduit:

PVC pipe minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No.1/2), ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, Junction boxes of required ways, type and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plate on it.

Hardware:

‘U’ nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, etc.

Other material for Surface finishing: Cement, sand, putty, and water.

Method of Construction:

Concealing of PVC conduits: (General)

Work shall be done in co-ordination with civil work to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No.1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. for which the distance between pipes shall not be less than 300mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No.1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC Conduits In walls / flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it.

Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories, and ‘U’ nails. All joints shall be made rigid with resin. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

Bunch of wires:

Specification No (WG-MA/BW)

Scope:

Bunch of wires:

Providing specified wires and drawing them through provided conduits / trunking and / or as directed; with coded ferrules, harnessing the bunch of wires with necessary material when used in panel boards, duly connecting / terminating with lugs, and testing for safety and beneficial use.

Material:

Wires: in conduits / trunking / panel boards

Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5.

Wires: open

PVC insulated and PVC sheathed wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5.

Earth Continuity Wire:

PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5.

Lugs:

Copper lugs of appropriate size & type

Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Bunch of wires:

Drawing of wires: General

Specified wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5, shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires: through PVC conduits

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2.

Drawing of wires: through Rigid Steel conduits

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1.

Open Wire bunch: Open wires shall be erected with due care so as to avoid chances of any mechanical injury. Harnessing shall be done with required material in an approved manner in panel boards or where ever necessary. For covering lead wires flexible conduit shall be used with gland as per necessity.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured between termination points of Earth wire.

Polarity Test:

Test shall be carried out for ensuring the correct polarity in switch and plug.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter length of single wire or bunch as specified.

Mains (surface type)

Mains in surface PVC conduit

Specification No (WG-MA/PC)

Scope:

Mains in surface PVC conduit:

Providing specified PVC Conduits, Wires and erecting the conduits as per approved Method of Construction; on surface of wall / ceiling, etc. including entries through walls / slabs / flooring as per requirement, and with all necessary hardware, accessories such as Spacers, Saddles, Bends, Tees, Junction boxes, Check-nuts/ glands, etc.; making conduits erection work rigid; and drawing the specified wires through these conduits and duly connecting / terminating with lugs, complete finishing, removing debris from site; testing for safety and beneficial use.

Material:

PVC Conduit:

PVC pipe of minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No 1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires)

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of appropriate colour coding as per Table No 1/5

Earth Continuity Wire:

PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green or green yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate type and size.

Other material: Rubber grommet, bush, flexible PVC conduit, gland etc.

Method of Construction:

Erection PVC Conduits for Surface type wiring:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm, round headed screws for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers. Distance between 2 spacers shall not be more than 600 mm. Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/2 for PVC conduits). Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No. 1/4. Flexible conduits shall be used at expansion joints.

Especially for PVC Conduits of surface type wiring:

In addition to general instructions above, all joints shall be made rigid with resin / adhesive.

Wherever offsets are necessary, it shall be done with bending spring. Size of conduit shall be as per Table No. 1/2 for number of wires to be drawn through the conduit.

Drawing of wires: General

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5, shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not

be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires: through PVC conduits for surface type wiring

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through conduit. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2. At the termination end flexible PVC conduit shall be used with gland as per required.

Mains in PVC Trunking (casing capping)

Specification No (WG-MA/PC)

Scope:

Surface type Mains in PVC Trunking (casing capping)

Providing specified PVC Trunking, Wires and erecting the Trunking as per approved Method of Construction; on surface of wall / ceiling, etc. including entries made with PVC conduit through walls / slabs / flooring as per requirement with all necessary hardware, accessories such as inner / outer Elbows, Tees, Junction boxes, etc; including erection of specified wires in PVC trunking, with coded ferrules and duly connecting with lugs, and finishing, removing debris from site; testing for safety and beneficial use.

Material:

PVC Trunking:

PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No1/2 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8mm thick push-fit joints/ accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires)

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green colour, ISI marked, of specified size but not less than 1.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate type and size.

Other material: Flexible PVC conduit, gland coded ferrules, etc.

Method of Construction:

Erection of PVC Trunking for surface type wiring

Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of unlevelled surface number and size of screws shall be changed to higher size as per requirement and in case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300mm shall be maintained between the Trunking or anti electrostatic partition is to be provided. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and required locations.

Erecting wires in Trunking:

Wires shall be erected within Trunking with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be erected in single Trunking. Wires shall be terminated in the terminals of accessories only, with appropriate type and size of lugs. Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be erected through Trunking. Number of wires shall not exceed with respect to size of Trunking as per Table No. 1/3. After erection of wires double locking shall be checked while fixing capping. At the termination end flexible PVC conduit shall be used with gland as per requ

Earth continuity shall be ensured at all earth terminals and at earth terminals of metal enclosures.

Polarity test:

Polarity test shall be carried out for ensuring polarity in switch and plug.

Mains (Concealed type)

Mains in PVC Conduits in RCC work

Specification No (WG-MA/CC, WG-MA/BW)

Scope:

Concealed Mains in PVC Conduits in RCC work:

Providing specified PVC conduit, wires and laying / erecting Conduits in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with of all required material including hardware, binding wire, fish wire; accessories such as deep PVC junction boxes, PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages and as and when directed drawing of specified wires through these conduits with fish wire, tagging with coded ferrules and duly connecting with lugs, complete testing the installation for safety and beneficial use.

Material:

PVC Conduit:

PVC pipe of minimum 20mm dia and above, depending on number of wires to be drawn (refer Table No 1/2, ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, deep Junction boxes of required ways and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

‘U’ nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, GI fish wire, etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 1.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of required size & type

Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Concealing of PVC conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No.1/4.(For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All PVC conduit bending shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC conduits:

In RCC work:

Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and at located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.

Drawing of wires:

General:

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires: Through PVC conduits:

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No.1/2.

Concealed Mains in PVC Conduits in walls / flooring:

Specification No (WG-MA/CC)

Scope:

Concealed Mains in PVC Conduits in walls / flooring:

Providing specified PVC conduit, Wires and laying / erecting the conduits in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with of all required material including hardware such as 'U' nails, binding wire, fish wire; accessories such as PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, refinishing the surface with cement mortar, removing debris from site and as and when directed drawing of specified wires

through these conduits with fish help of wire, tagging by coded ferrules and duly connecting / terminating with lugs, complete testing the installation for safety and beneficial use.

Material:

PVC Conduit:

PVC pipe minimum 20mm dia and above depending No. of wires to be drawn (refer Table No 1/2, ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, Junction boxes of required ways and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plate on it.

Hardware:

‘U’ nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, etc.

Other material for Surface finishing: Cement, sand, putty and water.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate size & type

Other material for wire drawing: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Concealing of PVC conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC Conduits In walls / flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it.

Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories, and ‘U’ nails. All joints shall be made rigid with resin. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

Drawing of wires:

General:

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with correct type of and correct size of lugs.

Drawing of wires: Through PVC conduits:

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No.1/2. At the termination end flexible PVC conduit shall be used with gland as per necessity.1.6 Point wiring (Surface type)

Point Wiring (Surface Type)

Specification No (WG-PW/SW)

Scope:

Point wiring (Surface type):

Providing all required approved specified material including hardware and erecting wiring on surface of wall, ceiling from switch board to outlet for light / fan / bell / independent plug point, in rigid steel / PVC conduit or PVC trunking as specified; fixing one board with a 1 way switch for one way point or two boards with a 2 way switch on each board, in case of 2 way point; for controlling power supply and one board / block with accessory for outlet of light / fan / plug and terminating wires within as per approved Method of Construction; removing all debris and testing the installation for safety and beneficial use.

Material:

Point wiring (Surface)

PVC conduit:

PVC pipe of minimum 20mm dia and above depending No. of wires to be drawn (refer Table No1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

PVC Trunking:

PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No1/2 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8 mm thick push-fit joints / accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.

Rigid Steel conduit:

Rigid steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as 5mm thick 20mm width spacers and G.I. saddles for individual pipe or GI strip for bunch of pipes, sockets, inspection type or normal; open bends, junction boxes of required ways all of the same make.

Wires: Phase and Neutral

PVC insulated wires of specified size, 1.1 kV, & minimum FR grade insulation, electrolytic tough pitch (ETP) copper conductor, ISI marked, of required colour coding as per Table No 1/5

Earth Wire:

PVC insulated minimum FR grade copper wires of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, 2.5 Sqmm or bare copper wire of 14g

Accessories:

Switch: 1 or 2 way Piano type 6/10 A, 1 or 2 way Modular type switch 6/10A.

Outlet: 6A angle / batten lamp holder or 3 plate ceiling-rose or Bakelite / porcelain three way connector or if plug point, 6A, 3-pin plug socket.

Boards:

Switchboards shall be double walled (back and front) of suitable size, to accommodate independent slot for each switch, socket, fan regulator. Boards shall be made up of 4mm thick marine grade plywood for back and front fixed on wooden frame with 0.8mm thick laminate pasted on exposed portion of front ply, totally varnished and with either brass hinged door or screwed top.

Or

As above with 3mm thick Bakelite/Hylam top instead of laminated front ply.

Or

Board made from Filled polypropylene.

Round/Square double wooden block or PVC board for mounting light / fan outlet accessory.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, PVC/ rubber bushings etc.

Method of Construction:

Point wiring (Surface)

Erection of conduits:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be duly screwed and firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixingspacers and 12x5 mm round headed for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers and saddles. Distance between 2 spacers shall not be more than 600mm. Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300mm. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No1/4. Flexible conduits shall be used at expansion joints. Bushing shall be provided at open ends.

Erection of conduits:

PVC pipes for surface type wiring:

In addition to General conditions above, all joints shall be made rigid with resin / adhesive.

Wherever offsets are necessary, same shall be done with bending spring. Size of conduit shall be correct depending on number of wires to be drawn as per Table No.1/2.

Or

Specially for Rigid Steel Conduit of surface type wiring:

In addition to general conditions above, Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). All exposed threaded portion of Rigid Steel Conduits shall be painted with anti corrosive paint. Sharp edges and burr at cut ends shall be made smooth. Inspection type conduits accessories shall be used as per requirement in accessible position to facilitate drawing or withdrawing of wires. All conduits piping work shall be properly earthed with 2.5 sq. mm G.I Earth wire fixed to conduit and made continuous with Earth clips at every 1m and at ends and joints viz. bends, junction boxes.

Or

Erection of PVC Trunking for surface type wiring:

Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of unlevelled surface number and size of screws shall be changed to higher size as per requirement and in case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300mm shall be maintained between the Trunking. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and required locations.

Drawing of wires: General

Wires shall be drawn with adequate care. Correct colour coding as per Table No 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped within circuit. For lighting load distribution wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the terminals of accessories only. Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be erected wherever necessary. In case of 2-way point wiring additional wires of phase conductor shall be provided between the 2-way switches.

Drawing of wires: through PVC conduits for surface type wiring

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No.1/2.

Or

Drawing of wires: through Rigid Steel conduits for surface type wiring

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1.

Or

Erecting wires in Trunking:

Wires shall be erected within Trunking with adequate care. Number of wires shall not exceed with respect to size of Trunking as per Table No. 1/3. After erection of wires double locking shall be checked while fixing capping.

Fixing Switchboards and accessories:

Control switchboards shall generally be erected at 1.35m height or as specified and fixed with minimum 2 Nos. (and more as per size of board) of screws of length not less than 50mm, termination of wires shall be done with lugs on switch and other accessories only by carefully inserting all strands in lugs, terminals and proper tightening. Switches shall be provided on phase wire only. Bare wire shall not be used for looping incoming supply to switches and for earthing inside switchboards. For plug socket phase wire shall be connected in right side terminal when seen from front. Proper termination of earth wire in Earth terminal shall be ensured.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured at all earth terminals of plug outlets and at earth terminals of metal enclosures.

Polarity test:

Polarity test shall be carried out for ensuring the correct polarity in switch and plug.

Mode of Measurement:

Measurement shall be carried out on the basis per number of points, for the point length up to 6 metre between switch and outlet. For the length exceeding 6 metre 10% of overall rate shall be added for every 1m.

Point wiring (Concealed type)

Specification No (WG-PW/CW)

Scope:

Point wiring (Concealed type):

Providing all required approved specified material including hardware and erecting rigid steel / PVC conduits, junction boxes, provided fan boxes, along with required accessories in RCC slabs before casting and in walls, flooring by making chases, and refilling the same after erection of conduits, fixing concealed type boxes for switch boards in walls, drawing wires through conduits, from switch board to outlet for light / fan / bell / independent plug point fixing modular type switch for controlling power supply and an accessory for outlet of light / fan / bell / plug at other end, with mounting plate, and terminating wires within at both ends, as per approved Method of Construction, closing all junction boxes with plates; removing all debris and testing the installation for safety and beneficial use.

Material:

Point wiring (Concealed):

PVC conduit:

PVC pipe of minimum 20mm dia and above depending No. of wires to be drawn (refer Table No1 / 2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, deep / normal Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Rigid Steel conduit:

Rigid steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No.1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as sockets, bends, deep / normal junction boxes of required ways all of the same make.

Sheet metal Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate, fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix surface cover plate on it. Cover plate shall be made up of fire resistant PVC material / 3mm thick laminate / Bakelite / Hylam / transparent acrylic sheet painted from inside to match colour of wall with duly tapered edges.

Wires: phase and neutral wires

PVC insulated wires of specified size, 1.1 kV, & minimum FR grade insulation, electrolytic tough pitch (ETP) copper conductor, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire:

PVC insulated minimum FR grade copper wires of electrolytic grade, having insulation of 1.1 kV grade, of green colour, ISI marked, 2.5 Sqmm or bare copper wire of 14g

Lugs: Pin type Copper lugs.

Accessories:

Switch: 1 or 2 way Modular type switch 6/10A.

Outlet:

Modular type 6A angle / batten lamp holder or 3 plate ceiling-rose or Bakelite / porcelain 3 way connector or if plug point, 6A, 3-pin plug shuttered socket.

Boards:

Switchboards shall comprise of; concealed type box of required modules made of sheet metal or Polypropylene material, mounting plate and cover plate. The required modules shall be worked out on the basis of points, plug socket/sockets, step type fan regulator, etc are to be fixed. For every blank module, 1 way blank plate shall be fixed. All the above accessories shall be of same make, as that of switch.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs / wooden gutties, 'U' nails, plumbing nails, steel binding wire, fish wire 20g, rubber / PVC bushes etc.

Other material for Surface finishing: Sand, Cement, water etc.

Method of Construction:

Point wiring (Concealed):

Concealing of conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300mm. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All the bends shall be done with Bending Spring.

Concealing of conduits: In RCC work

Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and at located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.

Concealing of Conduits: In walls

Chases shall be made in walls of adequate width, with cutter and chiseling through it.

Necessary finishing of the surface shall be done. Conduits of adequate size shall be erected with use of appropriate accessories and 'U' nails.

Drawing of wires:

Use of Steel fish wire shall be made for drawing of wires. Wires shall be drawn with adequate care. Correct colour coding shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped within circuit only. For lighting load distribution, wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the

terminals of accessories only. Adequate extra length shall be left at termination points. In case of 2-way point wiring additional wires of phase conductor shall be provided between the 2-way switches.

Fixing Switchboards and accessories:

Control switchboards shall generally be erected at 1.35m height or as specified and fixed with minimum 2 Nos. of screws of length not less than 50 x 8mm, Boards shall be in line and plum and shall be in level with wall surface so as to fix mounting plate flush with wall, Termination of wires shall be done in switch and other accessories only by carefully inserting all strands in terminals and proper tightening. Switches shall be provided on phase wire only. Bare wire shall not be used for looping incoming supply to switches. Phase wire shall be routed through switch only. For plug socket phase wire shall be connected in right side terminal when seen from front. Proper termination of earth wire in Earth terminal shall be ensured. All blank modules shall be plugged with blanking plates.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured at all earth terminals of plug outlets and at earth terminals of metal enclosures.

Polarity test:

Polarity test shall be carried out for ensuring the correct polarity in the plug.

Mode of Measurement:

Measurement shall be carried out on the basis per number of points, for the point length up to 6 metre between switch and outlet. For the length exceeding 6 metre 10% of overall rate shall be added for every 1metre.

Table No. 1/1

Maximum Number Of Single Core 1.1 kV Cables That Can Be Drawn In Rigid Steel Conduits

Size of cable mm ²		Size of conduit mm													
Nominal Cross sectional area	No. and dia. of wires	16		20		25		32		40		50		63	
		S	B	S	B	S	B	S	B	S	B	S	B	S	B
1.0	1 / 1.12 Cu	5	4	7	5	13	10	20	14						
1.5	1 / 1.4	4	3	7	5	12	10	20	14						
2.5	1 / 1.8 3 / 1.06 Cu	3	2	0	5	10	8	18	12						
4.0	1 / 2.24 7 / 0.85 Cu	3	2	4	3	7	8	12	10						
6	1 / 2.80 7 / 1.06 Cu	2		3	2	6	5	10	8						
10	11 / 3.55 Al 7 / 1.40 Cu			2		5	4	8	7						
				2		4	3	6	5						
16	7 / 1.70					2		4	3	7	6				
25	7 / 2.24							3	2	5	4	8	6	9	7

35	7 / 2.50							2		4	3	7	5	8	6
50	7 / 3.0 Al 19 / 1.80									2		5	4	6	5

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Note 2: The table shows maximum capacity of conduits for the simultaneous drawing of cables. The columns headed 'S' apply to straight runs of conduits which have distance not exceeding 4.25m between draw in boxes and which do not deflect from straight by an angle more than 150. The columns headed 'B' apply to bent runs of conduit, which deflect from the straight by an angle of more than 150.

Note 3: In case of inspection type draw in box has been provided and if the cable is first drawn through one straight conduit, then through the draw in box and then through the second straight conduit such system may be considered as that of straight conduit even if the conduit deflects through the straight by more than 150.

Table No. 1/2

Maximum Number of Single Core 1.1 kV Cables That Can Be Drawn In Rigid Non-Metallic Conduits

Size of cable mm ²		Size of conduit mm					
Nominal Cross sectional area	No. and dia. of wires	16	20	25	32	40	50
1.0	1 / 1.12 Cu	5	7	13	20		
1.5	1 / 1.4	4	6	10	14		
2.5	1 / 1.8 3 / 1.06 Cu	3	5	10	14		
4.0	1 / 2.24 7 / 0.85 Cu	2	3	6	10	14	
6	1 / 2.80 7 / 1.06 Cu		2	5	9	11	
10	11 / 3.55 Al 7 / 1.40 Cu			4	7	9	
16	7 / 1.70			2	4	5	12
25	7 / 2.24				2	2	6
35	7 / 2.50					2	5
50	7 / 3.0 Al 19 / 1.80					2 2	5 3

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Table No 1/5

Colour Code for Wires

Table No. 1/3

Maximum Number of Single Core 1.1 kV Cables in Cable Trunking (Casing and Capping)

Size of cable mm ²		Size of Trunking mm				
Nominal Cross sectional area	12/16 x 12 mm	20 x 12 mm	25 x 12 mm	32 x 12 mm	40 x 20 mm	50 x 20 mm
1.0						
1.5	3	5	6	8	12	18
2.5	2	4	5	6	9	15
4.0	2	3	4	5	8	12
6		2	3	4	6	9
10		1	2	3	5	8
16			1	2	4	6
25				1	3	5
35					2	4
50					1	3

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Telephone wiring (TW)

1. General

All material shall conform to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which PSI mark is not available in market, it shall be approved either by ITDI DOT of Govt. of India. Work shall be carried out as per the Method of Construction specified by BIS and as specified by DOT (Department of Telephone), Govt. of India. Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of Engineer in Charge.

2. Scope:

Specification No: (WG-TW)

To provide wiring for telephone on surface of wall or ceiling concealed in slab, wall, underflooring, etc., through existing metallic conduits, rigid PVC conduits, PVC trunking, with all necessary hardware, material, etc. as specified.

To provide, install, test & commission the instruments/equipments and accessories used in telephone system, such as; Main Distribution Frames (MDF), Krone Modules, Over Voltage Magazine, PBX /EPABX, CO-axial cable, Rosette box, Jumper wire, etc.

3. Material:

PVC Telephone cable:

PVC insulated Tinned copper solid conductor with minimum 0.5 mm dia. (Single & Multi pair) properly paired and colour coded, shall be terminated on KRONE module with suitable tool.

Jelly filled Armoured Telephone cable:

PVC insulated, PVC sheathed with steel armouring, Tinned copper solid conductor with minimum 0.5 mm dia multi pair, with Jelly, properly paired and colour coded. Saddles: Saddles fabricated from G I sheet of required gauge (16/18 gauge) either galvanized finish or painted with superior quality enamel black paint, with necessary shearing for mechanical strength, semicircular shaped with extended piece having suitable holes for fixing on spacer.

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gutties, etc.

MDF:

Manufactured by reputed manufacturer of specified capacity, facility for wall mounting, with door& lock, aluminium frame for fixing of KRONE, duly enclosed in cabinet made from 18 SWG CRCA sheet with powder coating of required colour.

Junctionbox:

Manufactured by reputed manufacturer of specified capacity, facility for wallmounting, with door& lock, aluminium frame for fixing of Krone, duly enclosed in cabinet made from 18SWG CRCA sheet with powder coating of required colour. The depth of the box should considerthe height of KRONE module plus protection magazine.

OverVoltageprotectionMagazine:

Manufactured by reputed manufacturer of 10 pair capacity, with 3pole gas discharge tube should be properly fitted on KRONE module in MDF / Junction box.

Rosette box:

PVC IB akelite box with LED indicator,RJ11 jack, facility for fixing on wall.

Jumperwire:

Twin twisted PVC insulated with Tinned copper solid conductor minimum 0.5 mm dia.

KRONEModule:

Disconnection type KRONE module having capacity to connect 10 pairs with silver-plated terminal contacts.

RG-11 Co-axial low voltage grade cable:

PVC insulated with Tinned copper solid conductor minimum 0.5 mm dia, with connector at both end suitable for termination in RJ type socket.

PBX (Analogue type):

Manufactured by reputed manufacturer and approved by Telephone Engineering Certificate (TEC) of specified extensions, having following features:

Direct Inward dialling (DID) with voiceguidance facility.

Caller line Identification (CLI) on Analog as well as digital extension.

Call Billing software(CB)

Dynamic STD locking

Conferencing facility for specified extensions.

EPABX(Digitaltype):

Manufactured by reputed manufacturer and approved by Telephone Engineering Certificate (TEC) of specified extensions, having following features:

Direct Inward dialling (DID) with voiceguidance facility.

Caller line Identification (CLI) on Analog as well as digital extension.

Call Billing software(CB)

Dynamic STD locking

Conferencing facility for specified extensions.

Provision of battery back-up and power failure line transfer.

4. Methodof Construction:

4.1 DrawingoftelephonewirethroughSteelconduitIPVCconduitIPVCTrunking:

As specified in Chapter forPoint Wiring.

4.2 Erection of Jellyfilled armoured Telephone cable:

Erection shall be done as per the layout finalized, in perfect level and plum. Before fixing the cable shall be straightened as far as possible for good aesthetics look. Cable shall be fixed with saddles firmly clipped on cable. Saddles shall be fixed to wall with minimum 50x8mm SM screws with plugs/wooden gutties (Distance between two saddles shall be minimum 600mm). Wood engutties shall be used wherever required (Especially for stone wall). The entries made in wall, floor slab, etc for laying the cable shall be made good by filling and finishing with plastering the same.

4.3 Erection of MDF Junction box / Rosette box / PBX / EPABX, etc:
Specified equipment shall be fixed to wall with minimum 50x8 mm SM screws, with necessary plugs, wood engutties, etc. or may be fixed on Table Top if required.

5. Mode of Measurement:

Work done for telephone in Steel I PVC conduit IPVC Trunking will be measured on running meter basis, (i.e. per running meter) for each single run. For the other accessories / equipments shall be done as per unit specified. (I.e. Job / each)

1.12 Computer Cabling (COC)

A) UTP Networking Cable

General:

All material shall conform to relevant standard as per ISO/IEC 11801, CENELEC EN 50173 & TIA/EIA 568-B2-1; CUL listed & ETL verified. Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of Engineer in Charge.

Scope:

Specification No (WG-COC/NC)

To lay the cables for Computer on surface of wall or ceiling concealed in slab, wall, under flooring etc, through existing metallic conduits, rigid PVC conduits, PVC trunking, with all necessary hardware, material, etc. as specified. The cable shall be used only for connections between Information Outlet & Patch/Multimax Panel. (Exception: For making MDIX patch cord)

Material:

UTP cable:

4 pairs, 100 ohms, unshielded twisted pair (UTP), each pair separated by a PE former (Star shaped) solid 23AWG tinned copper conductor rated for temperature of 75°C, PVC insulated grey colour with following types as in the table 1.12/1

Table 1.12/1

Sr. No.	Type	Class	Tested frequency
1	Cat 6	E	350MHz
2	Cat 6+	E	500MHz

The Category 6 cable and Category 6 channel components shall be manufactured by a single manufacturer. The manufacturer shall warrant the Category 6 channel cable, components, and applications for a period of 20 years.

The Delay Skew on the 100 meter channel shall not exceed 30 ns

The 20 year warranty shall be a transferable warranty and has component replacement policy in case of manufacturing defect

Category 6, 100mtr channel, 4-connection model should guarantee 400% margin over standard NEXT specification across swept frequency

Category 6, 100mtr channel, 6-connection model should guarantee +4dB margin over standard NEXT Specification across swept frequency (1~250MHz)

The high performance Category 6 UTP cable 23 AWG shall be of the traditional round design with Mylar bisector tape Non-Plenum rated.

The cable shall support Voice, Analog Base b and Video/Audio, Fax, Modem, Switched- 56, T-1, ISDN, RS-232, RS422, RS-485, 10BASE-T Ethernet, Token Ring, 100Mbps TP-PMD, 100 BASE-T Ethernet, 155 Mbps ATM, AES/EBU Digital Audio, 270 Mbps Digital Video, 622 Mbps 64-CAP ATM and emerging high-bandwidth applications including 1Gbps Ethernet, gigabit ATM, IEEE 1394 BS100 and S400, as well as all 77 channels (550 MHz) of analog broadband video.

The cable jacket shall comply with Article 800 NEC for use as a non-plenum cable.

The 4 pair UTP cable shall be UL® and c (UL®) Listed Type CM.

Performance shall be characterized to 550 MHz to support high-bandwidth video applications

Non Plenum CAT6 UTP Cable

Weight=25.3 lb (1000 ft)

Jacket Thickness=.022 in

Outside Diameter=0.232 in

Conductor Diameter=.022 in

Insulation Type=High density Polyethylene

Jacket Material=PVC

Maximum Pulling Tension=25 lbs

Nom. Velocity of Propagation=0.69

Max DC Resistance=9.83 Ohms/100m

Mutual Capacitance @ 1kHz= 4.95 nF/100m

Operating Temperature= -20 to 60° C

The high performance Category 6 UTP cables shall be of the traditional round design with Mylar bisector tape.

The 4 pair UTP cable shall be UL Type CM (non-plenum)

Performance shall be characterized to 550 MHz to support high-bandwidth video applications

Method of Construction:

The cable shall be laid in provided separate casing and capping /PVC conduit/trunking 400mm away from electrical cables wherever required without sharp bends. The cable shall be spliced at both the ends for punching/crimping at keystone jacks/ UTP connectors.

Mode of measurement:

Executed quantity shall be measured on running metre basis.

B) UTP Patch cord

Scope:

Specification No (WG-COC/PC)

Structured cabling, to make connections from switch to patch panel or information outlet to computer

Material:

UTP Patch Cord:

Assembly (conforming to EIA/TIA 568B-2-1) of Cat 6 type 4 unshielded twisted pair 24-26 AWG (0.51mm-0.40mm), each pair separated by a PE former (Star shaped) 100 ohms stranded wire PVC insulated cables with modular RJ-45 polycarbonate UL94V housing 15 milliohms gold over nickel contacts (superior three piece connector) crimped on both ends with T568A & T568B wiring schemes with 8P8C connection. The cord shall be branded. The cords shall be used in structured cabling in accordance with following table 1.12/2.

Sr.No.	Length	Use in
1	1m	From switch to patch panel
2	3m	From computer to information

All patch cords shall exceed TIA/EIA and ISO/IEC Category 6/Class E specifications.
All patch cords shall be backward compatible with Category 5 and Category 5E systems.
The patch cords shall incorporate an anti-snag feature that provides maximum protection from snagging during moves and re-arrangements.
Patch cords shall be UL listed, UL-C certified and AUSTEL approved.
Patch cords shall support network line speeds in excess of 1 gigabit per second.

Physical Specifications:

Contact Material: Phosphor Bronze
Contact Plating: Gold 50 micro-inch (1.27 microns) Nickel
100 micro-inch (2.54 microns)
Insertion Life: 750 minimum
Plug Material: Polycarbonate UL-rated 94V-O
Operating Temperature: 14°F to 140°F (-10°C to 60°C)

Method of construction:

The patch cord shall be erected for making connections from switch to patch panel or from computer to information outlet.

Mode of measurement:

Executed quantity shall be counted on number basis

BACKBONE (Fibre Network)

C) PVC Armoured Optical Fibre Cable (OFC)

General:

All material shall conform to relevant standard as per IEEE, EIA/TIA 568-B.3

Scope:

Specification No (WG-COC/OFC)

Optical fibre cable is used for connecting remote places networks by means of fibre switch or fibre module without much loss of signal.

Material:

Optical Fibre Cable:

Dielectric & metallic sheath armoured multimode optical fibre cable for underground/aerial applications, fibres separated into binder groups inside a Industry standard 3mm gel filled buffer tubes standard around a central strength member; water blocked with dry water blocking material, making access & handling individual tubes easier & craft-friendly cable core; operating temperature of 40 - 70°C, crush resistance of 44N/m, as per table 1.12/3.

Table 1.12/3

Fiber Count	Sub Units	Outer Diameter in. (mm)	Weight lbs/kit kg/km	Minimum Bend Radius In. (cm)		Max. Tensile Load lbs.		Max. Vertical Rise Feet (Meter)
				Loaded	Unloaded	Short Term	Long Term	
Apr-48	5	0.46 (11.7)	63 (94)	18 9.2 (23.4)	4.6 (11.7)	607	180	

							-800	
72	6	0.50 (12.7)	72 (107)	10.0 (25.4)	5.0 (12.7)	607 (2700)	180 (800)	2509 (765)
				11.5 (29.4)			180 (800)	
96	8	0.58 (14.7)	95 (141)	14.8	5.8 (14.7)	607 (2700)	180	1904 (580)
				-37.8			-800	
144	12	0.74 (18.9)	146 (217)	17.2 (43.8)	7.4 (18.9)	607 (2700)	180 (800)	1237 (377)
			211 (315)					
288	24	0.86 (21.9)			8.6 (21.9)	607 (2700)		852 (260)

Note* There are 12 fibres per tube

04/ 06/ 12/ 24fibres				
Sr. No.	Grade	Core dia.	1GbpsDistance at wavelength	
			850nm	1300nm
1	FR	62.5µm	3000m	550m
2	FR	50 µm	1100m	600m
3	FRLS	62.5 µm	3000m	550m
4	FRLS	50 µm	1100m	600m

The cable shall support Giga bit Ethernet and legacy applications including Ethernet, Fast Ethernet, Token Ring ,ATM and FDDI.

The loose tube dielectric OSP cable shall be armoredwith a corrugated polymer coated steel tape and constructed within dustry standard 3mm buffer tubes, stranded around a central strength member

The armor layer shall provide crush protection meeting the Telcordia requirements for Superior Armored cable.

The buffer tubes shall compatible with standard hard ware, cable routing and fan-out kits.

The cable core shall be water blocked with dry water-blocking materials,making access and handling of individual tubes easier and craft-friendly.

The cables shall be designed for point-to point applications as well as mid-span access,and provide a high-level of protection for fiber installed in the outside plant environment.

SR No	Features
1	Support 10 Gbps up to 300 meters
2	Meets and exceeds the next generation multimode fiber (OM3) specifications in standards
3	Gigabit Ethernet is supported up to over 1.0 kilometre for 1000BASE-SX.
4	Supports very high speed data transmission by controlling DMD
5	Differential Mode Delay Exceeds TIA-492AAAC-A (IEC-60793-2-10ed2)@ 850nm
6	> 2,000 MHz-km laser bandwidth at 850 nm
7	Core Diameter should be 50.0 ± 3.0 µm
8	Cladding Diameter should be 125.0 ± 1.0 µm
9	Max. Attenuation, Loose Tube Cable 3.0 dB/km
10	Coating/Cladding Concentricity Error should be =< 6 µm

11	Clad Non-Circularity $\leq 1\%$
12	Zero Dispersion Wavelength 1297-1316 nm
13	Water Immersion, 73.4°F (23°C) should be ≤ 0.20 dB

Environmental and Mechanical

	Specification	Test Method
Operating Temperature	-40°to +70°C	FOTP - 3
Installation Temperature	20°to +70°C	N/A
Storage Temperature	-40°to +70°C	N/A
Crush Resistance	44 N/mm	FOTP - 41
Impact Resistance	Exceeds	FOTP - 25
Flexing	Exceeds	FOTP - 104
Twist Bend	Exceeds	FOTP - 85

Cable Identification: Buffer Tubes and Fibres are identified with standard color coding:

1 - Blue	5 - Slate	9 - Yellow
2 - Orange	6 - White	10 - Violet
3 - Green	7 - Red	11 - Rose
4 - Brown	8 - Black	12 - Aqua

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gaskets, clips etc.

Method of Construction:

As per the method of construction of PVC armoured cable. But the se cables shall be tagged as "OFC" every metre length & can be laid in trench side by side. For underground cable laying cable indicator mentioning "Optical Fibre Cable" is a must.

Mode of measurement:

Executed quantity shall be measured on running meter basis.

D) Fibre Patch Cord (FPC)

General:

All material shall conform to relevant standard as per IEEE, EIA/ TIA, CEN ELEC

Scope:

Specification No (WG-COC/FPC)

The cord is to be used to connect fibre optic equipment to fibre optic cross-connects, interconnects & information outlets. (e.g. Remote Ethernet switch with fibre optic module can be connected to another same type of switch or Fibre Optic Switch.)

Material:

FRLS duplex fibre patch cord/ pigtails 1mtr in length with LC/ SC/ ST termination consisting of 1.6mm/ 3.0mm dia. 62.5um fibre with minimum bandwidth of 200MHz-km at 850nm & 500MHz at 1300nm with following specifications, as per table 1.12/4.

Table 1.12/4

SR No.	Outside dia.	Cable retention strength	Minimum Bend Radius	Maximum Cordage Tensile Load
1	1.6mm: 1.6mm x 3.3mm	50 Newton	Loaded: 5.1cm Unloaded: 3.5cm	Short Term : 3111 Newton Long Term: 93 Newton
2	3.0mm: 3.0mm x 5.9mm	50 Newton	Loaded: 5.8cm Unloaded: 3.5cm	Short Term : 400 Newton Long Term: 120 Newton

The fiber-optic patch cord shall be configurable with standard LC, SC, and ST terminations, and shall be available in either 1.6 mm or 3.0 mm duplex zip cord. The 1.6 mm cord age shall exceed the requirements for larger diameter cord age and allows at least twice as many fibers to be installed in a cabinet. The duplex cord age shall be 1.6mm by 3.5mm and have two single fiber cords joined together with a web. The connector shall have a pull-proof design that helps prevent accidental disconnects and helps to assure optimal performance of equipment. Custom hybrid patch cords shall also be available, to simplify migration to industry- leading connectors. All fibers shall be Differential Mode Delay (DMD) tested by using a high-resolution test bench that exceeds the FOTP-220 standards and shall be independently certified by UL®. All patch cords shall be a distinctive aqua color for positive identification.

Physical Specifications

Minimum Bandwidth	At @ 850 nm: 4700 MHz-km (laser), 3500 MHz-km (OFL) At @ 1300 nm: 500 MHz-km (laser), 500 MHz-km (OFL)
Attenuation:	3.0 dB/Km @ 850 nm, 1.0dB/Km @ 1300 nm
Cable Outside Diameter	: Duplex: 1.6 x 3.7 mm
Min. Bend Radius:	2.5 cm
Operating Temperature Range:	At -20 to 70 °C
Average Connection Loss:	LC = 0.1 dB
Tip Material:	Ceramic
Return Loss Minimum:	At -20 dB
Mating Durability for:	500 Reconnects
Insertion Loss Change:	<0.2 dB
Temperature Stability	At -40 to + 75 °C
Insertion Loss Change:	<0.3 dB

Method of Construction:

Supplying & plugging FRLS duplex fibre patchcord/ pigtailed in to the LC/SC/ST termination of LIU & fibre module/ fibre switch port complete.

Mode of Measurement:

Executed quantity shall be counted on number basis

1.13. Networking Components (NWC) Switches/Routers

A) Web Smart Power Over Ethernet Switch (ENS)

General:

All material shall conform to relevant standard as per IEEE 802.3af PoE

Scope:

Specification No (WG-NWC/ENS)

Preferred in Wireless LAN obviating the use of external power supply for Access Points

Material:

Ethernet Switch:

Ethernet Switch with PoE: 24 ports PoE (Power Over Ethernet) with IEEE 802.3af PoE protocol, each PoE to supply up to 15.4 Watts for connecting devices such as Access Point needing additional power, 10/100 Base-Tx 24 Fast Ethernet ports, 1000 Base-T 4 ports, 2 combo ports for flexible copper/fibre Gigabit connections, VLAN web manageable switch with rack mountable clips, screws, console utility software, mechanisms to detect an attack against the central processing unit of the switch and to take corrective action on attacking interface.

Feature-rich solution with functionality enabling by Secure Always On access to mission critical applications

High performance switch architecture and stacking performance delivering 320 Gbps

High-density 10/100 ports for edge connectivity

Two combo 10/100/1000/SFP uplinks ports per switch for high speed gigabit or low speed connections such as 100FX

Simplified converged network deployments through support for Power over Ethernet (PoE), advanced Quality of Service (QoS), and auto-configuration of ports with IP Handsets & Wireless Access Points

Technical Specifications:

10/100 Power over Ethernet ports: 24 per switch

10/100/1000/SFP Gigabit ports: 2 per switch

SFP support: SX, LX, XD, ZX, CWDM, 100FX, & T1

Resilient Stacking: up to 8 units / 192 ports per stack

Stacking ports: 2 built-in stacking ports per switch

Total stacking capacity: 320 Gbps

Individual switch packet throughput: 6.6 Mpps

Individual switch capacity: 48.8 Gbps

Concurrent VLANs: 256

Jumbo Frame Support on Gigabit ports

Maximum MAC addresses: 8,000

Standards Compliance:

IEEE 802.3 10BASE-T Ethernet

IEEE 802.3u 100BASE-TX Fast Ethernet

IEEE (ANSI) 802.3 Auto-negotiation

IEEE 802.3z Gigabit Ethernet

IEEE 802.3x Flow Control

IEEE 802.1Q VLANs

IEEE 802.1p Priority Queues

IEEE 802.1D Spanning Tree

IEEE 802.1w Rapid Spanning Tree

IEEE 802.1s Multiple Spanning Tree Groups

IEEE 802.3ad Link Aggregation

IEEE 802.1X Ethernet Authentication Protocol
 IEEE 802.3AB Link Layer Discovery Protocol
 RFC 783 Trivial File Transfer Protocol (TFTP)
 RFC 791/950 Internet Protocol (IP)
 RFC 792 Internet Control Message Protocol (ICMP)
 RFC 826 Address Resolution Protocol (ARP)
 RFC 854 Telnet Server and Client
 RFC 951 / 1542 BOOTP
 RFC 1112 Internet Group Management Protocol v1
 RFC 1215 SNMP Traps Definition
 RFC 1271 / 1757 / 2819 RMON
 RFC 1361 / 1769 Simple Network Time Protocol (SNTP)
 RFC 1493 Bridge MIB
 RFC 1573 / 2863 Interface MIB
 RFC 1643 / 2665 Ethernet MIB
 RFC 1905 / 3416 SNMP
 RFC 1906 / 3417 SNMP Transport Mappings
 RFC 1907 / 3418 SNMP MIB
 RFC 1945 HTTP v1.0
 RFC 2011 SNMP v2 MIB for IP
 RFC 2012 SNMP v2 MIB for TCP
 RFC 2013 SNMP v2 MIB for UDP
 RFC 2138 RADIUS
 RFC 2236 Internet Group Management Protocol v2
 RFC 2474 Differentiated Services Support
 RFC 2570 / 3410 SNMPv3
 RFC 2571 / 3411 SNMP Frameworks
 RFC 2572 / 3412 SNMP Message Processing
 RFC 2573 / 3413 SNMPv3 Applications
 RFC 2574 / 3414 SNMPv3 USM
 RFC 2575 / 3415 SNMPv3 VACM
 RFC 2576 / 3584 Co-existence of SNMPv1/v2/v3
 RFC 2660 HTTPS (Secure Web Server)
 RFC 2665 Ethernet MIB
 RFC 2863 Interfaces Group MIB
 RFC 2674 Q-Bridge MIB
 RFC 2737 Entity MIBv2
 RFC 2819 RMON MIB

Additional features:

Customizable Auto-negotiation Advertisements (CANAs)
 Distributed Link Aggregation Groups
 Virtual Link Aggregation Control Protocol (VLACP)
 Single IP address for stack management
 Resilient fail-safe stacking
 Automatic Unit Replacement (Configuration and Software)
 Automatic Detection Automatic Configuration (ADAC)
 802.1X Single Host Single Authentication
 802.1X Single Host Multiple Authentication
 802.1X Multiple Host Multiple Authentication
 802.1X Guest VLAN
 802.1X Non-EAP (NEAP) access
 DSCP-based Recognition, Marking and Recolouring

Ingress and Egress Port Mirroring
Broadcast and Multicast Rate limiting per port
ASCII Configuration File
Web, NNCLI, JDM
SSHv2 and SNMPv3 secure management support
Secure Network Access (NSNA) support
BPDU Filter
Stack Monitor
USB software and ASCII configure upload
New unit quick to configure

Resiliency Features:

- Should support a technology which will allow multiple physical network links between two network switches and another device (which could be another switch or a network device such as a server) to be treated as a single logical link and load balance the traffic across all available links
 - Generally all the physical ports in the link aggregation group must reside on the same switch. It should also support protocols remove this limitation by allowing the physical ports to be split between two switches.
 - Load balancing mechanism should not be round robin or dynamic which may not work with applications like Voice & Video, where session persistence is a must.
- Main Objective of above features is to achieve Active-Active Cluster Switching. And achieve sub second fail over in case of Link failure & Device Failure, which will result in 99.999% uptime.

Power over Ethernet specifications:

802.3af compliant with Power classification support
Signal pair power delivery
Maximum 15.4 watts per port
Maximum DTE Power AC 320 watts
Maximum DTE Power AC+ RPS 740 watts

Electrical specifications:

Power supply: AC 100-240V, 50-60Hz
Input current at 110v: 7.1A
Input current at 220v: 3.6A
Max power consumption: 470W

Dimensions:

Width: 438.2mm (17.25 in)
Height: 1RU 43.7mm (1.72 in)
Depth: 368.3mm (14.5 in)

Environmental specifications:

Operating temperature: 0 to 50 degrees C
Storage temperature: -25 to 55 degrees C
Relative humidity: 10% - 90% non-condensing
Peak noise level: 42.3 dB
Thermal rating: 375 BTU/hr
Calculated MTBF: 242,552 hrs

Safety Agency Approvals:

IEC 60950 International CB Certification

EN 60950 European Certification
UL60950 US certification
CSA22.2, #60950 Canadian Certification
NOM Mexican Certification

Electromagnetic Emissions and Immunity:
CISPR22, Class A/CISPR24 International
EN55022, Class A/EN55024 European
FCC, Part 15, Class A US Certification
ICES-003, Class A Canadian Certification
AN/NZS 3548 Australian/NZ Certification
BSMI - Taiwan - CNS 13438, Class A
MIC - Korea - MIC, No. 2001-116
VCCI Class A Japanese Certification

Hardware:

Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction:

The Ethernet switch fitted with rack mountable clips shall be fixed in U Rack (Networking Cabinet) with 4nos. of chromium plated brass nuts & bolts. The switch shall be configured for TCP/IP addresses for switch IP & Gateway.

Mode of measurement:

Executed quantity shall be counted on number basis

B) 24 Port Gigabit Switch (GBS) Scope:
Specification No (WG-NWC/GBS)
To be used in wired LAN connections.

Material:

Gigabit Ethernet Switch:

24 nos. of 10/100/1000 Base-T Gigabit ports, 2 or 4 combo SFP slots for flexible fibre backbone, VLAN, manageable, 19" standard rack mountable, auto detection of MDI/MDIX, Layer 2, Safeguard Engine to protect against traffic flooding caused by virus/worm outbreaks with rack mountable clips, screws, console utility software.

Feature-rich solution with functionality enabling by Secure Always On access to mission critical applications

High performance switch architecture and stacking performance delivering 320Gbps

High-density 10/100/1000 ports for edge connectivity

Shared SFP uplinks per switch for gigabit fibre connectivity

Technical Specifications:

10/100/1000 Ethernet ports: 24 per switch

SFP Gigabit ports: 4 per switch

SFP support: SX, LX, XD, ZX, CWDM, 100FX & T1

Resilient Stacking: up to 8 units

Stacking ports: 2 built-in ports per switch

Total stacking capacity: 320 Gbps

Individual switch packet throughput: 36 Mpps

Individual switch capacity: 88 Gbps

Concurrent VLANs: 256

Jumbo Frame Support on Gigabit ports

Maximum MAC addresses:8,000
Standards compliance:
IEEE 802.3 10BASE-T Ethernet
IEEE 802.3u 100BASE-TXFast Ethernet
IEEE (ANSI) 802.3 Auto-negotiation
IEEE 802.3z Gigabit Ethernet
IEEE 802.3xFlow Control
IEEE 802.1Q VLANs
IEEE 802.1p Priority Queues
IEEE 802.1D Spanning Tree
IEEE 802.1w Rapid Spanning Tree
IEEE 802.1s Multiple Spanning Tree Groups
IEEE 802.3ad Link Aggregation
IEEE 802.1XEthernet Authentication Protocol
IEEE 802.3AB Link LayerDiscovery Protocol
RFC 783 Trivial File Transfer Protocol (TFTP)
RFC 791/950Internet Protocol (IP)
RFC 792 Internet ControlMessage Protocol (ICMP)
RFC 826 Address Resolution Protocol (ARP)
RFC 854 Telnet Server and Client
RFC 951 / 1542 BOOTP
RFC 1112 Internet Group Management Protocol v1
RFC 1215 SNMP TrapsDefinition
RFC 1271 / 1757 / 2819RMON
RFC 1361 / 1769 SimpleNetwork TimeProtocol (SNTP)
RFC 1493 Bridge MIB
RFC 1573 / 2863 InterfaceMIB
RFC 1643 / 2665 Ethernet MIB
RFC 1905 / 3416 SNMP
RFC 1906 / 3417 SNMP Transport Mappings
RFC 1907 / 3418 SNMP MIB
RFC 1945HTTP v1.0
RFC 2011 SNMP v2 MIBfor IP
RFC 2012 SNMP v2 MIBfor TCP
RFC 2013 SNMP v2 MIBfor UDP
RFC 2138RADIUS
RFC 2236 Internet Group Management Protocol v2
RFC 2474Differentiated Services Support
RFC 2570 / 3410 SNMPv3
RFC 2571 / 3411 SNMP Frameworks
RFC 2572 / 3412 SNMP Message Processing
RFC 2573 / 3413 SNMPv3Applications
RFC 2574 / 3414 SNMPv3USM
RFC 2575 / 3415 SNMPv3VACM
RFC 2576 / 3584 Co-existence of SNMPv1/v2/v3
RFC 2660HTTPS (Secure Web Server)
RFC 2665 Ethernet MIB
RFC 2863 InterfacesGroup MIB
RFC 2674 Q-Bridge MIB
RFC 2737 Entity MIBv2
RFC 2819RMON MIB
Additional features:
CustomizableAuto-negotiation Advertisements (CANA)

Distributed Link Aggregation Groups
 Virtual Link Aggregation Control Protocol (VLACP)
 Nortel Multiple Spanning Tree groups
 Single IP address for stack management
 Resilient fail-safe stacking
 Automatic Unit Replacement (Configuration and Software)
 Automatic Detection Automatic Configuration (ADAC)
 802.1X Single Host Single Authentication
 802.1X Single Host Multiple Authentication
 802.1X Multiple Host Multiple Authentication
 802.1X Guest VLAN
 802.1X Non-EAP (NEAP) access
 DSCP-based Recognition, Marking and Recolouring
 Ingress and Egress Port Mirroring
 Broadcast and Multicast Rate limiting per port
 ASCII Configuration File
 Web, NNCLI, JDM
 SSHv2 and SNMPv3 secure management support
 Nortel Secure Network Access (NSNA) support
 BPDU Filter
 Stack Monitor
 USB software and ASCII configure upload
 New unit quick to configure

Resiliency Features:

- Should support a technology which will allow multiple physical network links between two network switches and another device (which could be another switch or a network device such as a server) to be treated as a single logical link and load balance the traffic across all available links
- Generally all the physical ports in the link aggregation group must reside on the same switch. It should also support protocols remove this limitation by allowing the physical ports to be split between two switches.
- Load balancing mechanism should not be round robin or dynamic which may not work with applications like Voice & Video, where session persistence is must.
- Main Objective of above features is to achieve Active-Active Cluster Switching .And achieve sub second failover in case of Link failure & Device Failure which will result in 99.999% uptime

Electrical specifications:

Power supply: AC 100-240V, 50-60Hz

Input current at 110v: 1.3A

Input current at 220v: 0.7A

Max power consumption: 150W

Dimensions:

Width: 438.2mm (17.25 in)

Height: 1RU 43.7mm (1.72 in)

Depth: 368.3mm (14.5 in)

Environmental specifications:

Operating temperature: 0 to 50 degrees C

Storage temperature: -25 to 55 degrees C

Relative humidity 10% - 90% non-condensing

Peak noise level: 42.4 dB

Thermal rating: 290 BTU/hr

Calculated MTBF: 312,001 hrs

Safety Agency Approvals:

IEC 60950 International CB Certification

EN 60950 European Certification

UL 60950 US certification

CSA 22.2, #60950 Canadian Certification

NOM Mexican Certification

Electromagnetic Emissions and Immunity:

CISPR 22, Class A / CISPR 24 International

EN 55022, Class A / EN 55024 European

FCC, Part 15, Class A US Certification

ICES-003, Class A Canadian Certification

AN/NZS 3548 Australian/NZ Certification

BSMI - Taiwan - CNS 13438, Class A

MIC - Korea - MIC, No. 2001-116

VCCI Class A Japanese Certification

Hardware:

Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction:

The Ethernet switch fitted with rack mountable clips shall be fixed in U Rack (Networking Cabinet) with 4 nos. of chromium plated brass nuts & bolts. The switch shall be configured for TCP/IP addresses for switch IP & Gateway.

Mode of measurement:

Executed quantity shall be counted on number basis

C) Broadband ADSL Router (ADSL)

General:

All material shall conform to relevant standard as per ITU G.992.2 & RFC

Scope:

Specification No (WG-NWC/ADSL)

For broadband internet connections to individual computer or Wired LAN/ Wireless LAN.

Material:

Broadband ADSL Router:

ADSL2+ broadband router with PPP (Point-to-Point Protocol), DHCP support, TCP/IP, downstream up to 24Mbps, upstream up to 1Mbps, RJ-11 for ADSL line, RJ-11 for phone line with Patch cord 3 metre in length, 10/100 Base-T port, USB 1.1 & 9V adaptor with UTP (Ethernet) Patch Cord, USB 2.0 patch cord, USB driver software

- Designed for the small to medium business-
Simpler than enterprise class routers but more robust than consumer grade routers
- Secure –
Good security and heavy encryption, but easy to implement; simple yet stateful firewall with simple filters
- Simplified architecture-

Has a smaller processor that does not require a noisy fan, making it small and attractive for in-office or desk top installation

Note: Provision of Network Interface Card (NIC) shall be made for computer without built in NIC.

Input/Output Requirements:

WAN 1- 10/100 Base-T Auto-sensing -RJ-45

LAN -4 Port Ethernet 10/100 Base-T Auto-sensing switch – RJ- 45 (fifth port for internal connection)

VPN Services:

Minimum 10 IPSec tunnels

IKEv1 Main Mode

IKEv1 Aggressive Mode

Up to 3 IP pools for Client

16 Split networks configured

64 Subnets specified for Split (inverse) network

Diffie-Hellman Group 1, 2

IPSec Tunnel Mode

ESP

Support for Dynamically addressed peers – ABOT

NAT Traversal

IPSec Transport Mode

Keep Alive – For branch office and client tunnels

VPN Router Client termination

Cryptographic Services:

DES

3DES

Data authentication SHA-1

Data authentication MD-5

AES -128

AES – 192, 256 – Branch Office

Authentication Services:

Pre-shared secrets

External RADIUS support

802.1x/EAP support

Firewall:

Stateful Packet Inspection

IP application Inspection (FTP, SMTP, HTTP, Telnet, SSL, DNS, etc.)

Denial of Service (DoS) detection and prevention

URL Filtering

Content filtering

ALG's:

CU-SeeME

FTP

SIP

H.323

IPSEC

VDI Live

Real Audio

IP Services: NAT:

NAT, Many to One, Static, Many to Many, Many One-to-One

Port Forwarding

IPSec pass-through

SIP and H.323 ALG's

Cone NAT

NAT support for tunnel Mode IPSec tunnels

IP Services: Routing:

Clear text routing

Static

RIP v1

RIP v2

IP Services: DHCP:

Client

Server

Relay

Static mapping – 8 IP address lease mapping

IP Services: DNS:

DNS Proxy

Dynamic DNS

IP Services: NTP:

RFC-867, 868, 1305

Layer Two Protocols:

PPPoE

IP masquerade/ alias –Configurable MAC address

Performance and Scaling:

20 Mbps 3DES throughput w/ 1500 byte packets

10 IPSec tunnels

Management:

TFTP/FTP firmware upload

RS232 console port

Built-in Diagnostic tool

SNMP

Web GUI

CLI (Command Line Interpreter)

Remote management (FTP, Telnet, Web)

Backup and restore configuration via FTP and Web

WAN and LAN Ports:

The WAN and LAN ports are 10/100-base T Ethernet ports, without PoE

Two-Port Router:

The router is based on the Intel IXP-425 network processor, running at 266 MHz. It will have 64 Mbytes of FLASH, and 32 Mbytes of RAM.

5-Port Switch:

The 5-port layer-2 switch uses the Infineon 6996i chip

Serial Port:

The serial port provides a DCE connection that can be used for either WAN back-up or for installing software into a router that has a corrupted software load

Power Supply:

The router will be powered by 19 volts DC. The power supply circuit block will convert this supply to the supply voltages needed by the rest of the circuitry. The Business Secure Router 222 uses a universal wall-mount power supply.

Method of construction:

The ADSLR router shall be connected directly to the incoming phone line without any parallel telephone, then to telephone to avoid breaks in Internet connection, 9V DC adaptor connected to provide power supply, UTP patch cord for connections between router Ethernet port to computer/ switch. The router shall be configured as per the requirements of Broadband Internet Service Provider. As far as possible use of USB port shall be avoided.

Mode of measurement:

Executed quantity shall be counted on number basis

Wireless LAN

D) Indoor LAN Dipole Antenna (DPA)

General:

All material shall conform to relevant standard as per IEEE.

Scope:

Specification No (WG-NWC/DPA)

To enhance the signal strength of Access Point & Wireless PCI adaptor / Router upto 500 metres.

Material:

Indoor LAN Dipole Antenna:

2.4 GHz, 5dBi gain, 50 ohms Omni-Directional Indoor Antenna outer covering made from polyurethane, polycarbonate wivel mechanism with built-in connector (RP-SMA & Reverse SMA/ TNC) for 802.11b/g wireless network

Method of Construction:

Supplying & erecting 2.4GHz, 5dBi Omni-Directional Antenna to be screwed to Access point/ wireless PCI adaptor complete.

Mode of Measurement:

Executed quantity shall be counted on number basis.

E) Omni Directional Antenna (ODA)

Scope:

Specification No (WG-NWC/ODA)

To enhance the signal strength of Access Point & Wireless PCI adaptor/ Router at difficult to reach or far places.

Material:

Omni Directional Antenna:

2.4 GHz, 4dBi gain, Collinear, 50 ohms Omni-Directional Indoor Antenna covering horizontal 360deg, vertical 36 deg. with 1.5m ULA-316 fixed cable, connectors (RP-SMA & Reverse SMA/ TNC), sturdy magnetic base stand to place it on flat surfaces & can be mounted on wall for 802.11b/g wireless network

Method of Construction:

Supplying & erecting 2.4GHz, 4dBi Omni-Directional Antenna on wall or on the desktop or suitable place which shall be at least 150mm away from electronic devices such as computers,

TV, video equipment & audio/video tapes. Mode of Measurement: Executed quantity shall be counted on number basis.

F) Aesthetic Omni Directional Antenna (AODA)

Scope:

Specification No (WG-NWC/AODA)

To enhance the signal strength of Access Point & Wireless PCI adaptor/ Router at difficult to reach or far places.

Material:

Aesthetic Omni Directional Antenna:

2.4 GHz, 20W (cw) power handling, 40 deg downtilt, 50 ohms Omni-Directional Aesthetic Indoor Ceiling Antenna with ULA-316 fixed cable, connectors (RP-SMA & Reverse SMA/TNC) for 802.11b/g wireless network.

S No.	Type	Colour	Gain (dBi)	Coverage (deg)		Cable (mtr)	Use
				Horizontal	Vertical		
1	Globe	White	4	360	63	2.0	Places with false ceiling
2	Rod	Gray-White	5	360	32	3.0	Any other place

Hardware: Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, etc.

Method of Construction

Supplying & erecting 2.4 GHz, Omni-Directional Indoor Aesthetic Ceiling Antenna on ceiling at suitable place fixed with required size of SM screws, plugs/ gitties etc. complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

1.13 Networking Accessories (NAS) LAN Accessories

A) UTP connector (RJ-45) (UTPC)

General:

All material shall conform to relevant standard as per TIA/EIA 568-B2-1.

Scope:

Specification No (WG-NAS/UTPC)

To make MDIX (Cross) patch cord required for cascade connections of switches & routers.

Material:

UTP connector:

Assembly of Gold over nickel contacts with 1.5A current carrying capacity, 30V with 15 milli ohms contact resistance, 8P8C connection easy to crimp with crimping tool in polycarbonate UL94V housing.

Method of construction:

The UTP cable shall be spliced, untwisted not more than 12mm, inserted into the connector with sequence as shown in the diagram crimped firmly with crimping tool. As per EIA/TIA 568B.2-1

Mode of Measurement: Executed quantity shall be counted on number basis.

B) Information Outlet (Ethernet) (IO)

General:

All material shall conform to relevant standard as per TIA/EIA 568-B2-1.

Scope:

Specification No (WG-NAS/IO)

For connecting computers to wired LAN or external wireless Ethernet interface in Wireless LAN.

Material:

Information Outlet Flush/Surface type:

Spring shuttered front access, high impact plastic body FR grade with high performance unshielded RJ-45 keystone jack (conforming to EIA/TIA 568-B.2-1 Cat 6, 15 milli ohms contact resistance, gold overnickel springcontact, 1.5A current carrying capacity, with T568A/T568B wiring option, insulation displacement connector for cable crimping to accept 22-26AWG solid wire for connections up to Gigabit Ethernet.

All Category 6 outlets shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in TIA/EIA 568-B.2-1 Commercial Building Telecommunications Cabling Standard and ISO/IEC 11801:2002 Second Edition.

The Category 6 outlets shall be backward compatible with Category 5E, 5 and 3 cords and cables.

The Category 6 outlets shall be of a universal design supporting T568 A & B wiring.

The Category 6 outlets shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current 10BASE-T, Token Ring, 100 Mbps TP-PMD, 155Mbps ATM, 622Mbps ATM using parallel transmission schemes and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T and 1.2 Gbps ATM

The Category 6 outlets shall be capable of being installed at either a 45° or a 90° angle in any M-series modular face plate, frame, or surface-mounted box avoiding the need for special face plates.

The Category 6 outlets shall have improved pair splitters and wider channel for enhanced conductor placement. The outlet shall also have a low-profile wire cap, which protects against contamination and secures the connection. Multicolored identification labels shall be available to assure accurate installation.

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gaskets, etc.

Method of construction:

The Information outlet shall be fixed on the wall with sheet metal (SM) screws, rawl plugs/wooden gaskets and making due connections as per EIA/TIA 568 B.2-1 by splicing the UTP cable, untwisted up to 12mm & punching the 4 pairs in the keystone jack with the help of punching tool. Not a single wire shall be left without connections.

Mode of Measurement:

Executed quantity shall be counted on number basis.

C) Keystone jack (RJ-45)(KJ) Scope:

Specification No (WG-NAS/KJ)

Structured cabling, to provide connections to switch/server from desktop computers/ Wireless devices in the patch panel

Material:

Keystone jack:

High impact plastic body FR grade with high performance unshielded RJ-45 keystone jack (conforming to EIA/TIA 568-B.2-1 Cat6), 20 milli ohms contact resistance, gold over nickel spring contact, 1.5A current carrying capacity, with T568A/T568B wiring option, insulation displacement connector for cable crimping to accept 22- 26AWG solid wire for connections up to Gigabit Ethernet

Method of construction:

The keystone jack shall be fixed with the help of its self-locking arrangement in provided patch panel before making due connection as per EIA/TIA 568 B.2-1 by splicing UTP cable, untwisted up to 12mm & punching the 4 pairs in the keystone jack with the help of punching tool. Not a single wire shall be left without connections.

Mode of Measurement:

Executed quantity shall be counted on number basis.

Patch Panel (PP)

Scope:

Specification No (WG-NAS/PP)

Structured cabling for the installation of keystone jacks

Material:

Patch Panel:

Three piece structure including front panel, cable management plate with pre-fitted B- clip to help in routing cables & metal case of 1.6mm thick Mild Steel powder coated panel of size 442.6 mm X 44.5 mm with the provision for 1 to 24 high density keystone jacks

24 and 48 port patch panels with 110 IDC connector terminations on rear

The patch shall have electrical performance guaranteed to meet or exceed TIA/EIA 568-B.2-1 Category 6 and ISO/IEC Category 6/Class E specifications.

The panel shall have vertical and horizontal cord organizers available as to improve patch cord management.

The panel shall be available in 24-port and 48-port configurations with universal A/B label in and 110 connect or terminations on rear of panel allowing for quick and easy installation of 22 to 24 AWG cable.

The patch panel shall have a black powder finish over high-strength steel.

The panel shall be equipped with a removable rear mounted cable management bar and front and rear labels.

The panel shall be UL listed, UL-C certified and ACA approved.

The panel shall support network line speed in excess of 1 giga bit per second and be backward compatible with Category 5e, 5 and 3 cords and cables.

The Category 6 modular jack panels shall meet or exceed the Category 6 / Class E standards requirement in ISO/IEC 11801, CENELEC EN 50173 and TIA/EIA and shall be UL Listed.

The panels shall be either wall or 19-inch rack mountable. The panels shall meet the following specifications:

Performance Specifications:

Category 6 Channel

(4 Connectors)

Operation		Typical Worst Pair Margin*	Guaranteed Margin**	Guaranteed Margin**
Insertion Loss		64.3%	5.0%	7.5%
NEXT		6.6 dB	6.0 dB	7.0 dB
PSNEXT		7.3 dB	7.5 dB	8.5 dB
ELFEXT		6.4 dB	6.0 dB	8.0 dB
PSELFEXT		6.1 dB	8.0 dB	10.0 dB
Return Loss		6.6 dB	4.0 dB	4.0 dB
Frequency Range		1-250 MHz	1-250 MHz	1-250 MHz

Operating Temperature Range: 14°F to 140°F (-10°C to 60°C) Storage Temperature Range:

-40°F to 158°F (-40°C to 70°C) Humidity: 95% (non-condensing)

Nominal Solid Conductor Diameter: 0.025 to 0.020 in (0.64 to 0.51 mm) (22 to 24 AWG)

Nominal Stranded Conductor Diameter: 0.025 to 0.020 in (0.64 to 0.51 mm) (22 to 24 AWG)

Insulation Size: 0.042 in (1.08mm) (22 to 24 AWG) Maximum DOD Insulation Types: All plastic insulates (including PVC, irradiated PVC, Polyethylene, Polypropylene, PTFE, Polyurethane, NAGPUR, Nylon, and FEP)

Insertion Life: 750 minimum insertions of an FCC 8-Position

Telecommunications Plug Front Panel: Black powder painted steel.

Plastic: High-impact, flame retardant, UL-rated 94V-0 thermoplastic

Hardware:

Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction

The Patch Panel shall be firmly secured in U Rack (Networking Cabinet) with 4 nos. of chromium plated brass nuts & bolts.

Mode of Measurement: Executed quantity shall be counted on number basis.

E) Lightguide Interconnect Unit (LIU) General:

All material shall conform to relevant standard as per IEEE, EIA/TIA, CENELEC

Scope:

Specification No (WG-NAS/LIU)

To terminate the fibre backbone cables & the equipment cables.

Material:

Lightguide Interconnect Unit:

Wall mount type Light guide Interconnect Unit with dimensions shown in the table, an interfacing unit for fibre cables coming in from field & those originating from the equipments. Consisting of fibres pools to provide minimum bending radius & splice trays as splice cover for pigtail splicing, two compartment design with adaptor panel in the centre, compartmentalizing the box, complete aluminium housing, fully powder coated, two doors enclosure with lock & key, rubber grommets at the cable entry points for tight sealing; Splice trays of 140x125x10mm complete aluminium body fully powder coated with provision for fibre splices fully cushioned splice holder containing grooves for fixing splice protective sleeves; FR grade high impact resistance plastic two halves design stackable sufficient room for excess cable.

Sr. No.	Ports	Dimensions	Fibre splices
1	12	300 x 300 x 80mm	6
2	24	370 x 350 x 80mm	12

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, etc.

Method of Construction:

Supplying & erecting Light guide Interconnect Unit (LIU) on wall with cable termination complete with sheet metal screws of required size, plugs/ wooden gitties.

Mode of Measurement:

Executed quantity shall be counted on number basis.

Fibre Accessories

F) ST "D" type Multimode Adaptor (MMA)

General:

All material shall conform to relevant standard as per IEEE, EIA/TIA 568-B.3

Scope:

Specification No (WG-NAS/MMA)

To couple two connectors together i.e. to provide optical connectivity between fibre cable & fibre switch/ fibre module.

Material:

ST "D" type multimode adaptor

consists of Diecast zinc alloy housing Nickel plated, thread type mounting, washer, nut, 2 nos. of rubber plugs, high precision mechanical design Zirconium/ Phosphor Bronze sleeve having insertion loss < 0.3dB max, return loss < -40dB.

Method of Construction:

Supplying & fixing ST "D" type with thread in provided Light guide Interconnect Unit on adaptor panel with nut & washer. The adaptor which is not in use shall be plugged with rubber plugs on both the sides to avoid dust accumulation in the adaptor.

Mode of Measurement:

Executed quantity shall be counted on number basis.

G) ST "D" type Multimode Connector for LIU (MMA-LIU1)

General

All material shall conform to relevant standard as per IEEE, EIA/ TIA 568-B.3

Scope:

Specification No (WG-NAS/MMA-LIU1)

To terminate the optical fibre cables in Light guide Interconnect Unit (LIU)

Material:

ST "D" type Multimode connector consists of bayonet coupling, 2.5mm Zirconium Ferrule, wide range of Ferrule selection, pre-radiused ferrule to provide fast physical contact polishing, insertion loss < 0.5dB.

Distilled water (as lubricant & flushing agent between each polishing process).

Epoxy or Anaerobic adhesive (to bond the fibre inside the ferrule).

Tools to be used:

Carbide cleaving tool with 30deg tip (to cut off the fibre to the desired height above the ferrule) Portable Microscope (200X minimum)

Polishing kit (includes a polishing puck, pads & an assortment of diamond, aluminium oxide & silica films)

Method of Construction:

The fibre shall be stripped & cleaved. Epoxy and polish connectors field-installed to terminate backbone and distribution cables. Epoxy and polish fibre termination include

Mode of Measurement:

Executed quantity shall be counted on number basis.

H) No Epoxy No polish ST "D" type Multimode Connector (MMA-LIU2)

Scope:

Specification No (WG-NAS/MMA-LIU2)

To terminate the optical fibre cables in Light guide Interconnect Unit (LIU)

Material:

ST "D" type Multimode connector with Factory pre-polished fibre stub end face consists of bayonet coupling, 2.5mm Zirconium Ferrule, insertion loss < 0.5dB

Tools to be used:

Carbide cleaving tool with 30 deg tip (to cut off the fibre to the desired height above the ferrule)

Method of Construction:

The no Epoxy no polish connectors field-installed to terminate backbone and distribution cables. The fibre shall be striped, cleaved, inserted into the connector & mechanically secured. The connectors with fibre cable shall be tested for loss test with Optical Time Domain Reflectometer (OTDR) & recording the results.

Mode of Measurement:

Executed quantity shall be counted on number basis.

Power over Ethernet Adaptor (PoEA)

General:

All material shall conform to relevant standard as per IEEE, TIA/EIA.

Scope:

Specification No (WG-NAS/PoEA)

To provide DC power supply to Ethernet devices, which do not have external/built-in power supply.

Material:

Power over Ethernet Adaptor without put voltage of 5VDC or 12VDC (selectable)

Within put of 48V DC consists of Power over Ethernet base unit, Power over terminal unit, AC to DC power adaptor, DC power cable & Ethernet cable.

Method of Construction:

Supplying & connecting Power over Ethernet Adaptor with all its connections of base unit, terminal unit & AC to DC power adaptor for supplying power to Access Point, Router or Wireless Ethernet Transceiver complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

J) Tri-Mode Dual band Wireless PCI LAN Card (LANC1)

General:

All material shall conform to relevant standard as per IEEE 802.11 xs.

Scope:

Specification No (WG-NAS/LANC1)

Making provision of Wireless LAN connectivity for desktop PCs in difficult places where signal strength is low.

Material:

Wireless PCI 32 bit interface LAN card covering 100 metres (indoor) transmission speed of 108Mbps to connect 802.11b, 802.11g & 802.11n networks operating in two non-interfering bands 2.4 GHz & 5GHz with 4dBi to 5dBi gain Omni directional dipole antenna & driver.

Method of Construction:

Supplying & fixing Tri-mode dual band wireless PCI LAN card in desktop computer with installation of driver & configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

K) Wireless PCI LAN Card (LANC2)

General:

All material shall conform to relevant standard as per IEEE 802.11g.

Scope:

Specification No (WG-NAS/LANC2)

Making provision of Wireless LAN connectivity for desktop PCs

Material:

Wireless PCI 32 bit interface LAN card to connect 802.11g networks operating in 2.4 GHz band covering 100 metres range (indoor), transmission speed of 54Mbps with external dipole antenna, detachable reverse SMA connector & driver.

Method of Construction:

Supplying & fixing Wireless PCI LAN card in desktop computer with installation of driver & configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

L) Manageable Wireless LAN Access Point (LAP1)

General:

All material shall conform to relevant standard as per IEEE 802.11b/g & IEEE 802.3/u

Scope:

Specification No (WG-NAS/LAP1)

To provide wireless access to the WLAN network

Material:

Wireless Access Point consists of 108 Mbps turbo mode handling heavy data payloads, 2dBi gain detachable dipole antenna with reverse SMA connector, external AC to DC\5V adaptor.

Method of Construction:

Supplying & connecting Wireless Access Point with AC to DC adaptor to Ethernet switch with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

M) High Performance Manageable Wireless LAN Access Point with PoE (Power over Ethernet) (LAP2)

General:

All material shall conform to relevant standard as per IEEE 802.11b/g, IEEE 802.3/u & IEEE 802.3af

Scope:

Specification No (WG-NAS/LAP2)

To provide high performance wireless access to the WLAN network

Material Wireless Access Point consists of 108 Mbps turbo mode handling heavy data payloads, dual 5dBi gain detachable dipole antenna with reverse SMA connectors, Power over Ethernet 10/100 Base-Tx port.

Note: To connect the Access Point, availability of PoE Ethernet Switch or PoE adaptor is essential.

Method of Construction:

Supplying & connecting Wireless Access Point to PoE Ethernet switch or Ethernet Switch through PoE Adaptor with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

N) Dual Band High Performance Manageable Wireless LAN Access Point with PoE (Power over Ethernet) (LAN3)

Scope:

Specification No (WG-NAS/LAP3)

To provide high performance wireless access to the WLAN network

Material:

Wireless Access Point consists of 108 Mbps turbo mode handling heavy data payloads operating in 2.4 GHz & 5 GHz bands, dual 5dBi gain detachable dipole antenna with reverse SMA connectors, Power over Ethernet 10/100 Base-Tx port.

Note: To connect the Access Point, availability of PoE Ethernet Switch or PoE adaptor is essential.

Method of Construction:

Supplying & connecting Wireless Access Point to PoE Ethernet switch or Ethernet Switch through PoE Adaptor with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis

LED Fittings (ESD-LED)

A) Surface / Recessed Mounting LED Luminaries

Scope:

Specification No (ESD-LED/IDF)

Supplying & erecting approved make, Surface / recessed mounting indoor fitting of specified wattage to provide specified lux level at specified height with p.f. > 0.95, complete as per manufacturer's specification, with appropriate driver.

Material:

Fitting: Scientifically designed highly polished & anodized Aluminum reflector ensures precise light control with optimum light utilization either with clear glass / frosted glass cover with ring or as per manufacturer's specification, leading to substantial savings in energy cost and excellent ambient conditions. Frame is fabricated from CRCA/MS sheet and epoxy powder coated white. Percolated frame ensure corrosion free life. Retaining clips for recess mounting fittings to facilitate mounting in false ceilings. Luminaries comprises of a deep drawn MS sheet canopy along with LED's with 100 lumens per watt mounted on top of aluminum heat sink of appropriate size for excellent thermal dissipation. The constant current driver circuit should be inside the luminary and can be driven between 80V to 260V AC. It should conform to class 1 of IS: 10322. Fitting shall be wired with multi stranded copper wire terminating on suitable connectors.

Driver: The constant current driver driven at 600mA of constant current should have short circuit protection, thermal protection & should work in the range of 80V to 260Volts.

LED's: The LED's of approved make having life of minimum 50000 burning hours, must have a color temperature between 5000 - 7000 and of 100 lumens per watt.

Metal Core PCB's: The PCB should be of metal core, copper clad laminate composed of 1 oz Electro deposit copper and 1.5mm 5052 Aluminum Alloy Laminated by 60 um high thermal conductive adhesive of modified epoxy.

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Method of Construction:

The fitting shall be fixed firmly in the designated place (False ceiling / unspecified ceiling) with the help of swinging bracket, and making the connection. In case where fittings are to be installed flush with /on false ceiling; layout shall be given to civil wing and work shall be done in co-ordination with civil wing e.g. making recesses in false ceiling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e each)

B) Bulk Head type LED Luminaries

Scope:

Specification No (ESD-LED/BHF)

Supplying & Erecting LED bulkhead Fitting of appropriate size with 8 W with minimum 50-70 lux level at ground level with p.f. > 0.95 with frosted glass.

Material:

Fitting:

Luminaries comprises of a deep drawn MS sheet body with clear acrylic cover of 3mm thickness or as per manufacturer's specification, along with LED's with 100 lumens per watt mounted on top of aluminum heat sink of appropriate size for excellent thermal dissipation. The constant current driver circuit should be inside the luminary and can be driven between 80V to 260V AC. It should conform to class 1 of IS: 10322. The surface of the canopy should be powder coated / stove enameled. Fitting shall be wired with multi stranded copper wire terminating on suitable connectors.

Driver:

The constant current driver driven at 600mA of constant current should have short circuit protection, thermal protection & should work in the range of 80V to 260Volts.

LED's:

The LED's of approved make having life of minimum 50000 burning hours, must have a color temperature between 5000 - 7000 and of 100 lumens per watt. The angle of illumination of each LED should be 90degrees and should be mounted on star type of metal core PCB's.

Metal Core PCB's: The PCB should be a metal core, copper clad laminate composed of 1 oz Electro deposit copper and 1.5mm 5052 Aluminum Alloy Laminated by 60 um high thermal conductive adhesive of modified epoxy.

Wooden board: As per (WG-PW/PW) 1.6 specified in chapter for Point wiring.

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Method of Construction:

The complete fitting with all the above accessories shall be erected as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e each)

C) LED Street Light / Flood Light Luminaires

Scope:

Specification No (ESD-LED/ODF)

Supplying & erecting Street Light fitting of specified wattage to provide specified lux level at specified height, complete with acrylic cover and gaskets, with appropriate driver circuit and erected on provided bracket.

Material:

Fitting: Luminaries comprises of a deep drawn MS sheet canopy with clear acrylic cover of 3mm thickness, along with LED's with 100 lumens per watt mounted on top of aluminum heat sink of appropriate size for excellent thermal dissipation. The constant current driver circuit should be inside the luminary and can be driven between 80V to 260V AC. It should conform to class 1 of IS: 10322 and Ingress Protection IP-55. The surface of the canopy should be powder coated / stove enameled. Fitting shall be wired with multi stranded copper wire terminating on suitable connectors.

Driver: The constant current driver driven at 600mA of constant current should have short circuit protection, thermal protection & should work in the range of 80V to 260Volts.

LED's: The LED's of approved make having life of minimum 50000 burning hours, must have a color temperature between 5000 - 7000 and of 100 lumens per watt. The angle of illumination of each LED should be 90degrees and should be mounted on star type of metal core PCB's.

Metal Core PCB's: The PCB should be a metal core, copper clad laminate composed of 1 oz Electro deposit copper and 1.5mm 5052 Aluminum Alloy Laminated by 60 um high thermal conductive adhesive of modified epoxy.

Method of Construction:

The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e each)

Fans (FG/FN)

A) Ceiling Fans

Scope:

Specification No (FG-FN/CF)

Supplying and erecting Ceiling fan of specified sweep with all accessories and necessary materials, erected in provided hook/clamp.

Material:

Ceiling Fan:

Electric Ceiling fan capacitor type with double ball bearing complete with capacitor, 300 mm down rod, canopies, shackles, reel insulator, half threaded bolts of 9.53 mm (3/8") dia 62.5 mm (2-1/2") to 88 mm (3-1/2") long and 7.94 mm (5/16") dia 44.5 mm (1-3/4") to 57 mm (2-1/4") long with nuts, with lock type split pin, spring & plate washers, etc.; three number blade made of Aluminium alloy, suitable for single phase, AC 210 volts, 50 Hz supply and conforming to class I of IS : 374/1979 with amendment no 1 to 6 except for performance parameters to the extent modified as details in general requirements. The down rod shall be capable to withstand a tensile load of 1000 kg without breakdown and a torsion load of 500 kg.cm without breakage as per Clause 10.14.1 of IS: 374/1979 with amendment no.1 to 6. Electrical motor should be single phase permanent capacitor type with no. of poles 12/14/16/18 (As per sweep), Class-I with basic insulation. Class of insulation shall be B class. The winding wire used for fan should be synthetic enamelled of 30 to 38 SWG.

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Paint: Superior quality enamel paint of specified colour for marking Sr. No and date of rection.

Table 2.6/1

Performance Parameters for Fans suitable for Rated Voltage

S.No	Sweep	Maximum Input Power in watts	Air delivery in m3/minute	Minimum Service Value
			at Rated Voltage	at 180 V
1	900 mm	42	140	3.4
2	1200 mm	50	215	4.3
3	1400 mm	60	270	4.5

Method of Construction:

Blades of ceiling fan shall be properly fixed. Down rod, clamp shall be carefully fixed with nut bolt and split pin. Canopies shall be tightened on down rod keeping sufficient clearance. Wiring connections shall be made with required wire leads. Regulator of fan shall be erected on provided switchboard with required wire leads.

Testing:

After erection fan shall be tested by connecting to supply at all positions of regulator.

Also steadiness of fan shall be checked at full speed, so that there is no wobbling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Exhaust Fans

Scope:

Specification No (FG-FN/EXF)

Supplying and erecting Exhaust fan of specified sweep and speed, with all accessories and necessary materials, suitable to work on 230 V / 415 V, AC Supply 50 Hz, erected in position.

Material:

Exhaust Fan:

ISI marked Exhaust fan suitable for Single/Three phase AC 230/415 Volts 50 Hz, capacitor run with mounting ring, four numbers of fixing hole without regulator and louvers. The weep and speed shall be as per table below. Fan motor with moisture proof treatment and E class insulation, ISI marked, conforming to IS: 2312/67 with amendments 1 to 8. The fan mounting rings shall be proper pre-treatment followed with at least two coats of primer; final finish shall be with two coats of grey colour paint duly baked. The connecting leads shall be brought out for making connections.

Paint: Superior quality enamel paint of specified colour.

Table 2.6/2 Corresponding Speed with Sweep

S.No	Sweep	Speed in RPM	Voltage level	CFM in m3/hr
1	375 mm	900	230 V	2460
2	375 mm	1400	230 V	4000
3	450 mm	1400	230 V	6800
4	450 mm	900	230 V	4350
5	375 mm	900	415 V	2460

Method of Construction:

The Exhaust fan complete with all above accessories and duly wired shall be erected at specified position, connected to the supply and tested.

Testing:

After erection fan shall be tested by connecting to supply. Also steadiness and vibrations if any, of fan shall be checked at full speed, so that there is no wobbling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e each)

Bus Riser

Range Aluminum Busduct

Air Insulated busduct – 400A – For Power Load

Specification for Air Insulated busduct:

General

The busbar trunking system shall be Air Insulated construction 3P+100% Neutral +50% Integral Earth Aluminum.

Busbars shall be of hard drawn Aluminum with Copper/Tin Contacts at Joints

The degree of protection of the busbar trunking system shall be IP54 for Indoor.

The neutral conductor should have the same cross-sectional area as the phase conductor.

The Earthing must be of Aluminum same material and grade as that of phase conductor one continuous piece integral earth rated at min 50% of phase. Earthing shall be factory fitted factory tested and Icw rating rating for the earthing shall also be declared on Type Test Certificate produced by manufacturer.

The measurement of total length for the busway will be made end to end: Straight Lengths Certificate

The busbar, of full range and each rating, should pass full type tests specified in latest IEC 61439:2012 The certificate shall be issued by an international independent testing authority (e.g. DEKRA , ASTA,KEMA,UL). Product should be KEMA/ KEMA KEUR / ASTA Diamond Certified.

Along with certification a product safety mark (KEMA-KEUR/ASTADIAMOND,) should be on the physical product offering a visible assurance for full product safety testing, factory inspection and ongoing surveillance under independent 3rd party authority to ensure conformity of the manufactured product in line with Sample tested during Type test .

Product Type test Certificate should be from same factory where product is being Manufactured.

Type Tests Certificate shall be furnished by vendor in Line with latest IEC 61439-6 for bus duct having passed below tests as per IEC

Clause 10.3. Degree of protection of assembly

Clause 10.4 Creepage and Clearance Distance

Clause 10.5 Protection against electrical Shock and integrity of Protective Circuit

Clause 10.7 Internal Electrical Circuit and Connections

Clause 10.8 Terminals for External Conductors

Clause 10.9 Dielectric Properties

Clause 10.10 Temperature rise

Clause 10.11 Short Circuit Withstand

Clause 10.101 Resistance to Flame propagation

Clause 10.102 Fire Resistance

Clause 5.101 Strength of Power Frequency Magnetic Field

Clause 10.2.2 Resistance to Corrosion

Clause 10.2.3 Properties of Insulation Material

Clause 10.2.5 Lifting

Clause 10.2.6 Mechanical Impact

Routine tests as manufacturer's factory: Busduct manufacturer shall conduct below routine tests at its factory.

Dielectric Test

Insulating Resistance Test

Ground Resistance Test

Visual Inspection

The busbar trunking system should pass seismic tests and being certified complying with seismic Zone IV Certified by a reputed international Agency.

Short Circuit Ratings and Tests

The whole busbar trunking system shall be capable of withstanding the short circuit of the electrical installation without damaging the electrical, mechanical and thermal stress under fault condition at a service voltage of 690V. The minimum rated insulation voltage shall be 690V.

The minimum certified short circuit ratings of the busbar trunking shall be as follows

For Phase:

400A - Icw for 1 sec shall be 40kA

For earth

400A – 60% phase capacity (24kA)

Housing

The busbar trunking housing shall be constructed of electro galvanized steel and aluminum to reduce hysteresis and eddy current losses and shall be provided with a suitable protective finish of ANSI 49 gray epoxy paint.

The busbar trunking housing shall pass at least 1000 hours salt spray test to ensure the anticorrosion ability.

Busbars

Busbars shall be of aluminum with copper cladding utilized Molecular Fusion technology.

There shall be no bolts passing through the busbars of the busway.

Each busbar shall be insulated with 2 Layers of Class B DuPont Mylar insulation or equivalent insulation, subject to clearance of all the type test as per IEC 61439-6

Joint

The busbar trunking joint shall be of the one-bolt type which utilizes a high strength steel bolt(s) and Belleville washers to maintain proper pressure over a large contact surface area. The bolt shall be two-headed design to indicate when proper torque has been applied and require only a standard long handle wrench to be properly activated.

It shall be possible to remove any joint connection assembly to allow electrical isolation or physical removal of a busbar trunking length without disturbing adjacent busbar trunking lengths.

Plug-in Holes provision

The connecting jaw of the plug-in unit shall plug directly onto the busbar and have full contact with busbar itself. Welded tab at plug-in busbar is not allowed.

All contact on joint and plug-in opening preferably of silver plated copper.

Shall have plug in provision of 2 no per floors to connect 2 nos of 32/63/100/125 A tap of units.

Plug-in Units

The plug-in jaw shall be spring design composed of different metal to ensure the firm and tight contact with the busbar

The earthing contact of the plug-in unit shall always be made before that of the live conductors and the last to break during removal. And it must connect to the earth bar of busway to ensure the safety.

Covers of all plug-in units must have interlocks to prevent the cover from being opened when the switch is in the ON position.

Plug-in units shall be operated with visible blade quick-make and quick-break mechanism with 32/63/100/125 FP MCCB.

Presence of Transparent shield shall be inside to avoid direct contact of human

The plug-in units shall be equipped with internal barriers to prevent accidental contact of fish tape and conductors with live parts on the line side of the protective device during time of wire pulling.

Termination:

Termination units at transformer, DG set and Panel shall inclusive of Flange end, Copper flexible, adopter Abox, solid aluminum links, earthing connection, required hardware, any other accessories required if any. It shall be as per manufacturer's recommendations. Coordination with other vendors to be done in order to minimize the joints, and to have proper termination.

To avoid phase transposition unit, coordination to be done with panel vendor. Required phase sequence to be communicated to client/ Panel vendor.

Phase transposition unit to be quoted with unit rate and quantity to be considered during detailed engineering, if it is not possible to get the change in phase sequence from panel vendor.

Confirmation of Spares: Manufacturer of busway shall give minimum assured written declaration for availability of spares for min 10 Years after product commissioning.

PVC/XLPE Cables (CB)
Armoured Cables (HT & LT)

General

All material shall conform to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which ISI mark is not available in market, it shall be as included in approved list.

Work shall be carried out as per the method of construction specified by BIS. If there is no reference for particular method of construction in IS, such work shall be carried out as per the approved method of construction specified in chapter 16 of P.W. Dept. Handbook.

Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of the Engineer in Charge.

Cables: (Armoured)

The following list records those Indian Standards in force, which are acceptable as good practice, and accepted standards.

SP 30: 1984 : National Electrical Code

SP 7 (Group 4): 2005 : National Building Code

IS 1255: 1983 Code of practice of Installation & Maintenance of armoured cables up to 33 kV.

IS 3961: Part 2: 1967 : Recommended current ratings of PVC cables.

IS 1554: Part 1; 1988 : PVC Insulated (Heavy duty) Electric Cables; Part 1 for working voltages up to and including 1100 Volts.

IS 1554: Part 2; 1988 : PVC Insulated (Heavy duty) Electric Cables; Part 1 for working voltages up to and including 3.3 kV to 11 kV.

IS 10810: Part 63; 1993 : Method for Test of cables, Part 63 Smoke density of electric cables under fire condition.

Scope: (Armoured cables)

Specification No. (CB-LT/AL, CB-LT/CU, CB-HT)

Providing armoured cable of specified voltage level, size & specified conducting material (Aluminum / Copper) as per Table no. 7/3 including required material,

hardware's for erection and erecting on wall, ceiling, RCC slab or drawing the same through pole, pipe, laying in provided conduit, trench, ducts, trays as per approved method of construction including glands, lugs, etc.

Material:

Cables:

Cables shall be XLPE for LT/MP and XLPE for HT as per Table no. 7/3 and of required construction, colour, shall carry ISI mark, IS No, manufacturer's name, size, duly embossed / screen printed at every metre and having the total count of progressive length in meter at each mark.

Earth wire: Galvanized Iron (G I) wire of appropriate gauge as per Table No 7/1.

Glands: As per specification(CB-GL)

Lugs: As per specification(CB-CL/AL, CB-CL/CU)

Saddles: Saddles fabricated from GI sheet of required gauge and size depending on dia of cable either galvanized or painted with superior quality enamel black paint with necessary shearing mechanical strength, semi circular shaped with extended piece having suitable holes for fixing.

G I Strip: 22 g x 25 mm width G I Strip.

Clamps: MS Clamps fabricated of required length and shape, having the size of 3/6 mm thick mild steel having 25/50 mm width (as per size of cable), rounded ends with wooden / resin cast grip for holding the cable.

Identification tags: For identifying root, connection position GI strip with identification mark / name embossed / painted with arrangement to tie should be fix on cable or arrangement of ferrules to be done.

Hardware: Sheet Metal (SM) screws of required sizes, plugs / wooden gutties, etc.

Method of Construction:

General:

Irrespective of method of construction the cable ends shall be terminated with appropriate size & type of glands with lugs duly crimped, as directed by Site engineer.

Wherever the cable has to be bent, the turning radius shall be as mentioned in Table No 7/2.

Grouping of cables shall be done with adequate distance between cables as mentioned in IS so as to minimize de-rating. Cables shall be tagged/ferruled with identification name / mark at the point from where distribution starts and at ends. Bare earth wire of appropriate size as per Table no. 7/1 shall run along with the cable. Earth wire running with the cable shall be terminated at the earth terminal nearest to cable termination.

Erection of Cable on Surface:

Erection shall be done as per the routes and layout finalized, in perfect level and in plumb.

Before fixing the cable shall be straightened as far as possible for good aesthetics look, continuous bare GI earth wire of required gauge as per Table No 7/1 shall be run. Cable with G I wire shall be fixed by saddles firmly clipped on cable and shall be fixed to wall with minimum 50 x 8 mm SM screws with plugs/wooden gutties, etc. (Distance between two supports / saddles shall be maximum 450 mm). Wooden gutties shall be used wherever required (Especially for stone wall). The entries made in wall, floor slab, etc for laying the cable shall be made good by filling and finishing with plastering the same.

Erection of Cable on Trusses:

Cable along with bare GI earth wire, while erecting on trusses, shall be firmly clamped by wrapping GI strip of 22 g, 25 mm width of required length fixed to truss with nuts and bolts.

Erection of Cable on Pole:

Cable along with bare GI earth wire, while erecting on pole, shall be firmly clipped by suitable wooden / epoxy resin cast grips, clamped with 25 x 3 mm or 50x6 mm MS strip of required length and fixed to pole with nuts and bolts.

Laying of Cable in provided Trench/Pole:

While laying Cable along with bare GI earth wire, utmost care shall be taken to prevent damage to the insulation of the cable and to the open end. Cable shall be brought out from trench vertically straight (minimum 1.0 metre above G L). Care shall be taken to inspect the trench so that depth of cable shall not be less than as shown in Table No 7/4. Suitable size of cable loops shall be provided near termination point at adequate depth.

Erecting cable in constructed Trench / duct:

Erection of cable/s in constructed trench / duct, shall be as per guide lines of IS 1255.

Erection of cable/s on trays:

Cable/s shall be tied with PVC tags on GI trays. At bending point care shall be taken so that sharp edges of sheet will not damage insulation of cable.

Mode of Measurement: Executed quantity shall be measured on the basis of running metre per run of cable.

Dismantling

Cable laid underground, or fixed on any surface shall be dismantled carefully without damaging complete with all its accessories, making coil and stored as directed. The surface of the dismantled cable shall be made clear by removing of unwanted material, cement mortar, etc. When cable is dismantled from trench refill back the trench and making the surface proper.

Mode of Measurement: Executed quantity shall be measured on the basis of running metre per run of cable.

Table No 7/1

Size of Bare GI Earth wire to be used with LT Cables upto 1.1 kV

S.No.	Size of cable	Size of bare GI Earth wire to be used with cable
1	2.5 Sqmm to 50 Sqmm of all cores.	12 SWG
2	70 Sqmm to 95 Sqmm of all cores.	10 SWG
3	120 Sqmm and above of all cores.	8 SWG

Table No 7/2

Minimum bending Radius for Cables

S.No.	Voltage level of cables	Single core	Multi core Unarmoured	Multi core Armoured
1	Up to 11 kV	20 D	15 D	12 D
2	Up to 22 kV	25 D	20 D	15 D
3	Up to 33 kV	30 D	25 D	20 D

Note: D diameter of cable.

Wherever possible, 25 percent larger radii than the specified above should be used.

Table No 7/3

Current Rating (In Ground) for PVC/ XLPE Insulated 1.1 kV Grade Cables

Nominal area of conductor	Aluminum Conductor				Copper Conductor			
	Single Core		Multi Core		Single Core		Multi Core	
Sqmm	PVC	XLPE	PVC	XLPE	PVC	XLPE	PVC	XLPE
10	51	55	46	50	65	71	60	65
16	66	74	60	68	85	95	77	87
25	86	98	76	90	110	125	99	115
35	100	118	92	108	130	150	120	138

50	120	137	110	126	155	175	145	161
70	140	172	135	158	190	220	175	202
95	175	204	165	187	220	260	210	239
120	195	234	185	215	250	301	240	276
150	220	262	210	240	280	336	270	308
185	240	298	235	273	305	381	300	350
240	270	344	275	316	345	441	345	405
300	295	387	305	355	375	496	385	455
400	325	458	335	420	400	586	425	538
500	345	495	-	-	425	635	-	-
630	390	555	-	-	470	710	-	-
800	440	625	-	-	-	-	-	-
1000	490	685	-	-	-	-	-	-

Rating Factors for Variation in Ambient Air Temperature			
Air Temperature (oC)	40	45	50
Rating Factor (XLPE)	1.00	0.94	0.88
Rating Factor (PVC)	1.00	0.90	0.81

Table No 7/4

Minimum laying Depth of cables (IS: 1255)

S.No.	Voltage level of cables	Minimum depth from top of the cable
1	Up to 1.1 kV	750 mm
2	3.3 kV to 11 kV	900 mm
3	22 kV to 33 kV	1050 mm
4	At road crossing	1000 mm
5	At railway crossing (from Bottom of sleepers to Top of pipe)	1000 mm

Notes below Table No 7/4:

1.	PVC Insulated electrical cable for voltage grade up to 1.1 kV is based on 8 volts drop.			
2.	The distances are given in meters and after rounding.			
3.	The distances are given in meters and after rounding.			
For Temperature Correction please see as detailed below:				
Ground temp.	20 degree C	25 degree C	30 degree C	35 degree C
Rating factors:	0.95	0.90	0.85	0.80

Table No 7/5

Distance up to which different sizes of UG Aluminum Conductor Cables 1.1 kV grade, can be used for different current ratings of 8 Volts drop. (PVC insulated, PVC Sheathed, 3 cores or 4 cores)

Maximum Conductor temperature – 70 degree C														
S. No	Current	Distance in meters for the following cable sizes in Sqmm												
	Amp	6	10	16	25	35	50	70	95	120	150	185	240	300
1	5	16	26	41	72	89	130	219	236	306	355	430	577	646

		5	0	5	5	5	0	5	0	5	5	0	0	0
2	10	80	130	205	360	450	650	960	1180	1530	1775	2150	2885	3230
3	15	55	85	140	240	300	430	640	785	1020	1185	1430	1920	2155
4	20	40	65	100	180	225	325	480	590	765	890	1075	1440	1615
5	25	30	50	80	145	180	260	385	470	610	710	860	1150	1290
6	30	25	40	70	120	150	215	320	390	570	590	715	960	1075
7	40	20	30	50	90	110	160	240	295	380	445	535	720	805
8	50	-	25	40	70	90	130	190	235	305	355	430	575	645
9	60	-	-	35	60	75	110	160	195	255	295	355	480	535
10	70	-	-	30	50	65	90	135	165	215	255	305	410	460
11	80	-	-	-	45	55	80	120	145	190	220	265	360	405
12	90	-	-	-	40	50	70	105	130	170	195	235	320	360
13	100	-	-	-	35	45	65	95	115	150	175	215	290	320
14	110	-	-	-	-	40	60	85	105	140	160	195	260	290
15	120	-	-	-	-	35	55	80	95	125	145	180	240	270
16	130	-	-	-	-	-	50	75	90	115	135	165	220	250
17	140	-	-	-	-	-	45	70	80	110	125	150	205	230
18	150	-	-	-	-	-	-	65	75	100	115	140	190	215
19	160	-	-	-	-	-	-	60	70	95	110	130	180	200
20	170	-	-	-	-	-	-	55	70	90	105	125	170	190
21	180	-	-	-	-	-	-	50	65	85	100	120	160	180
22	190	-	-	-	-	-	-	-	60	80	90	110	150	170
23	200	-	-	-	-	-	-	-	60	75	90	105	145	160
24	225	-	-	-	-	-	-	-	-	65	80	95	125	145
25	250	-	-	-	-	-	-	-	-	-	70	85	115	130
26	275	-	-	-	-	-	-	-	-	-	-	80	105	115
27	300	-	-	-	-	-	-	-	-	-	-	70	95	105

Cable Joints & End Termination Kits (LT/HT Cables) (JT/LT/HT)

Scope:

Specification No (CB-JT/LT/HT)

Providing straight through cable jointing kit of approved make and jointing cable as per the manufacturer's instructions and duly marking name of jointer and date.

Material:

Joint kit: Kit manufactured by reputed manufacturer with PVC moulds made in two parts, with epoxy compound, earth continuity lead of appropriate cross section having lugs at both ends, aluminum ferrules of the size of the cable, cross shaped epoxy spacer, MS clips for holding the moulds, adhesive for pasting the moulds.

Method of Construction:

Straight through joint Kit: LT/HT Cables

Before providing joint to the cable, the cable ends of the equivalent length of the joint moulds, shall be prepared by removing the outer PVC insulation along with the steel armouring. The ferrule shall then be inserted over the bare core of the cable, and shall be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimped portion shall be wrapped first with the PVC insulation tape and then with the insulation tape used for wrapping HT conductor. The above method shall be carried out for all the cores strictly following the colour code. The leads of the both the cables now shall be placed into the mould by using the epoxy spacer, for having sufficient gap in-between the leads. The earth continuity lead shall be clamped to the both ends of the cable. After covering the cable leads with the PVC moulds, the edges shall be clipped after applying the adhesive on the inside face of the moulds. The pasting of moulds shall be rigid and as far as possible leak proof, so that the epoxy compound shall not spill out. Now the duly stirred epoxy compound shall be poured and fill till the compound rises through the risers provided on the moulds. After completing the above procedure, the joint shall be allowed to dry out for at least 8 to 10 hours (for epoxy compound to get hardened) depending upon the size of cable. Before connecting to supply, the dry and hardened joint shall be tested for its insulation level with 1000 V/ 5000 V Meggar. The cable should be fixed or laid in such manner that there should not be pressure on end of moulds or on jointing position of cables

Outdoor/Indoor end termination Kit: LT/HT Cables

Before providing end termination kit to the cable, the cable end of the equivalent length of the moulds, shall be prepared by removing the outer PVC insulation along with the steel armouring. The ferrule shall then be inserted over the bare core of the cable, and shall be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimping shall be done in such a manner that there shall be no air gap. Then the crimped portion shall be wrapped first with the PVC insulation tape and then with the insulation tape used for wrapping HT conductor. The above method shall be carried out for all the cores strictly following the colour code. The leads of the cable now shall be placed into the mould by using the epoxy spacer, for having sufficient gap in-between the leads. The earth continuity lead shall be clamped to the ends of the cable. After covering the cable leads with the PVC moulds, the edges shall be clipped after applying the adhesive on the inside face of the moulds. The pasting of moulds shall be rigid and as far as possible leak proof, so that the epoxy compound shall not spill out. Now the duly stirred epoxy compound shall be poured and fill till the compound rises through the risers provided on the moulds.

After completing the above procedure, the joint shall be allowed to dry out for at least 8 to 10 hours (for epoxy compound to get hardened) depending upon the size of cable. Before connecting to supply, the dry and hardened joint shall be tested for its insulation level with 1000 V/ 5000 V Meggar.

Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each). Cable Glands (GL)

Scope:

Specification Nos (CB-GL)

Termination of cable ends with cable glands for preparing and fixing the cable leads for connection. Cable glands shall be of Flange type.

Material:

Cable glands: Flange type heavy duty. Made of high purity brass metal, with brass washers, rubber rings, threaded stud with washers and nuts.

Method of Construction

Before erection of gland, the cable end shall be prepared by removing the outer PVC insulation up to the point where gland to be fixed, by assessing the length of leads required. Bottom portion of gland shall be inserted over the steel armouring, and then armour strips shall be bent for the length of collar of gland, remaining length of armoring shall be cut. The cable end shall then be, inserted through the entry of plate where the cable is to be terminated. The top portion of gland with washer shall be then inserted in such a manner that the bent armour strip should be touching the surface of the entry. The nuts shall be tightened with spring washers over the projected stud portion. Fixing of gland shall be at right angle to the gland plate. Tightening shall assure continuity of earth. Hole to the gland plate shall be punched / knocked out, of correct diameter with respect to gland size.

Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each).

Cable Indicator Plate (CIP)

Scope:

Specification No (CB-CIP)

Providing and fixing of cable indicator plate along the route of under ground cable.

Material:

Cable indicator plate: Circular plate made of cast iron having 100 mm dia. and 6 mm thick.

Iron rod for fixing of cable indicator plate: 700 mm long galvanized iron rod of 12 mm dia., and 150 mm long cross bar welded at bottom or hook to be made with same continuous bar.

Method of Construction:

Cable indicator plate fixed/welded to the 700 mm long iron rod or angle, with 150 mm cross bars welded at bottom as fasteners or bent in 'J' shape to hook the cable in the bent portion, shall be buried along the route of cable in the trench made for laying the cable. For clear visibility, the Cable indicator plate shall be buried in such a manner that the plate should be minimum 200 mm above the ground level and shall be provided at every 15-25 metre in straight run, at both ends of road crossing and immediate before and after turning point of cable.

Mode of Measurement:

Executed quantity will be measured on number basis. (I.e. each).

CABLETRAY&ACCESSORIES

Scope

Scope of these specifications covers the design, material selection, fabrication, testing at manufacturer's works, insurance, packing, transportation, loading/unloading, supply at site and installation of cable trays, trunking (Raceway) and accessories covered here in.

Material and construction (Cable tray)

Cable trays and accessories shall be manufactured to comply with the specifications of National Electrical Code (NEC) and National Electrical Manufacturers' Association (NEMA).

Cable trays and accessories shall be fabricated using mild steel sheets and hot dip galvanized in accordance with B.S.729 after fabrication. All bolts, nuts and washers shall also be galvanized. The zinc coating shall be uniform, smooth and free from imperfections such as flux & ash, black spots, blisters etc. Cable trays and accessories shall undergo a process of degreasing, pickling in acid & cold rinsing prior to galvanisation.

Cable trays shall be of the following type:

- i. Ladder type with rungs
- ii. Perforated type.

Perforated cable trays shall be generally of channel type and the perforations shall be 10x30 mm oval holes. Perforated cable trays shall also be galvanised. Galvanising shall be in accordance with that specified above for ladder type cable tray.

Ladder type cable trays shall be made from min 1.6 mm thick sheet formed in 'C' section of 75/100 mm height and in ward flanges of 15mm wide runners and 30mm wide x 10mm high rungs ('C' shaped) from a 1.5mm thick sheet. Perforations as mentioned above shall be provided in the width of the rungs. Pitch of the rungs shall not exceed 250 mm center to center. Rungs shall be tack welded to the side members.

The thickness of sheet steel for perforated trays shall be 1.2mm and they shall be of the formed channel shape.

Cable trays shall be of following dimensions as specified in BOQ.

Accessories

Following accessories and hardware, as required, shall be supplied with cable trays:

- | | |
|---|----------------------|
| ¾ | Coupler plates |
| ¾ | bends |
| ¾ | Tees |
| ¾ | Reducers |
| ¾ | 4-way cross |
| ¾ | Fasteners (Hardware) |

Testing at manufacturers work

The material for cable trays and accessories shall be offered for stage inspection by the Owner as follows:

- | | |
|---|---|
| ¾ | Prior to fabrication and galvanising. |
| ¾ | After fabrication but before galvanising. |
| ¾ | After galvanising but prior to dispatch. |

During inspection, thickness of sheets, dimensions and weight of zinc coating will be measured. Items not conforming to specifications shall be rejected.

Plate / Pipe type Earthing

Plate type Earthing (With or Without CI Cover, Funnel, etc) (EA-EP)

Scope:

Specification No (EA-EP)

Supplying and erecting galvanised cast iron / copper earth plate type / G.I. pipe type earthing with / without C.I. cover as per instructions from the site engineer.

Material:

Earth Plate: Galvanised cast iron / Copper earth plate or G.I. pipe as per specifications given in Table No 9.1/1.

CI Cover:As per specifications given in Table No 9.1/1.

Earthing Conductor:Copper/G.I strip/Annealed bare copper wire/G.l. earth wire of size as per specifications given in Table No 9.1/1.

GI Pipe:As per specification (CW-PLB/GP) mentioned chapter no. 17.5 for watering, and as enclosure for Earth wire, refer specifications given in Table No 9.1/1.

Hardware:Screw / nut bolts with required washer of dimensions, Rawl plug / clip/ 'U' nails and material as per specifications given in Table No 9.1/1.

Filling material: Coal /Charcoal/ salt as per specifications given in Table No 9.1/1.
as per specifications given in Table No 9.1/1.

Lugs: As per specification (CB-LG/AL, CB-LG/CU)mentioned chapter 7.9 & 7.10 Copper/ Aluminium lugs as per specifications given in Table No 9.1/1.

Method of construction:

Pit is to be dug of required dimensionand depthfor the earthing at site, and laying of Galvanised cast iron / Copper earth plate or G.I. pipe shall be as per Table No 9.1/1. The earth connection to equipment/ switch gear and earthing electrode shall be connected as shown in the diagram and as per IS 3043 amended up to-date. The connections shall be made either by strip or double run of earth wire with drilling, welding, riveting, brazing and nut bolting to plate or pipe, where ever required in an approved manner. As far as possible continuous strip shall be used, but where ever jointing of strip is unavoidable, the overlap portion must not be less than 2 1/2 times the width of the strip either welded/

brazed/soldered by all sides or 6 inches overlap with two nut bolts/ riveting of adequate size with required washer and covered by anti-corrosive paint as per approved jointing practice in the industry and as per directives from site engineer in charge.

Pit shall then be filled with screened soil with alternate layer of coal and salt, and if, necessary brick masonry work (Where ever applicable) shall be done as specified in IS: 3043, with laying wires in PVC/ G.I. pipe and watering arrangement as per and covered with C.I. Cover (Where ever applicable).

Where ever requires or as specified by Site Engineer, a Test link shall be provided for facilitating the testing of resistance of earth electrode.

Testing:

The value of each earth electrode shall be measured by earth tester in presence of site Engineer and record to be submitted.

Mode of Measurement:

Executed quantity will be measured on number basis (i.e. each
Table No 9.1/1

Detailed Specifications of various types of Earthing

Type of earthing----->		Galvanised cast iron earth plate type without C.I cover	Copper earth plate type with C.I cover	Galvanised cast iron earth plate type with C.I cover	Pipe type earthing with out C.I cover
S.No.	Particulars				
1	Depth from top of plate	1.5 m	1.5 m	1.5 m	1.5 m

	Up to Ground level				
2	Size & type of material for pipe / Plate type earthing.	Cast iron earth plate size 60x60x0.6 cms	Copper earth plate size 60x60x0.6 cms	cast iron earth plate size 60x60x0.6 cms	'B' grade G.I. pipe 40mm. dia. 2.5 mtr. Long or 20 mm dia. G.I. Rod
3	Salt/charcoal	30 Kg. charcoal and salt each	30 Kg. charcoal and salt each	40 Kg. charcoal and salt each	N A
5	Type of Wire	Double G.I. wire 8 SWG	Double G.I. 8 SWG	Double G.I. 6 SWG	double G.I. 8 SWG
	Wire enclosure	12mm. dia. G. l. pipe 2 mtr. Long	12mm. dia. G. l. pipe 2 mtr. Long	12mm. dia. G. l. pipe 2.5 mtr. Long	N A
7	Nut bolts	12 mm dia. Cadmium / GI	12 mm dia. Cadmium / GI	12 mm dia. Cadmium / GI	N A
8	Washers	GI	GI	GI	N A
9	Watering pipe	19mm. dia. G.I. pipe	19mm. dia. G.I. pipe	19mm. dia. G.I. pipe	N A
10	Lugs	Yes	Yes	Yes	Yes
11	funnel	No	yes	yes	N A
12		No	yes	yes	N A

Low Impedance Earthing (Pipe in pipe technology) (EA-EPP)

Scope:

Specification No (EA-EPP)

Supplying and erecting approved type earthing system with Pipe in pipe technology with necessary ancillary materials and complete erection as per instructions from the site engineer

Material:

GI Pipe: As per specification no. (CW-PLB/GP) mentioned chapter 17.5;
50 mm dia x 3 meter long (In place of traditional GI pipe Earthing), for LV / MV applications.

Or

80 mm x 3 meter long (In place of traditional copper plate Earthing), for HV/EHV applications.

Earthing Conductor:G.I strip/GI earth wire of size as per specifications given in Table No 9.1/1.

GI Pipe: As per specification no. (CW-PLB/GP) mentioned chapter 17.5 for watering and as enclosure for Earth wire, as per specifications given in Table No 9.1/1.

Hardware: Screw / nut bolts with required washer of dimensions, Rawl plug / clip/ 'U' Nails and material as per specifications given in Table No 9.1/1.

Filling material: Coal /Charcoal/ salt as per specifications given in Table No 9.1/1.
as per specifications given in Table No 9.1/1.

Lugs: As per specification no. (CB-LG/AL, CB-LG/CU) mentioned in chapter 7.9 & 7.10 for Copper/ Aluminium lugs and as per specifications given in Table No 9.1/1.

Method of construction:

Earthing Pipe in pipe technology with ancillary materials shall be done by digging an 8" / 10" dia hand bore 10.5' deep sufficient to install the electrode in normal soil conditions. The space between the soil and the electrode is filled up with electrolyte material mixed with the dug out mother soil, along with water and tightly packed up to the base of the terminal. In rocky areas and under hard soil and sandy soil conditions the method of installation will be as specified by manufacturer. Installation shall include drilling, welding, reventing, brazing and nut bolting pipe when ever required in an approved manner with required material such as nut bolts and washer etc. and with necessary brick masonry work as per the specification. (As per IS 3043 amended up to-date). As far as possible continuous GI strip shall be used but when ever jointing of strip is unavoidable, the jointing over lap portion must not be less than 21/2 times the width of the strip either welded/ brazed/soldered by all sides or overlap of 6 inch with two nut bolts/ riveting of adequate size with required washer and covered by anti corrosive paint as per approved jointing practice in the industry and as per directives from site engineer in-charge.

Testing:

The value of each earth electrode shall be measured by earth tester and record to be submitted.

Mode of Measurement: Executed quantity will be measured on number basis i.e. each

Excavation (EXN)

A) Cable Trench (CTR) General

This part of specification deals with the preparation of trenches in soft soil, hard murum, BT road, and laying of cables inside the trench, etc as per IS: 1255.

Scope:

Specification No (CW-EXN/CTR)

Excavating in all types of soil strata and making trench for laying cable/cables, providing sand bed for laying the cable, covering cable with specified material as per requirement, and finishing the same by making the surface proper with crown on top of the trench.

The following list shows Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984 : National Electrical Code

SP 7 (Group 4): 2005 : National Building Code

IS 1255: 1967 : Code of practice of Installation & Maintenance of armoured cables up to 33 kV.

Material:

Bricks: Solid Clay bricks of minimum size 225x110x62.5 mm (L x B x H), burnt in the kiln, of good quality.
Sand: Screened sand of good quality.

Method of Construction:

Trench in Soft soil / Hard Murum / Tar road: Single run of cable

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum 300 mm width shall be excavated up to minimum depth below the ground surface as per Table No 17.1/1 Bottom of the trench should be carefully levelled and freed from stones. Cable duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand at the bottom of the trench. Bricks shall be laid all over the run of cable as specified below:

Lengthwise for cable up to and including 10 Sqmm of all cores.

Width wise for cable above 10 Sqmm of all cores.

Remaining portion of the trench shall be back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150 mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

Trench in Soft soil / Hard Murum / Tar road: Two or more cables run of cable

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum required width more than 300mm. shall be excavated up to minimum depth as per Table No 5, below the ground surface. Bottom of the trench should be carefully levelled and freed from stones. Cables duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand. The inter-axial distance between two cables shall be between 230 and 400 mm. at the bottom of the trench. Bricks shall be laid all over the run of cable as specified below:

Lengthwise for cable up to and including 10 Sqmm of all cores.

Width wise for cable above 10 Sqmm of all cores.

Remaining portion of the trench shall be back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150 mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

Trench in Soft soil/Hard Murum/Tar road with half round Hume pipe:

(For cables of size 25 Sqmm. and above shall be covered by min. 150 mm. dia. of RCC Hume pipe)

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum required width more than 300mm. shall be excavated up to minimum depth as per Table No 5, below the ground surface. Bottom of the trench should be carefully levelled and freed from stones. Cables duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand. The inter-axial distance between two cables shall be between 230 and 400 mm. at the bottom of the trench. Inverted 150mm. dia. Half round RCC Hume pipe shall be laid above full length of cable. For more than one cable higher size or more number of Hume pipes are to be provided.

Remaining portion of the trench shall be back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150 mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

As per 3.1 above, in place of bricks, the cable of size 25 sq.mm and above shall be covered with 150 mm dia. half round Hume pipe.

Mode of Measurement:

Executed quantity shall be measured on the basis of running meter per run of cable.

Table No 17.1/1

Minimum laying Depth of cables (IS: 1255)

S.No	Voltage level of cables	Minimum depth from top of the cable
1	Up to 1.1 kV	750 mm
2	3.3 kV to 11 kV	900 mm
3	22 kV to 33 kV	1050 mm
4	At road crossing	1000 mm
5	At railway crossing (from Bottom of sleepers to Top of pipe)	1000 mm

LV PANEL BOARD

Rated Insulation Voltage Ui	:	Upto 1000 V
Frequency	:	50 Hz
Frequency variation	:	±3% of the nominal value
System design fault level (sym.)	:	50KA for 1 sec
System earthing	:	Solidly Earthed
Rated Impulse Withstand voltage Uimp	:	12kV/8kV
Degree of Protection	:	IP54

Applicable standards

The equipment proposed in this offer has been designed, manufactured, and tested according to the relevant IEC recommendations.

IEC 61921 / IS 16636 – 2017 - Low-voltage power factor correction banks

IEC 61439-1/2 Low voltage switchgear & controlgear assemblies – Part 2 Power switchgear and controlgear assemblies

IEC 61641-ed 3 Enclosed low voltage switchgear and controlgear assemblies Guide for testing under conditions of arcing due to internal fault

IEC 60529 Degrees of protection provided by enclosures

IEC 60947-2 Low voltage switchgear & control gear – part 2 Circuit breakers

IEC 60947-3 Low voltage switchgear & control gear – Part 3 Switches, disconnectors, switch-disconnectors & fuse combination units

IEC 60068 Environmental testing

IEC 61140 Protection against electric shock – Common aspects for installation and equipment – Basic safety publication

IEC 60947-4-1 Contactors and motor starters LV Equipment Mandatory Specifications

Mandatory Safety Standards and tests

To ensure safety of the persons and equipment, each rating of the switchboard must be type tested recently in accordance with IEC 61921, IS 16636 : 2017, IEC 61439 - 1 & 2. The

testing must have been performed in the independent laboratories witnessed by competent authorities of international repute.

All the performance type tests must be done with the device mounted inside the switchboards and shall be considered applicable for that particular make only. In case the make is changed separate test must be conducted. Test certificates must be available for inspection before the quotation is made

This is a Mandatory specification for low voltage switchboard dedicated for large installations comprising of LV Main distribution boards and Sub - distribution applications and motor control Centers. The specifics of site conditions and special applications are mentioned separately in the annexures This equipment is desired to be installed indoors in the substation or the specific rooms or shop floor. The LV Equipment shall be flexible, made of several type of panels to be coupled with each other for various applications with specifically rated horizontal busbars and vertical busbars for particular vertical section. For personal and equipment safety against accidental touch, each feeder must have Pre-designed finger proof metallic or molded barriers.FRP/Hyles shrouds will not be acceptable under any circumstances.

Pre-designed Metallic barriers between feeder chambers, Busbar chambers and cable compartment. All the openings between these compartments must be properly sealed and shrouded.

As per IEC 61921, IS 16636:2017 type tested design metallic partitioning in ensure safety of during operation and maintenance. Metallic partitions on the cable termination must be designed for easy termination of the cable sizes mentioned in the BOQ/ SLD. It should easily possible to reassemble the form partitions after terminations of the cable.

Differentiated locks (& Keys) for Feeder compartment, Cable compartment and Busbar compartment.

Several interlocking systems as mentioned elsewhere in this specification or special requirement to prevent inadvertent operation.

If, specific environmental conditions are mentioned (e.g. Corrosive, conductive, highly humid or outdoor), supplier must submit the processes to be followed to avoid adverse effect on the working of the switchboard.

Manufacturing Unit - Systems, Safety and Green Initiatives. The Supplier manufacturing unit must have statutory and quality system standards certification

ISO 9001 Quality Management Systems (QMS)

ISO 14001 Environment Management Systems (EMS)

OHAS18001 Certification for occupational health and safety.

LV equipment shall be modular, metal enclosed pre-engineered, comprehensively type tested as per IEC 61921, IS16636:2017, IEC61439-1&2, to house switchgear devices of reputed makes as specified and as per the BOQ/SLD.

General

The switchboard shall be metal enclosed, free standing, floor mounting, compartmentalized, extendable on both sides, modular type, suitable for indoor installation with dust & vermin protected.

The switchboard shall complies to latest edition of IEC 61439-1&2, Test certificate shall be issued by a reputed authority.

The equipment shall be suitably constructed for safe, proper and reliable operation without undue wear, corrosion, heating or other operating trouble.

Panel builder shall produce valid licensed agreement made with original manufacturer.

The weatherproof housing shall be manufactured from Hot Galvanized Iron confirming to international specification and suitable for mounting on a flat concrete base or pier 300 mm above ground level.

The enclosure frame shall be from OEM. The frame shall be of bolted design made of Galvanized iron with 9 fold structure for better rigidity and strength with 275GSM. No welding frame to be considered.

All the load bearing members shall be made of GI sheet steel and it shall be of a totally enclosed design with cables entering from the Top/bottom and secured by cable cleats or glands and maintains equipotentiality of the switchgear.

The housing shall be arranged for front access/Rear access by means of hinged doors which shall be screwed to secure them.

All openings/corners shall be smooth without burrs, smooth. The openings for passing control wires and cables shall be smoothened or provided with suitable rubber gaskets. Doors and covers shall be provided with gasket to ensure specified IP degree.

All hardware shall be treated to achieve resistance to corrosion. Joints and connections shall be made using high quality 8.8 grade steel bolts, nuts & washers. Specific washers shall be used to ensure effective continuity.

The switchboards shall be formed using distinct vertical panels comprising of different compartments

Full metal sheet shall be provided between two adjacent vertical panels running up to full height of the switchboards.

All the meters, CTs, auxiliaries pertaining the feeders will be housed together in the same compartment respecting the connection rules, clearances recommended by standards and the manufacturers guidelines. For the ACB feeders however, the protection relays, other auxiliaries like control/selector switches, meters etc. shall be mounted in a separate compartment near to the breaker compartment with proper labelling

The rated impulse withstand voltage of the system shall be 8kV for ACB & MCCB feeders for total panel.

The Electrical Panel shall have a rated short time withstand current of 50 kA for 1 second

The busbar will be designed for mounting on insulated supports that are sufficient in number to accept the flow of peak short circuit current upto 254kA.

The switchboard Main distribution panel shall restrict the internal arcs faults within the compartment to ensure maximum safety to the operating personnel and also to minimize the downtime for replacement and repairs. Type test certificate shall be carried out to verify the arc containment within the compartment for 50kA, 0.3sec as per IEC 61641.

The Switchboard shall have Seismic withstand of Zone –IV.

Even under extreme condition of short circuit or Mal-operation there will be no danger in the vicinity of the assembly.

The switchboard shall be with Outer glass door with gasket to prevent from accidental / unauthorized operation of switchgears.

The glass should be of minimum 4mm thick which should comply Mechanical impact of IK-09.

The doors should be with pre-assembled handle (reversible) with 4 closing points must be used, double tongue standard type with locking system must be chosen.

No hylam sheets to be used for segregation, GI sheet are preferable.

KIOSK arrangement

The KIOSK should comply minimum IP55 with rear accessibility.

The KIOSK shall be equipped with breather without defeating the Ingress protection for better air ventilation inside the KIOSK. And shall be provided with rain canopy

Rear accessible is required (i.e) Rear cover can be opened for accessing the panel. The panel KIOSK door & Panel door should match in order not collide each other while opening the doors.

The thickness of the sheet shall be 1.6mm.

The panel shipping section & Kiosk should not be problem during erection of the panels at site. Also ease during cable termination

The KIOSK door shall be fitted with door stiffeners.

The panel manufacturer should have ISO 9001 certification. And shall have a minimum experience of 10 years in the field of switchgear assembly. Enclosure system and switchgear components shall be from the same manufacturer

The entire switchboard shall be of bolted design to avoid welding cracks in case of welded design.

The switchboard shall be of modular kit design for easy transportation and assembling at site by which Quick and error free assembly can be achieved.

Finger touch proof design ensures highest safety to maintenance personnel.

Enclosure manufacturing

The switchboard shall be factory manufactured by OEM or manufactured by authorized Franchisee of OEM based on design given by OEM.

The switchboard shall be complete design verified assembly as per IEC 61439-1&2.

The enclosure protection shall not be less than IP-52 unless other specified in BOQ.

The switchboard shall be modular, extendable cubicle, fully compartmentalized and floor mounting.

The form of separation shall be Form-4, a modular individual mounting arrangement shall be used and the internal separation shall be carried out using GI sheets with 275GSM.

The switchboard frame (Uprights) shall be pre-punched and bent with minimum 1.5mm thickness and fitted with a multipurpose hinge, used to assemble the door and to couple the structures, both laterally and rear.

Base/top steel sheet painted (epoxy polyester RAL 7035 orange peel), with inlet/outlet for cables. They are supplied pre-mounted by means of a three-way joint, which is able to provide considerable structural rigidity.

The switchboard construction should be with universal width which can be used for both Incoming vertical as well as outgoing feeder vertical.

Zinc coating will be provided on the sheets which will prevent rust formation during storage and handling for processing, in addition to giving corrosion protection to the finished product.

The GI sheet used in the enclosure shall be 275gsm.

The sheet steel used for the enclosure manufacturing will pass through the pretreatment process for surface treatment.

The outer doors and cover shall be Poly urethane PUR gasket to prevent from ingress of dust.

The glass should be of Tempered glass to avoid sharp edges in case of damage.

External and internal painting with electrostatic application of thermosetting powder enamel with epoxy polyester binders. Grey orange peel RAL 7035 colour, total thickness of min 80 micron.

The painting should pass the resistance test to saline fog (min 193 hours)

The switchboard shall have integral base frame.

The doors and covers shall be made of CRCA sheet steel of thickness as per OEM standard

Switchboard Configuration

The switchboard shall be configured with Air Circuit Breaker, Moulded case circuit breaker, MCCB, MCB, Contactors and other equipment's as per BOQ.

The MCCBs shall be arranged in multi-tier formation. The incoming Air Circuit breaker shall be arranged in single tier formation only but double tier formation can be arranged to facilitate operation and maintenance which is applicable to only outgoing ACBs only.

The switchboards shall be adequate size with a provision of spare space to accommodate possible future additional switchgear.

Special care has to be taken to ensure effective earthing of the frame and doors of the switchboard.

All panels and covers shall be properly fitted. The unused holes in the panel shall be closed with suitable grommet.

The panel has to be provided with “Danger” label confirming to relevant standard.

Switchboard Compartmentalization

The switchboard shall have separate totally enclosed compartment for main horizontal busbar, vertical busbars, ACBs, MCCBs and Cable chamber.

The switchboard shall be with Form 4b construction.

Insulated shutters shall be provided between drawout and fixed portion of the switchgear such that no live parts are accessible with equipment drawn out. Degree of protection within compartments shall be atleast IP 2X.

Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker “ON” and “OFF” position.

For incoming vertical separate and adequate compartments shall be provided for accommodation instruments, indicating lamps, control contactors and control MCB etc.

Outgoing MCCBs “ON” and “OFF” operation can be performed only after opening the door.

Each switchgear cubicles shall be fitted with label in front and back identifying the circuit, switchgear type, rating and duty. All operating device shall be located in front of switchgear only.

A suitable wire wat with cover shall be provided to take interconnecting control wiring between vertical section.

Incase of dead front access panel separate cable chamber and vertical chamber to be provided for easy maintenance.

In case of rear access panel cable compartment can be provided in the rear only for outgoing vertical with sufficient space for easy termination. The incoming and outgoing cables can either entering from bottom or top depending on the site requirement.

Proper cable support shall be provided in cable compartment to support and clamping the cable.

Switchboard Busbar

Busbar shall be made of high conductivity Aluminium of ETP grade busbar and shall be of rectangular cross section.

The busbar shall be suitable for full load current for phase busbar and half/full rated current for neutral busbar or as stipulated in BOQ.

The busbar system shall be designed as per the pre-defined guidelines provided by the original manufacturer.

The fault level rating of the busbar system shall be as per the drawings however the minimum short circuit withstand capacity shall be 50KA RMS for 1second.

The busbar system shall be type tested by the manufacturer at reputed laboratory for short circuit withstand capacity. The neutral and earth busbars shall also be type tested for the short circuit withstand capacity.

The busbar system shall be supported adequately at regular intervals as per OEM guidelines based on the type test results on a specially designed busbar supports. The supports shall be independently fixed to structure to strengthen the busbar arrangement. Wherever required additional intermediate supports shall be provided between the busbars.

All vertical droppers shall also be adequately supported as per the manufacturer guidelines and the test results. The Vertical busbars shall be connected to the main busbars by suitable sized and graded bolt & nut and contact washers.

The busbar shall be supported on Non-breakable, glass reinforced polyamide 6.6 insulated supports able to withstand operating temperature of 140OC.

The busbar support should qualify glow wire test of 690OC.

The supports shall comply UL 94 safety of Flammability Plastic Materials for Parts.

The busbar support should withstand the impulse voltage of 12kV.

The material and busbar support spacing should be same as per the type tested assembly.

The minimum clearance to be maintained for enclosed indoor air insulated busbar shall be as per IEC guidelines.

The dimensioning of the busbar system shall be as per the rated current of the mainswitching device, the short circuit current, the maximum rated permissible temperature at permanent operation and the ambient temperature around the busbars. The selection of busbars shall be supported by calculations and recommendations from the OEM.

The neutral busbar shall run along with the phase busbars. Neutral busbar running at bottom or in the cable chamber/alley will not be accepted in case of Form-4 construction.

Earth busbar shall be running throughout the panel fitted directly on to the structure for connection of the protective conductors to provide equipotential bonding of exposed conductive parts. Earth busbar shall be located at the bottom of the panel in case of bottom entry and top of the panel in case of Top entry.

All non-current carrying metallic components shall be permanently connected to earth.

Hardware used for busbar connections shall be zinc plated, yellow passivated / bichromated steel of 8.8 grade. Tightening of busbar bolts shall be done as per manufacturer recommendations and pre-defined guidelines using calibrated torque wrenches.

Auxiliary buses for control power supply, space heater power supply or any other specified service shall be provided. These buses shall be insulated, adequately supported and sized to suit specific requirement. The material for auxiliary supply bus will be insulated electrolytic copper. Wires.

With aluminium bus bars, only aluminium wire/solid bar connections shall be made for incoming/outgoing mountings on the switchboards.

With copper bus bars, only copper wire/solid bar connections shall be made for incoming/outgoing mountings on the switchboards.

The cross section of the neutral bus bar shall be the same as that of the phase bus bar for bus bars of capacities upto 200A; for higher capacities, the neutral bus bar must not be less than half the cross-section of that of the phase bus bar.

Each bus bar shall be suitably insulated with PVC sleeves/tapes. The insulation of the rising mains shall be capable of withstanding the voltage of 660V of A.C

Bus bar has to be as per TTA design of OEM.

Bus bar support insulators shall be class *F insulators made of non-hygroscopic, non-combustible, track resistant and high strength FRJP/ SMC/DMC material, and shall be of suitable size and spacing to withstand the dynamic stresses due to short circuit currents. The spacing between two insulators should not exceed 250 mm.

The minimum clearance to be maintained for enclosed indoor air insulated bus bars for medium voltage applications shall be as follows:

Between Min. Clearances

Phase to earth 26mm

Phase to phase 32mm

For strip connection from bus bars to switchgear, the above clearances don't apply.

Bus bar joints shall be thoroughly cleaned and suitable oxidizing grease shall be applied before making the joint.

High tensile bolts, plain and spring washers shall be provided to ensure good contact at the joints.

The overlap of the bus bars at the joints shall be not less than the area of the cross section of the bus bars.

Bus bars and main connections shall be marked by color or letter as per table shown below.

Sr. No	Busbar and main connections	Colour	Letter/Symbol
i)	Three Phase	Red, Yellow, Blue	R.Y.B.
	Two Phase	Red, Blue	R.B.

Sr. No	Busbar and main connections	Colour	Letter/Symbol
	Single Phase	Red	R
ii)	Neutral connection	Black	N
iii)	Connection to earth	Green	E
iv)	Phase variable (such as connection to reversible motors)	Grey	Gy.

Instruments

Instruments shall be digital flush mounting type. Digital Load Managers shall be provided for the parameters as indicated in the SLD and B.O.Q. Energy meters shall be suitable for 3 phase 4 wire unbalanced load. Energy meters shall be mounted flush and gaskets shall be used for making the door cut-out dust tight.

All meters unless otherwise specified shall be with RS485 port and necessary software for parameter display at remote PC shall be provided by vendor along with the panels/meters. Electrical indicating / measuring instruments shall be of 96 x 96 mm Digital MFM unless otherwise specified. These shall be mounted semi-flush with only flanges projecting. All meters shall be 1 accuracy class unless otherwise specified.

Current Transformer

Current transformers as specified in drawing shall be provided for each circuit conforming to relevant IS : 2705. CTs shall be epoxy resin cast with bar primary or ring type and shall be mounted on fixed portion of the switchgear cubicle. Facilities shall be provided for short circuiting and earthing of CT secondary leads at the terminal blocks. Also test links, shall be provided in CT secondary leads to carry out current and phase angle measurement tests with CTs. in service.

Class I accuracy for metering and Class 1 and 5P10 for protection with rated burden of 15/30 VA on secondary.

Error limit to specific class of accuracy.

Current transformers shall be designed to withstand the thermal and mechanical stresses resulting from fault currents equal to the maximum interrupting and momentary current ratings respectively of the circuit breakers.

Insulation level of the CTs shall correspond to the voltage level of the switchgear. CTs shall have polarity marks indelibly marked on CT terminals and at the associated terminal blocks. The arrangement of mounting and supporting the CTs shall be such as to take care that tracking along insulator surface from busbars to CT supporting metal clamps, cleats and bolts resulting - over shall be avoided.

Meters and Indicators

The meters and relays shall comply the following: -

MISC type with Class – I accuracy.

Ammeters, Voltmeters, with 96 x 96 mm size flush mounting type with selector switches and back up fuses

Maximum Demand electronic meters with integration time of 30 minutes, wherever specified.

Indicating lamps shall be LED type with control MCB. All indicating lamps shall be colour coded.

Relays

Relays shall conform to IS: 3231 and shall be mounted semi flush with only flanges projecting on the front. All protective relays shall be in drawout cases with built - in test facilities. Necessary test plugs shall be the contractor. Test blocks and switches when supplied separately, shall be located immediately below each relay for testing. Auxiliary relays and timers shall be in non-drawout cases. All protective relays shall be provided with externally hand reset, positive action, and operation indicators.

Wherever the relays external to ACBs are specified, they shall comply the following features:
Inverse time characteristic with minimum time over current having 50 – 200% setting.

Instantaneous earth fault having 20-80% setting.

Direct acting trip coil to suit 5A CT secondary and with time delay dash pot or TC fuses.

Shut trip coils to have necessary DC power source with associated charger.

Discrimination of operating characteristics for trips and delay elements with up and down streams switchgear.

Testing of relays by primary injection and secondary injection.

Enclosed in dust proof flush mounting drawout type cases.

Accessible for setting and resetting from the front.

Provided with positive acting hand-reset flag indicators visible from the front.

Access to setting devices shall be possible only after the front covers are removed. Access to resetting shall be external to the case.

Auxiliary relays shall be rated to operate satisfactorily between 70% and 110% rated voltage.

Each relay shall be provided with at least two separate voltages from contacts. Make and type of relays shall be as approved by the Engineer.

Control & Selector Switches

Control and instrument switches shall be of the rotary type provided with plates engraved with switch operating positions and suitable for semi - flush mounting with only the switch front plate and operating handle projecting out. The contact assembly at the back of the switch shall be fixed and accessible from the back.

Control switches shall have momentary contacts, spring return to center with pistol grip handles. Instrument and selector switches shall have stay put contacts with oval knurled handles. Three number of contacts, their rating and their operation in each switch shall be as per the requirement of the connected circuit and the control schematics. Controls supply 240 V, 1Ø A.C. for vacuum contactor and control circuit shall be tapped after main switch but before power fuses and P. T. shall be provided for each meter feeder with necessary protection.

Annunciators

Annunciators when specified shall have audible alarm and visual display through translucent plastic window of 50mm x 65mm (minimum) size engraved with appropriate function in block letters on each windows. “Acknowledge” “Reset” and “Lamp Test” pushbuttons with alarm buzzer shall be provided common for the annunciation system in the relay compartment of switchgear.

On receipt of an alarm impulse, audible alarm shall be sounded and lamps inside appropriate window shall start flickering. On pressing of “Acknowledge” button the audible alarm shall stop sounding and lamp shall glow steady. By pressing the “Reset” button, the trouble lamp shall not reset unless the alarm condition has disappeared. Annunciator shall provide sealed in lamp indication and audible alarm shall be ready to operate for any new alarm condition immediately after audible alarm is reset for a previous alarm condition.

Cable Termination

For power cables, cable boxes with cable pot heads/sealing ends shall be provided in the switchgear in a separate compartment to suit the types, sizes of cables shown in cable schedule. Connecting leads of adequate size with terminal clamps/lugs, shall be supplied for connecting cable box terminals to switchgear power terminals.

For control cable entry to each switchgear cubicle, separate removable type gland plate shall be provided with cable through to lead these cables upto the control terminals. Gland plate and control cable through shall be adequately sized for the number of control and instrument cables emanating from the cubicles.

Space Heater & Receptacle

Each switchgear cubicle shall be provided with space heater rated for 230 V, single phase, A.C. Supply. The capacity and location of these space heater inside switchgear cubicles shall be such that temperature through out the cubicle section is maintained at least 5 deg. C above

dew point by common thermostats to prevent any moisture condensation. MCB shall be provided inside each switchgear cubicle to control the power supply to the space heaters. Each switchgear cubicle shall be provided with one, 3pin receptacle - plug with on-off switch rated for 5 Amps, 240V, 1 phase A.C. supply along with 10W lamp

Internal Wiring

Switchgear shall be supplied completely wired internally to equipment and terminals and ready for external cable connection at the terminal blocks. All wiring for controls and instruments shall be carried with 1100/660 volts grade PVC insulated copper conductor wires of minimum size 2.5 Sq.mm. Wire terminations shall be made with solder less, crimping type & copper lugs which firmly grip the conductor and insulation. Engraved core identification yellow colour plastic ferrules marked to correspond with switchgear wiring diagram shall be fitted at both end - terminations of all the cubicle internal wiring.

Spare contacts of relays, control switches, auxiliary contacts of circuit breakers etc. Shall be wired to terminal blocks. At least 10% of the terminals shall be provided as spare for future use. Terminal blocks shall be 650 V grade, rated for minimum 15 Amps and complete with insulating barriers, terminal stud, washers, nuts and lock nuts and identification marks. Each terminal shall be suitable to receive 6.0 sq.mm. conductor.

Control and space heater supplies will be provided at one point in switchgear cubicle for each line up to switchgear. In each cubicle and running the entire length of line up of switchgear, control wiring through shall be provided to carry the interconnecting wires between cubicles and the common control and space heater buses. Also inter-cubicle wiring for interlocks and controls shall be carried out through this wiring through. These wires shall be suitable terminated and tagged between transport sections.

Potential free contacts shall be provided for each breaker for ON / OFF Trip signal for IBMS system as standard.

Earthing

All vertical panels shall be connected to a copper/GI earth busbar running throughout the length of the switchboard. The minimum earth bus size shall be 50x6 mm. All doors and movable parts shall be earth educing flexible copper connections to the fixed frame of the switchboard. Provision shall be made to connect the earthing busbar to the platform earthing grid at two ends. All non-current carrying metallic parts of the mounted equipment shall be earthed. The washer used for earthing connection shall be specific type to ensure & good earthing connection.

Name Plate

Suitable engraved white on black name plates and identification labels of metal for all Switchboards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

Painting

All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Pre-treatment shall be done using 9-11 tank process. The content of the tank shall be regularly checked for concentration and ph value records of this shall be subject to inspection. After pretreatment sheet shall undergo Powder coating to achieve Uniform thickness of 70-120 microns.

Interlocks

It shall not be possible to push "in " a drawn out circuit breaker in closed condition or withdraw a circuit breaker in closed condition.

It shall be possible to operate a circuit breaker only in the defined "Full in" or "Service" and "Test" position inside the panel. It shall not be possible to operate the breaker in intermediate positions while inserting or withdrawing circuit breaker.

Tests

Inspection and shop testing for all panels as per IS Standard shall be offered to consultant/owner's representatives. The tests to be done shall include: Physical checking,

Megger/insulation resistance, (1000V Megger), H.V. test Functional tests including control and interlock functions, Automatic operation simulation etc. Any such tests required by local authorities, Electricity Boards and for complying statutory requirements.

AIR CIRCUIT BREAKER

General:

The air circuit-breakers are constructed and tested in accordance with the international IEC/EN 60947-2 standards. The breaker shall provide the class II insulation between front panel and internal power circuits to avoid an accidental contact with the live main current carrying path with the front cover open.

The circuit-breakers shall have a rated service voltage of 690 V AC and a rated insulation voltage and impulse withstand voltage 1000 V & 12 kV respectively;

The short-circuit capacity shall be $ICU=Ics=Icw=100\%$ and Icw value shall be declared for 1 sec and circuit breakers are of category B.

The mechanical life shall be at least 12000 operations and tested as per IEC 60947-2 standard requirements.

The electrical life of air circuit breaker shall be at least 8000 operations up to 2500 A & at least 5000 operations up to 4000 A and are tested in accordance with IEC 60947-2 standard requirements.

The air circuit breaker shall have operating temperature from $-25\text{ }^{\circ}\text{C}$... $+70\text{ }^{\circ}\text{C}$ and shall not have any derating up to $50\text{ }^{\circ}\text{C}$ in free air when tested as per product standard.

Construction characteristics

ACBs shall be available in the 3 & 4 pole versions in withdrawable versions and shall be capable of providing short-circuit, overload and earth fault protection through microprocessor-based unit.

The circuit breaker shall have double insulation and suitable for isolation with marking so as to guarantee maximum operator safety;

Minimum degree of protection shall be offered IP30 shall be guaranteed on the front when mounted on the switchboard

The circuit breaker cradle shall be designed and constructed to permit smooth withdrawable and insertion. The movement shall be free of jerks, easy to operate and positive.

It shall be possible to signal at least with 4 electrical contacts mounted on the circuit breaker the status of the circuit breaker or information related to the trip unit. In addition digital input shall be available to command specific actions on the breaker up to 15 auxiliary contacts.

For withdrawable breakers the positions (connected, test, isolated) of the moving part shall be clearly indicated. It shall be possible to fit the circuit breaker with

A device which permits the opening of the compartment door only when the mobile part is in racked-out position or test;

A device which permits to freeze the mobile position when the door is open

All terminals shall be changeable from horizontal to vertical position and the vice versa at site to suit the bus bar orientation if required

All Acbs, control wiring shall be accessible from the front along with all accessories and the terminal box shall offer spring clamps which helps user to make the wiring easier and safer. It shall be possible to install the electrical accessories without removing the cover shielding the command;

There shall be a provision of positive earth connection between fixed and moving portion of the ACB either through connector plug or sliding solid earth mechanism. Earthing bolts shall be provided on the cradle or body of ACB.

It shall not be possible for the breaker to be withdrawn from the cubicle when in the ON position and to achieve the same suitable mechanism shall be provided to lock the breaker in the tripped position before the breaker is isolated.

It shall not be possible for the breaker to be switched ON until it is in the fully inserted position.

It shall not possible for the circuit breaker to be plugged in unless it is in the OFF position

Key lock and padlock shall be provided in the open position of circuit breaker, racked in/ test/ racked out position.

The circuit breakers provided with special locks that allow the moving part to be inserted into the corresponding fixed part.

A safety latch shall be provided to ensure that movement of the breaker as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due to its weight.

All EDO ACB's shall have ready to close contact to ensure that ACB gets a command only when it is ready to close for applications of remote control, AMF, synchronization and auto source change over systems/

Operator safety

Operating Mechanism

The circuit breaker shall trip free with in dependent manual spring operated or motor wound spring operate mechanism with mechanical ON/OFF indication.

The circuit breaker shall provide with in-built mechanical and electrical anti-pumping mechanism.

The closing time shall be less than or equal to 40ms to ensure faster closing of the breaker.

The operating handle and mechanical trip push button shall at the front of and integral with the circuit breaker. The handle shall be placed within the breaker itself in order to have access whenever required in case of emergency

The circuit breaker shall have the following distinct and separate positions which shall be indicated on the face of the circuit breaker

Service – Both main and secondary isolating contacts closed

Test – Main isolating contacts open and secondary isolating contacts closed

Isolated – Both main and secondary isolating contacts open

The operating mechanism remains untouched/segregated and protected whenever accessories are installing inside the breaker from the front side of the breaker.

Protection Releases

The microprocessor release shall provide on the breaker for against overload (L) (40 to 100% of I_n), Selective short-circuit (0.6 to 10 times I_n), and earth (10% to 100% of I_n) fault with adjustable setting and time delays with inverse and definite time characteristics along with instantaneous short-circuit protection (1.5 to 15 times I_n) and release shall be true RMS sensing with EMC/EMI capability.

The release shall not require auxiliary power supply for the protection function or for the alarm indication.

The release shall have in-built battery that enable indication of the cause of the fault to be view for an unlimited time after tripping.

The release shall have wide touch screen display with possibility to view the maximum parameters. It shall also have bar graph with touch screen to indicate individual phase loading and identify whether all phases are evenly loaded.

Auxiliary switch shall consist of min 4NO & 4NC contacts. The total Auxiliary switch block shall have minimum six auxiliary. In case of draw out breakers two sliding contacts should be provided.

Shunt trips are used for remote control. Shunt trip coil should operate through an auxiliary switch. The operating ranges should be normally 50-110 % of the rated voltage.

Under voltage release must be energized before closing breaker. This should be provided for remote control.

Over current release shall consist of Current Transformer with slides on each current carrying path of a bi-metal relay common to all transformers. The transformer shall have a fix ratio suited to particular setting range.

Overload releases shall be thermal time lagged. Overload relay range shall be 50 % to 100 % of CT ratio. Frame shall facilitate site adjustment from 25-100% of ACB rating to match the load requirement.

RA unit - given for 0-110% operating range of SHT-ensures supply available to shunt trip from same AC source in short circuit condition.

RC unit – for up to 3secs. Time delay with U/V trip. Ideal for protection against transient voltage dips and nuisance tripping continuously adjustable time delay range of 40-500 ms with S/c trip ideal for selective interruption co-ordination of ACB's.

Contacts made of electrolytic copper of 99.9 % purity, of ACB shall be totally shrouded, for eliminating access to live parts.

Short Circuit release pick up shall be adjustable for closer protection.

Breaker shall be compact in size, for saving space in the cubicle & as far as possible shall be lightweight for easy handling.

Thermal over load and magnetic short circuit protection shall be provided.

ZSI Interlocking - Zone selective interlocking (ZSI) wiring ready. All ACBs in main LT panel shall surely be provided with zone selective interlocking which helps in reducing the thermal and dynamic stress on installation during short circuit and ground faults. The releases shall be suitable to communicate between incomer breaker and outgoing breakers enabling zone selective interlocking. The manufacturer shall supply all equipment required for ZSI viz. ZSI module, power supply and wiring connectors to implement ZSI etc. ZSI Wiring shall be done as shown below by Panel Builder.

Digital connectivity

The protection release shall be suitable for communication via Modbus TCP for incomer breaker and Modbus RTU for outgoing breaker. without using any additional external device or protocol converter. It shall be compatible for integration into SCADA system. The user should be able to integrate all LV devices and shall be able to control and monitor in the system remotely without accessing the devices manually. To guarantee the maximum safety, a redundant communication profile shall be provided. In case of switchboard monitoring, switchgear manufacturer shall able to provide cloud based compatible devices which make data enablement easy and provide asset monitoring.

Accessories

All suitable electrical accessories like coils, aux contacts, electrical interlock accessories shall be available for meeting the requirement for different purpose of logic of interlocks.

Mechanical accessories such as Key lock in open in position, locks for enabling racked in/racked out operations, Mechanical operation counter, compartment door interlock, Protection for opening and closing push button common for all frames as and when needed based on the design/project scope.

In case of switching between 2 sources or 3 sources or 2 incomes with bus coupler scenario, the manufacturer shall have cabled based interlock between the circuit breakers.

Following interlocks and features shall be incorporated for equipment protection and personnel safety:

Door interlocks to prevent opening of the door unless circuit breaker is in test or isolated position.

MCCBs shall be of micro processor based with RS 485 port or thermal magnetic as per SLD
 All MCCB's shall be universal mounting line load interchangeable and with door interlock & handle. All MCCB's on Distribution Panels shall be provided with variable setting.
 Door handles will be provided with pad locking arrangement.
 All MCCB's on Main panel shall be provided with shunt release and 2No. + 2NC Auxiliary contact block. All MCCB's shall be provided with suitable spreader links on both sides for bus bar and cable connections.
 All MCCB's shall have clear ON, OFF & TRIP positions.
 MCCB's should comply with IS 13947 part -2, IEC (6094) and IEC 60947-3 & IEC 60947 part – 2.
 The MCCB shall be suitable for universal mounting i.e. the load/line shall be interchangeable with shrouded incoming contacts.
 The MCCB shall be suitable for minimum operating voltage of 415V.
 The thermal setting shall be adjustable from 64 % to 100% of its normal current.
 The magnetic setting shall be adjustable from 3.5 to 10 In (normal current).
 Trip reset should be available Manual / Automatic.
 Isolator switches for electronic circuits to open the MCCB automatically.
 The MCCB's must house transparent label holder to ensure circuit identification.
 The MCCB's must have fully insulated safety shutters.
 Overload Zone adjustable from 0.4 to 1 in with line (For 630 amp & above MCCB)
 Short circuit Zone adjustable from 1.5 to 10 In with time.
 MCCBs encapsulated poles double roto active mechanism to lower the thermal dynamic stresses in the installation.

Miniature Circuit Breakers (MCB)

MCB's shall be of current limiting type, ISI marked confirms to IS 8828 – 1996.
 The power loss per pole shall be low and shall be in accordance with IS 8828 – 1996.
 All cable entries shall be either from bottom or top.
 MCB's shall be of C - curve characteristic & shall have quick make & break non-welding self wiping silver alloy contacts for 10 kA short circuit both on the manual & automatic operation & Should have indication on front face
 All the active, live parts of MCB's should be out of human reach, ensuring safety & confirms to IP: 55 degree of protection.
 The MCB's must house transparent label holder to ensure circuit identification.
 The MCB's must have fully insulated safety shutters.
 The MCB's shall have lockable switching lever.
 The Minimum electrical endurance shall be 20,000 operations.
 The housing of the MCB shall be mounted self-extinguishing DMC (Dough Moulding Compound).
 The short circuit Current shall be brought to zero within 4 to 5 milliseconds from the time they are established.
 All MCB's shall have a minimum short circuit Capacity of 10kA RMS.
 Single Pole / Single pole with Neutral / Double Pole / Triple pole / Four pole: MCB, ISI marked as per IS 8828 : 1996 (IEC 60898) with hammer trip and watch mechanism 15 arc plates, 10 KA capacity with nominal rating of 240/415V.

Distribution Board suitable for MCB's (MCBDB)

Horizontal / Vertical type DB's
 MCBDB suitable for 230 V / 415 V, horizontal/vertical, with door of specified ways (poles), shall be phase segregated type having residual current protection in each phase, surface / flush mounting to house incoming and outgoing MCB's, and erected on iron frame.
 DB's shall be prewired and shall be fabricated as per IS: 8623.

Suitable for flush mounting & surface mounting, with 100 A copper bus bar (or as specified) (For Horizontal type DB), neutral bar, earth bar & cable ties for cable management. In case of Vertical DB the bus bar shall be of 250 A rating (or as specified) DB's shall be of IP – 43 degree of protection with double door arrangement. All the MCB distribution boards shall be fabricated out of 18 SWG thick sheet steel duly rust inhibited through a process of degreasing, pickling, phosphating & powder coating to an approved colour over primer & shall be of the totally enclosed dust proof type suitable for wall mounting. All components shall be mounted on DIN rails & covered totally with a sheet steel cover rendering it finger-safe. Access to the internal connections shall be only through removing the cover sheet. All DB's shall be internally prewired using copper insulated high temperature PVC wires. Bus bars & neutral bar shall be fully insulated with standard colour code. Bus bar withstanding capacity shall be 10kA. DB's must have facility of reversing door without modification, pan assembly for ease of installation & convertible locking.

Residual Current Circuit Breaker (RCCB)

RCCBs shall be ISI marked as per IS 12640 (part 1) – 2000 and Confirming to IEC 61008-1. It shall work on residual current energy, having 30 milliamp sensitivity (or as specified) and shall protect against earth leakage. Tripping time shall be maximum 30 millisecond (or as specified). Breaking capacity shall be 20 kA with hammer trip and watch mechanism 15 arc plates. RCCB shall operate for rated leakage at nominal Ten volts AC, and also in both, Neutral Open & Snapping condition. RCCBs shall have trip free mechanism with quick make & break non-welding self wiping silver alloy contacts for 20 KA short circuit current both on the manual & automatic operation. Test knob facility shall be provided. All the active, live parts of RCCBs should be out of human reach, ensuring safety & confirms to IP20 degree of protection. The RCCBs must house transparent label holder to ensure circuit identification. The RCCBs must have fully insulated safety shutters. The Minimum electrical endurance shall be 20,000 operations.

Residual Current Circuit Breaker with over voltage cut Off (RCBO)

RCBO's with integral combination of RCCB+MCB, shall be ISI marked as per IS 12640 (part 1) – 2000 and Confirming to IEC 61008-1. It shall work on residual current energy, having 30 milliamp sensitivity (or as specified) with protection against earth leakage and over voltage upto 290 Volts. Tripping time shall be maximum 30 milliseconds (or as specified). Breaking capacity shall be 20 kA with hammer trip and watch mechanism 15 arc plates. RCCB shall operate for rated leakage at nominal Ten volts AC, and also in both, Neutral Open & Snapping condition. RCBO's shall have trip free mechanism with quick make & break non-welding self wiping silver alloy contacts for 10 kA short circuit both on the manual & automatic operation. Test knob facility shall be provided. All the active, live parts of RCBO's should be out of human reach, ensuring safety & confirms to IP20 degree of protection. The RCBO's must house transparent label holder to ensure circuit identification. The RCBO's must have fully insulated safety shutters. The Minimum electrical endurance shall be 20,000 operations.

Surge Protection Devices shall compliance according to IEC 61643-11:2012 and EN 61 643-11:2012 electrical installations must be protected against direct lightning and surge impulses with din rail Class I+II/Type 1+2 (10/350µs) surge arresters.

SPDs use MOV technology to allow for high lightning discharge currents, pluggable types avoid ejection of the cartridge during the discharge of the current and non-blow out technology avoids fire risks.

The SPD must provide either common protection in TNC network or common and differential mode protection in TT and TNS networks according to IEC 61643-11:2012 recommendations.

Supply, install and connect Surge Protective Devices with the following technical characteristics:

Technology : Metal oxide varistors

Impulse current wave form 10/350 µs : $I_{imp} = 25 \text{ kA}$

Maximal discharge current wave form 8/20µs : $I_{max} = 60 \text{ kA}$

Nominal discharge current wave form 8/20 µs : $I_n = 25 \text{ kA}$

Voltage protection level : $U_p \leq 1.5 \text{ kV}$

Nominal voltage : $U_N = 230 \text{ V}$

Maximum continuous operating voltage : $U_c = 255 \text{ V}$

Short circuit withstand = 50 kA

Integrated thermal disconnecter

Pluggable cartridge for an easy and quick intervention

Visual state indicator

Safety system

Auxiliary contact

No electrical consumption on visual state indicator

Back up protection with Fuse or Circuit breaker : $\leq 125 \text{ A}$;

Certified standard IEC 61643-11 and EN 61643-11.

APFC PANEL with Harmonic suppressor

APFC panels shall be indoor type, sheet steel enclosed, compartmentalized for switchgear, single front IP-42 as specified in SLD / as per type tested design compliance with IEC 61921 by OEM.

415V capacitors have to be designed to provide the desired kVAR output as per SLD.

All switchgears for Capacitors shall be suitable for contactor switching type.

Capacitors - App or MPP Type IS: 13585 part-I 1994 at 525 Volts.

Contactor - Power contactors suitable for the kVAR ratings as per IEC 61921

Series reactor – 7% Copper wound dry type with class-F insulation, isolation levels exceeding 3kV-ac/1 minute. Reactors, contactor switching, iron core suitable as per requirement.

Harmonic filter circuit - Circuit suitable to filter Harmonics up to 17th Harmonics.

CRCA sheet - CRCA sheet 14/16 SWG with 9 tank process & powder coating suitable to site condition of required colour shade.

MS angles & channels - Size as per site condition.

Bus bar - Electrolytic aluminium bus bar of capacity as mentioned in SLD.

Exhaust fan: Tube axial exhaust fan of adequate capacity.

Fabrication materials: MS Jali, Hinges, nut bolts washers, screws etc. of suitable size.

Switchgear - MCB, MCCB, ACB as mentioned in SLD..

Power factor Controller Relay - 16 steps APFCR relay (with steps as specified in the Single Line Diagram), microprocessor type within / separate built power factor meter & kVAR meter, programmable intelligent relay / dynamic correction Intelligent relay with switches time from selected 1sec.to 1200 sec. having display of system v/s, current, frequency, target

PF, THD, short fall KVAR, active power KW, KVAR, Harmonic display up to 17th order, Loss of capacitance, RS485 communication port in-built.

Testing & Inspection

During fabrication, switchgear maybe subject to inspection. Manufacturer shall furnish all necessary information.

All routine verification and acceptance tests shall be carried out as per IEC 61921, IS 16636:2017, IEC 61439 at manufacturer's work under his care and expense.

If specifically agreed heat run test may be performed at manufacturer's works. Heatrun test shall be performed at least on one incomer and two outgoing vertical panels of the ordered switchboard., shall include the following sections of the bus duct as a minimum:

Acceptance tests shall be as a general visual check shall be carried out. This shall cover measurement of overall dimension, location, number and type of devices, terminal boxes, location and connection of terminals etc.,

Manual and electrical operation of Circuit Breakers. / relays shall be checked under the worst conditions of auxiliary supply voltage.

Dry insulation test with power frequency voltage shall be conducted for the main and auxiliary circuits Insulation resistance of the main and auxiliary circuits and bus duct shall be checked before and after High voltage withstand test.

Operation check shall be carried out on selected typical feeder/s for control function /interlock as per the schematic diagrams by manually simulating fault conditions and operation of control switches/relays etc.

Relays shall be tested with secondary injection test equipment. Breaker trip unit shall be tested using specific breaker test kit.

For equipment bought from other sub-suppliers, certified test reports of tests carried out at the manufacturers works shall be submitted. Normally all routine tests as specified in the relevant standards shall be conducted by the sub-supplier at his works.

Certification

All offered equipments shall be of same design as per the type test report and shall have same constructional features and materials as per the type test reports as per IEC 61921, IS 16636:2017

Shall have been type tested and witnessed by an authority of international reput, approved by the purchaser. Type test reports shall submitte during technical bid evaluation or during inspection at FAT.

Shall have been in continuous satisfactory service for similar application.

Manufacturing Facilities

To ensure timely delivery and adherence to project schedule supplier must have following Adequate assembly area to assemble 500 switchboard cubicle in one month.

CNC press and bending machines in the same facility.

Paint shop along with permanent 9 – 11 tank pretreatment Plant.

Adequate Loading & Unloading area.

Suppliers have routine test equipment

Inhouse temperature rise test facilities.

Quality control documentation and system and processes shall be available for inspection for all the previous and running work orders.

Specific requirements

Vendor is required to make his proposal based on these documents. If there is any deviation or any alternatives must be specifically mentioned in the proposal.

TECHNICAL SPECIFICATIONS FOR FIRE PROTECTION SYSTEM

FIRE PROTECTION REQUIREMENTS

General:

Fire safety in building has become very important consideration in construction and maintenance. A normal office building has fire load in the form of large quantity of papers and furnishing. Buildings like Hospitals, Laboratories, Auditorium, Libraries, and Museum etc. require fire safety provisions by virtue of their type of occupancy and importance irrespective of their height. The design and installation of a fire fighting system is of utmost importance. The fire fighting installation on completion will have to be got cleared from the local fire fighting authorities (Fire Service) for its efficacy, suitability and usability by the Fire Service in the event of a fire.

Following types of water based fixed fire fighting installations are normally provided in buildings:

Hydrant system

Wet Riser

Down Corner

Automatic Sprinkler

The design of fire fighting system for a building shall base as per the provisions in National Building Code of India (Part IV) (Amended upto date) and also considering the provisions in the Development Control Rules of local body/authority.

The operating pressure of individual hydrant shall be between 5.5 kg/cm² to 3.5 kg/cm² and the operating pressure of the furthest level hydrant from main pump shall be minimum 3.5 kg/cm²

The pipeline will be designed in such a way that it should be possible to get discharge at any location.

Specifications:

This part deals with the specifications of following pumps.

Specification No(s)

- | | | |
|-----|----------------------------------|--------------|
| 1.1 | 1. Main Fire Pump (Single Stage) | (FF-MFP/SSC) |
| | 2. Jockey Pumps | (FF-MFP/JP) |
| | 3. Booster Pumps | (FF-MFP/BP) |

Scope:

Supplying, installing, testing, perfect aligning, proper leveling and commissioning of Fire service main/jockey/booster pump single/multi stage having specified discharge and head with required HP or similar to with minimum parameters, confirming to IS:1520 with specified size of suction and delivery pipes, coupled with squirrel cage. A.C. induction motor. The pump set shall be erected in alignment on cement concrete foundation. The Main Fire pumps should be able to deliver minimum operating pressure of 3.5kg/cm² at highest and farthest hydrant.

Material:

Pump Body:

The centrifugal pumps shall conform to IS 1520. The pump casing shall be of heavy section close grained cast iron and designed to withstand 1.5 times the working pressure. The casing shall be provided with shaft seal arrangement as well as flanges for suction and delivery pipe connections as required.

Impeller:

The impeller shall be bronze. This shall be shrouded type with machined collars. Wear rings, where fitted to the impeller, shall be of the same material as the impeller. The impeller surface shall be smooth finished for minimum frictional loss. The impeller shall be secured to the shaft by a key.

Shaft:

The shaft shall be of stainless steel EN-8/C-40 and shall be accurately machined. The shaft shall be balanced to avoid vibration at any speed within the operating range of the pump.

Shaft Sleeve:

The shaft sleeve shall be of bronze

Bearing:

The bearing shall be of stainless steel and of ball or roller type suitable for duty involved. These shall be grease lubricated and shall be provided with grease nipples /cups. The bearings shall be effectively sealed against leakage of lubricant or entry of dust or water.

Shaft seal:

The shaft seal shall be mechanical type so as to allow minimum leakage. A drip well shall be provided beneath the seal.

Motor:

Suitable HP squirrel cage induction motor, TEFC (totally enclosed fan cooled) synchronous speed 2900 RPM, suitable for operation on 415 volts, 3 phase 50 Hz AC with IP 55 protection for enclosure, horizontal foot mounted type with Class-“F” insulation, conforming to IS-325.

Body: Cast iron

Rotor Shaft: Stainless steel

Bearing: Refer specification for bearing under Pump above.

Winding: Class “F” insulated copper winding.

Base plate: Fabricated from Mild steel, foundation bolts etc.

Cement Concrete Foundation: Cement, Sand and Water, in 1:2:4 ratio.

Anti Vibrating Pads: Made from high quality rubber of specified grade and strength.

Hardware: Mild Steel

Method of Construction:

The surface of the pump foundation should be chipped with pneumatic hammer or sharp pointed chisel. The teak wood box of appropriate size shall be placed and filled with cement concrete in 1:2:4 ratio with 20 x 25 mm stone metal and required size and strength of foundation nut & bolts. The necessary curing and finishing shall be done in approved manner. The M.S. fabricated base plate of suitable size and strength should be fixed with anti-vibration rubber pads. Proper leveling and alignment shall be observed before tightening of foundation bolts. Both the pump and motor shall be placed on common base plate frame with perfect alignment, proper leveling. The pump should be connected to pipe line with M.S. flanges, caskets, nut bolt etc. and shall be checked for the leakages. The coupling guard shall be provided with nut bolts of required size. The pump shall be tested for 3.5 kg/cm² pressure at highest and farthest point of the building for minimum 2 hours. The necessary test certificate from manufacturer of pump and motor shall be produced. The motor should have efficiency more than 90% and power factor above 0.80.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.2 Pipes

Specification No. (FF-PP)

Scope:

Supplying erecting C class (Heavy Duty) galvanized iron pipe, ISI mark of specified diameter with screwed sockets, Joints & necessary G.I. fittings such as sockets, check nuts, elbows, bends, tees, reducers, enlarger, plugs, etc. including electric resistance welding (ERW), fixing

with clamps and all connected works such as painting including etch primer for aboveground pipes, excavation, drilling holes in wall, slabs, backfilling & making good the damages.

Material:

The galvanized iron pipes shall be of type and diameter as specified and shall comply with I.S.1239-1973 and 1969 for the specified type. The specified diameter of the pipes shall refer to the inside diameter of the bore pipes. The fittings of which the galvanizing has been damaged shall not be used. For the firefighting works, the C Class pipes and accessories shall be used.

Anti-Corrosive Protection on Under Ground Pipe:

Corrosion protection tape shall be wrapped on M.S. Pipes to be buried in ground. This corrosion protection tape shall comprise of coat tar/asphalt component supported on fabric of organic or organic or inorganic fiber and minimum 4mm. thick and conform to requirement of IS: 10221-Code of practice for coating and wrapping of underground mild steel pipe line. Before application of corrosion protection tape all foreign matter on pipe shall be removed with the help of wire brush and suitable primer shall be applied over the pipe thereafter. The primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Both primer and tape shall be furnished by the same manufacturer. Corrosion protection tape shall then be wound around the pipe in spiral fashion and bounded completely to the pipe. There shall be no air pocket or bubble beneath the tape. The overlaps shall be 15mm and 250mm shall be left uncoated on either end of pipe to permit installation and welding. This area shall be coated and wrapped after the pipe line is installed.

The tapes shall be wrapped in accordance with the manufacturer's recommendations. If application is done in cold weather, the surface of the pipe shall be pre-heated until it is warm to touch and traces of moisture are removed and then primer shall be applied and allowed to dry. No joint shall be located in the thickness of the walls. If the pipe is required to be cut and the end threaded, the burns of the cut end shall be filled smooth and any obstruction in the bore shall be entirely eliminated. The rate includes wastage in cutting etc. When the pipe is to be fixed to walls it shall be fixed with standard bracket, clips or holder bates keeping the pipe about 12mm clear of the wall. The pipe shall be fixed to the wall horizontally and vertically and parallel to one another when more than one pipe is laid unless unavoidable. The supporting clips etc. for the pipe shall be spaced at about two meters or so as necessary. When holes are not left during construction they shall be cut into the walls or slabs, etc. to pass the pipe through or to fix clamps, etc. after fixing of the pipes, clamps etc. these shall be neatly made good.

Pressure Testing:

All piping shall be tested to hydrostatic test pressure of at least one and a half times the maximum operating pressure, but not less than 10 kg/cm² for a period not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-charge. Piping repaired subsequent to the above pressure test shall be re-tested in the same manner. System may be tested in sections and such sections shall be securely capped. Pressure gauges may be capped off during pressure testing of the installation.

Method of Construction:

Galvanized iron pipes of specified diameter and type and galvanized iron fittings with ERW shall be erected on MS angle support with one coat of etch primer and two coats of Post Office fire red enamel paint duly tested to 1.5 times of working pressure. Excavating and back filling trenches including dewatering, cutting through walls, floor etc. and making site good. Laying, jointing, and fixing the pipe with the fittings including cutting pipes, wastage and threading the ends. At all the road crossings the pipes shall be laid lower than the crust of the road. During excavation if, any other service pipes (Water, electric, telephone, etc) come across, these shall be carefully protected and supported. Any damages done shall be made good. The pipe shall be laid on a well compacted bed in the trench. The trench after laying the pipe shall be refilled except at the joints in layers and manually rammed. Care

shall be taken to see that no earth, etc. gets inside the pipes. The filling shall be kept raised by about 5cm. for subsequent settlement. Bedding and cushioning of murum, good earth, or sand shall be provided for the pipe in case of trench through rock. The trench at the joints shall be filled similarly after satisfactory testing of the pipe. Any surplus excavated stuff shall be disposed of satisfactorily without causing nuisance.

Mode of Measurement:

Measurement shall be for one metre of each type and diameter of pipe laid complete with fittings, clamps etc. as specified. The lengths shall be measured net on the straight and bends along the center line of the pipes and fittings correct up to a cm.

1.3 Foot Valve with Strainer (-ve suction)

Scope:

Specification No. (FF-VL/FV)

Supplying and installing cast iron foot valve of specified diameter with strainer conforming to IS: 4038 with Gun metal seat (flapper), nut bolts, gasket, washers etc. for negative suction.

Material:

Housing, seat discs and disc plates: Grey cast iron

Hinge pins and disc guide: High tensile Stainless Steel bars

Strainers: a) Grey cast iron b) Galvanized steel.

Disc faces: a) Vegetable tanned leather (Min.3 mm thick), b) Leaded tin bronze, c) Natural rubber (with reinforcement of cotton canvas)

Flange jointing nature: a) Compressed fiber board or rubber minimum 1.5mm thick. The fiber board shall be impregnated with chemically neutral oil and shall have a smooth and hard surface. b) Compressed asbestos fiber.

Method of Construction:

The footwall with strainer shall be fitted with provided flange, gaskets, nut bolts to be erected at required position and fitted firmly to pipe with proper alignment so as the joints should be leak proof with shellac and other material required including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.4 Sluice valve

Specification No. (FF-VL/SV)

Scope:

Supplying and installing cast iron double flange sluice valve of specified diameter conforming to IS:780, ISI mark, having cast iron body and gun metal working parts with nut bolts, gaskets etc. and tested to 1.5 times of working pressure, in an approved manner.

Material:

Body: a) Brass b) Leaded tin bronze

Bonnet or cover: a) Leaded tin bronze b) Forged brass, c) Brass

Stuffing box, disc hinge, check nut, stem nut, disc retaining nut, gland, gland nut, gland flange, body seat rings and disc or wedge facing rings (where renewable): a) Leaded tin bronze, b) Extruded brass rod, c) Forged brass d) Brass

Stem, hinge pin and plug: a) Extruded brass b) High tensile brass, c) Forged Brass

Ball (for ball type check valves): Chromium steel.

Nut bolts: Mild steel

Hand Wheel: Cast iron

Gasket: Compressed asbestos fibre

Gland packing: a) Hemp and jute b) Asbestos

Spring: Phosphor bronze wire

Seating ring: Synthetic rubber

Method of Construction:

The double flange sluice valve shall be fitted with provided flange, gaskets, Nut bolts, etc. to be fitted to pipe, accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement;

Executed quantity shall be measured on number basis.

1.5 Butterfly valves

Specification No. (FF-VL/BFV)

Scope:

Supplying & installing cast iron double flange butterfly valve of size 75/80mm. dia confirming to IS: 13095 having cast iron body. FG 220 Nitrite rubber replaceable seat with Moulded "O" ring, C.I. powder coated disc flow control complete & instead to 1.5 times of working pressure in an approved manner.

Material:

Body: Castiron Spheroid graphite iron Carbon steel.

Disc: a) Cast iron Spheroid graphite iron carbon steel, b) Stainless steel Gun metal c)

Aluminium bronze

Shaft: a) Stainless steel b) Carbon steel Aluminium bronze Nickel copper alloy

Seating ring Seal retaining ring: a) Stainless steel, b) Gun metal aluminium bronze deposited metal suitable for duty or resilient material.

Seat: Elastomers

Shaft bearing seals: Manufacturer's standards suitable for duty.

Internal fastenings: Stainless steel

External bolting: Carbon steel

Method of Construction:

The double flange butterfly valve shall be fitted with provided flange, gaskets. Nut, bolts etc. to be fitted to pipe, accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.6 Non Return Valves

Specification No. (FF-VL/NRV)

Scope:

Supplying & installing double flange NRV of specified diameter conforming to IS: 5312 (Part-1), ISI mark, having cast iron body and gun metal working parts with nut bolts, gaskets etc. and tested to 1.5 times of working pressure in an approved manner.

Material:

Body, cover, door, bearing holder: Grey cast iron

Hinge pin, door pin and door suspension pin: Stainless steel

Body seat rings: Leaded tin bronze

Door face ring: Leaded tin bronze

Bearing bushes/Bearing block: Leaded tin bronze

Plugs for hinged pin/Air release plug: Leaded tin bronze

Bolts: Carbon steel

Nuts: Carbon steel

Gaskets: Rubber

Hinges: Grey cast iron

P N Rating and Test Pressure:

S.No.	PN Rating	Test for	Test Pressure (Gauge)MPs	Test Duration in minutes
1	PN 1.0	Body Seat 24	1.5 1.0	5 2

2.	PN 1.6	Body Seat	1.5 1.0	
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Method of Construction:

The double flange NRV shall be fitted to pie with provided flange, gaskets, and nut bolts etc. accessories with washers, spring washers, and check nuts as required with roper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.7 Hydrant Valves (Landing Valves)

Specification No. (FF-VL/HV)

Scope:

Supplying and installing gun metal single outlet, hydrant valve Morris pattern, oblique type, conforming to IS:5290, ISI mark, with G.M. blanks cap and M.S. or G.I. chain in an approved manner.

Material:

Valve Body, bonnet, stop valve, Check nut, female outlet: Bronze/Aluminium alloy or Stainless Steel as per BOQ

Hand Wheel: M.S. or C.I. (Black painted)

Spring: Made of phosphor wire

Washer, Gasket: Rubber

Blank Cap: ABS plastic

Method of Construction:

The hydrant valve shall be connected with provided flange, gaskets, Nut bolts etc. with use of required tools and plants.

The water discharge shall be not less than 900 lpm for single head and 1800 lpm for double head valves at 7kg/cm²

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.8 Priming Tank

Specification No. (FF-VL/FFA/PT)

Scope:

Supplying and Installing One piece Moulded hdp /Fibre water tank of required capacity with necessary plumbing material on provided M.S. structural supports in an approved manner.

Material:

Priming Tank: HDPE/Fiber of good quality material

Gate Valves: As per (FF-VL/GV) above

Method of Construction:

The priming tank shall be installed on provided M.S. structural supports with 20/25 mm dia. Inlet valve and 50mm dia. Outlet valve with provided necessary G.I. piping upto delivery of main fire pump before non-return valve.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.9 Hose Reel

Specification No. (FF-FFA/HRD)

Scope:

Supplying and installing wall mounting swinging Hose reel drum as per IS:884 and fitted with 19mm dia. 30 meter long high pressure polypropylene (Polyhose) pipe as per IS: 444 (type III) G.M. chrome plated nozzle and 19 mm dia. And G.M. gate valve on the inlet pipe with necessary M.S. Bracket for holding Hose reel drum fitted in position with wall fasteners, in an approved manner.

Material:

Hub and sides: Aluminium Alloy/Mild steel/Aluminium sheet.

Wall Bracket: Cast iron/Mild steel

Hose tube (20mm): Thermoplastic (Textile Reinforced) Type-2, (Nominal internal dia) as per IS-12585

Nozzle with branch Pipe: Brass as per IS 8090

Stop Valve (Ball Valve): Gun metal

Method of Construction:

The wall mounting swinging Hose reel drum with Gun Metal Nozzle, gate valve, shall be connected on M.S. bracket with provided flange, gaskets, Nut bolts etc. with use of required tools and paints. The water flow rate shall be not less than 24 LPM and the range of jet shall be not less than 6 metre.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.10. R.R.L. Hose Pipe

Specification No. (FF-FFA/RRL)

Scope:

Supplying fire fighting R.R.L. Hose pipe, conforming to IS: 636 (Type-A) 15 meter length, fitted with male and female G.M. coupling conforming to IS: 993, with ISI mark.

Material:

Hose pipe material: Rubber lined woven jacketed & 63mm in dia., the lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity and splits. The tensile shall be minimum 5.00 MPa and shall withstand pressure of 10.2kg/cm²

Coupling: Gun metal

Method of Construction:

Hose pipe of 15 metre length with male and female Gun metal coupling shall be connected as per direction.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.11 Nozzles

Specification No. (FF-FFA/NZ)

Scope:

Supplying G.M. branch pipe of 63 mm diameter with specified length fitted with 20 mm diameter detachable hexagonal nozzle confirming to IS: 903, ISI mark.

Material:

Nozzle: Chrome plated Gun metal

Method of Construction:

Gun metal hexagonal nozzle fitted with required tools and plants including necessary labour, material etc.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.12 Fire Brigade connection

Specification No. (FF-FFA/FBC)

Scope:

Supplying and installing fire brigade Header pf 150mm Φ G.I. "C" class pipe having 2 Nos. of 100mm 'T' outlet with 100mm Φ flange, fitted with 2 Nos. of G.M. fire branching inlet connection, each consisting of 2 Nos. 63mm dia. G.M. male inlet for supplying water in fire tank.

Material:

Pipe material: G.I. 'C' class (Heavy duty)

Branching inlet: Gun metal

Male inlet: Gun metal

Method of Construction:

In case under ground storage tank is not approachable by fire tenders, a 4 way 63mm diameter instantaneous male inlet connection is provided at street level and connected to UG

tank with 1 meter length of 150mm. diameter underground pipe. The whole unit shall be placed in provided MS box made of 2mm thick MS sheet with openable glass cover.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.13 Siamese connection (Fire service inlet)

Specification No. (FF-FFA/SMC)

Scope:

Supplying and installing fire brigade Header (Siamese Connection) of 150mm Φ G.I. 'C' class pipe having 2 Nos. of 100mm 'T' outlet with 100mm Φ flange, fitted with 2 Nos. of G.M. Male inlets with spring type NRV for supplying water to Wet riser.

Material:

Pipe material: G.I. 'C' class

Branching inlet: Gun metal

Male inlet: Gun metal

Non Return Valve: As per (FF-VL/NRV) above

Method of Construction:

In order to facilitate feeding of water in the system by fire service, a 4 way 63mm diameter collecting head shall be provided and connected with each riser/down corner and the ring main with non return valve and with provided butterfly/slucice valve. This should be located at a place where fire brigade tender can reach.

The whole unit is placed in provided MS box made of 2 mm thick MS sheet with open-able glass cover.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.14 Air Cushion Tank (Air Vessel)

Specification No. (FF-FFA/ACT)

Scope:

Supplying and installing Air Vessel of 300mm Φ 1.5 mtr. In height M.S. Tank fabricated from M.S. black ERW pipe, conforming to I.S.3589, having 6mm thickness, dish end at both ends, duly welded with 300mm Φ pipe, having inlet of 50mm Φ , duly fitted with 50mm Φ sluice valve and 20/25mm Φ drain with G.M. gate valve, to be installed inside pump house along with provided M.S. angle tripod.

Material:

Air Vessel: MS ERW pipe confirming to IS: 3589

Tripod: MS angle of size 75 x 75 x 5mm

Method of Construction:

300mm dia. 1.5 metre height air vessel, Gate Valve, flanges, MS angle Tripod including necessary labour, material and use of required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

Air Release Valve

Specification No. (FF-FFA/ARV)

Scope:

Supplying and erecting Air release cock of 20/25mm Φ made from G.M. with necessary G.I. coupling for fixing on top of Air vessel or on wet riser.

Material:

Air release Valve: Gun metal

Coupling: G.I.

Method of Construction:

Air release Valve with necessary GI coupling shall be fixed on top of wet riser with required labour, tools etc.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.16 Pressure Gauge

Specification No. (FF-FFA/PG)

Scope:

Supplying and installing pressure gauge of 100 mm dia or 0-14 kg/cm² fitted with 12/15mm Φ pad cock valve, G.I. nipple, elbow etc. as per requirement in an approved manner.

Material:

Pressure gauge: 100 mm diameter made from brass metal

Cock valve, elbow, pipe: G.I.

Method of Construction:

The 100 mm dia Pressure Gauge with G.I. cock valve, erected with G I pipe including accessories with required labour, tools. Etc. as directed by engineer - in -charge.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.17 Pressure Switch

Specification No. (FF-FFA/PS)

Scope:

Supplying and installing pressure switch with 12/15mm Φ isolation valve, G.I. nipple, elbow etc. in an approved manner.

Material:

Pressure switch: Brass metal

Isolation valve, elbow, Nipple: G.I.

Method of Construction:

The Pressure switch with G.I. isolation valve, and necessary G.I. fittings (elbow, Nipple) fitted with required labour, tools. Etc.

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.18 Gate Valves

Specification No. (FF-VL/GV)

Scope:

Supplying and installing Gun metal Gate valve of specified diameter having threaded ends conforming to IS: 778, ISI mark, along with G I threaded nipple.

Material:

Body: a) Brass b) Leaded tin bronze

Bonnet or cover: a) Leaded tin bronze b) Forged brass, c) Brass

Stuffing box, disc hinge, check nut, stem nut, disc retaining nut, gland, gland nut, gland flange, body seat rings and disc or wedge facing rings (where renewable): a) Leaded tin bronze, b) Extruded brass rod, c) Forged brass d) Brass

Stem, hinge pin and plug: a) Extruded brass b) High tensile brass, c) Forged Brass

Ball (for ball type check valves): Chromium steel.

Nut bolts: Mild steel

Hand Wheel: Cast iron

Gasket: Compressed asbestos fibre

Gland packing: a) Hemp and jute b) Asbestos

Spring: Phosphor bronze wire

Seating ring: Synthetic rubber

Method of Construction:

The Gate valve shall be fitted to pipe with provided flange, gaskets, Nut bolts, etc. to accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement;

Executed quantity shall be measured on number basis.

1.19 Orifice Plate

Specification No. (FF-FFA/OP)

Scope:

Supplying and erecting one no. Brass orifice plate having 6 mm thick with specified outer diameter and suitable inner diameter to reduce the pressure between 3.2 kg/cm² to 5.5 kg/cm².

Material:

Body: Stainless steel 6 mm thick

Method of Construction:

The orifice plate shall be placed before the hydrant valve

Mode of Measurement:

Executed quantity shall be measured on number basis.

1.20 Common Auto control Panel

Specification No. (FF/ACP)

- | | |
|---------------------------------------|--|
| 1) Mounting | : Floor Mounted |
| 2) Type | : Floor mounted and cubical compartmentalized type |
| 3) Panel | : 14/16 guage CRCA stove enamel |
| 4) Incoming | : 200 AMP, TPN MCCB |
| 5) Bus Bar | : TPN Aluminum bars of 200 Amps rating |
| 6) Accessories (Incoming side) | : Ammeter 0-200 Amps with ASS |
| | : Voltmeter 0-500 Volts with VSS |
| | : Phase indicating lights with control fuse |
| 7) Outgoings | 1) Star delta starter with |
| | : 160 Amps TP MCCB – 1 No. |
| | : TP contactor – 3 No. |
| | : Overload relay -1 No. |
| | 2) DOL starter -2 Nos |
| | : 63 Amps TP MCCB – 2 Nos. |
| | : TP contactor -2 Nos |
| | : Overload relay -2 Nos |
| 8) Power and control wiring | : As per IS Code of Electrical |
| 9) Accessories with each MCCB | : Single phase preventor |
| (on outgoing side) on starter feeder: | start/stop push button/auto/manual switch |
| | : ON / OFF indicator |
| 10) Earthing | : 50 x 6 mm GI Strip |
| 11) Other Accessories | : Audio visual Alarm with flasher and |
| | Hooter and for hydrant pump tripped, |
| | Jockey pump tripped, (both and standby) |
| | Hydrant mains pressure low and other |
| | off normal condition. |

1.21 Scope: (Armoured cables)

Specification No. (CB-LT/AL, CB-LT/CU)

Providing armoured cable of specified voltage level, size & specified conducting material Aluminium / Copper), including required material, hardware's for erection and erecting on

wall, ceiling, RCC slab or drawing the same through pole, pipe, laying in provided conduit, trench, ducts, trays as per approved method of construction including glands, lugs, etc.

Material:

Cables:

Cables shall be PVC for LT/MP and XLPE for HT and of required construction, colour, shall carry ISI mark, IS No. manufacturer's name, size, duly embossed/screen printed at every meter and having the total count of progressive length in meter at each mark.

Earth wire: Galvanized iron (GI) wire of appropriate gauge

Glands: As per specification

Lugs: As per specification (CB-CL/AL, CB-CL/CU)

Saddles: Saddles fabricated from GI sheet of required gauge and size depending on dia of cable either galvanized or painted with superior quality enamel black paint with necessary shearing mechanical strength, semi circular shaped with extended piece having suitable holes for fixing.

G.I. Strip: 22.g x 25mm width G.I. Strip.

Clamps : MSClamps fabricated of required length and shape, having the size of 3/6mm thick mild steel having 25/50mm width (as per size of cable), rounded ends with wooden/resin cast grip for holding the cable.

Identification tags: For identifying root, connection position GI strip with identification mark/name embossed/painted with arrangement to tie should be fix on cable or arrangement of ferrules to be done.

Hardware: Sheet Metal (GM) screws of required sizes, plugs/wooden gutties, etc.

Method of Construction:

General:

- a) Irrespective of method of construction the cable ends shall be terminated with appropriate size & type of glands with lugs duly crimped, as directed by Site engineer.
- b) Wherever the cable has to be bent, the turning radius shall be as mentioned in Table No.7/2. Grouping of cables shall be done with adequate distance between cables as mentioned. In IS so as to minimize de-rating. Cables shall be tagged / ferruled with identification name/mark at the point from where distribution starts and at ends. Bare earth wire of appropriate size shall run along with the cable. Earth wire running with the cable shall be terminated at the earth terminal nearest to cable termination.

1.21.1 Erection of Cable on Surface:

Erection shall be done as per the routes and layout finalized, in perfect level and a plumb. Before fixing the cable shall be straightened as far as possible for good aesthetics look, continuous bare GI earth wire of required gauge shall be run. Cable with G.I. wire shall be fixed by saddles firmly clipped on cable and shall be fixed to wall with minimum 50 x 8mm SM screws with plugs/wooden gutties, etc. (Distance between two supports / saddles shall be minimum 450mm). Wooden gutties shall be used wherever required (Especially for stone wall). The entries made in wall, floor slab, etc. for laying the cable shall be made good by filling and finishing with plastering the same.

1.21.2 Erection of cable/s on trays:

Cable/s shall be laid with PVC tags on GI trays. At bending point care shall be taken so that sharp edges of sheet will not damage insulation of cable.

Mode of Measurement:

Executed quantity shall be measured on the basis of running meter per run of cable.

1.22 Sprinklers

Specification No. (FF-SPR)

Scope:

Supplying and erecting 15 mm dia. NBCM Body chrome finished, pendent type quartzoid bulb sprinklers.

Material:

Chrome plated sprinkler bulb having 68 degree/78degree C fixed temperature rating UL listed.

Method of Construction:

The sprinkler bulb shall be fitted to sprinkler pipe line and tested for required pressure.

Mode of Measurement:

Executed quantity shall be measured on number basis.

2.0 INTELLIGENT ADDRESSABLE FIRE ALARM SYSTEM

2.1. BASIS OF DESIGN

An Intelligent Fire Alarm System (IFAS) shall be provided to effect total control over the life safety services required in the building. The IFAS shall be of the digital, distributed processing, real time, multi-tasking, multi-user and multi-location type.

The IFAS provided shall be able to tie-up the following Mechanical, Electrical & Low Voltage Services into an integrated system.

Air Handling Units

Lifts

The system shall be provided with Addressable and Analog fire alarm initiating, annunciating and control devices.

The addressable and intelligent system shall be such that smoke sensors, thermal/heat sensors, manual call points etc., can be identified with point address. The system shall be capable of:

Setting smoke sensor sensitivity remotely to either high sensitivity manually or on a pre-programmed sequence e.g. occupied/unoccupied period. The FAS shall be able to recognize normal and alarm conditions, below normal sensor values that reveal trouble condition, and above normal values that indicate either a pre alarm condition or the need of maintenance.

The operator shall also be able to adjust alarm and pre alarm thresholds and other parameters for the smoke sensors.

Provide a maintenance/pre-alert alarm capability at smoke sensors to prevent the detectors from indicating a false alarm due to dust, dirt etc.

Provide alarm verification of individual smoke sensors. Systems that perform alarm verification on a zone basis shall not be acceptable. Alarm verification shall be printed on the printer at the Control Station's printer to enhance system maintenance and identify possible problem areas.

Provide local numeric point address and Indicating display of device and current condition of the point. Local annunciation shall not interfere with annunciation from the Fire Control System.

Provide outputs that are addressable, i.e. outputs shall have point address. The operator shall be able to command such points manually or assign the points to Logical Point Groups (Software Zones) for pre-programmed operation.

In the event of a fire alarm, but not in a fault condition, the following action shall be performed automatically.

The System Alarm Indication on the main fire alarm control panel shall flash.

A local piezo-electric sounder in the control panel shall be sounded.

The LCD display on the main fire alarm control panel shall indicate all information associated with Fire Alarm condition including the type of alarm point and its location within the premises.

History storage equipment shall log the information associated with the Fire Alarm Control Panel condition, along with the time and date of occurrence.

All system output programs assigned via control-by-event programs that are to be activated by a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

All lifts initiated through the systems will automatically be returned to Ground Floor.

Air handling units on affected floors shall automatically be switched OFF and simultaneously respective fire dampers shall also be closed.
Shall give output for staircase pressurization fans to put on.
Shall give signal for start smoke evacuation system.

2.2. FIRE ALARM CONTROL PANEL (F A C P)

2.2.1 The distributed Intelligent Fire Alarm Control Panel (FACP) shall function as fully stand-alone panel as well as providing a communication interface to the central station. FACP shall have its own microprocessor, software and memory and should be listed under UL864 or EN54. In the event of failure of the central or communication breakdown between the central station and the FACP, the FACP shall automatically operate on stand-alone mode without sacrificing any functions.

2.2.2 The memory data for panel configuration and operation shall reside in non-volatile memory (EPROM). The card containing the memory shall have battery back-up for up to 100 hours on the board itself, if required.

2.2.3 FACP shall supervise detection circuits and shall generate an alarm in case of abnormal condition.

2.2.4 FACP shall provide general purpose inputs for monitoring such functions as low battery or AC power failure. FACP shall provide tamper protection and commandable outputs, which can operate relays or logic level devices. Output commands shall take any of, but not limited to, maintained command, Momentary Command, Alarm Follow, or Alarm latch as required. Any relay in the FACP which is intended to be removable shall be supervised against removal.

2.2.5 Smoke detectors shall be powered using the FACP-based smoke detection circuits. FACP shall provide for resetting smoke detectors, fault-isolation and sensor loop operation. It shall be possible to mix different fire devices within the same FACP to optimize field wiring.

2.2.6 FACP shall provide indication for communication with the central console and alarm/trouble conditions in each sensor loops.

2.2.7 FACP shall provide monitoring and control of one floor or area or for multiple floors or areas. FACP shall meet the following requirements to assure the integrity and reliability of the system.

The FACP shall be UL (9th Edition) listed independently as a fire alarm control panel. FACP electronics shall be contained in an enclosure made of minimum 16 gauge steel. Access to FACP switches and electronics shall be by key-lock. Usage of no other tools should be required. Visual indicators of FSP status for each zone shall be visible without opening the key-locked cover.

2.2.8 All hardware and software to allow the FACP configuration and operation to be changed shall be provided. Memory data shall be contained in non-volatile memory (EPROM).

Alarm verification with field-adjustable time from 0 to 60 seconds for individual smoke detector shall be provided. During the alarm verification, the panel shall retard the alarm until the end of the period. If the alarm is only a transient smoke alarm, the panel shall automatically reset the alarm. Only a verified alarm shall initiate the alarm sequence for the software zone (Logical Point Group) or point. Final time setting shall be as per approval of the fire authorities. When alarm verification is being performed on a smoke detector, the action shall be printed on the listed printer(s).

2.2.10 Display at the FACP shall be provided to indicate point in alarm or trouble. In such systems, means for manually scanning the points in trouble shall be provided and a trouble and alarm LED shall be used to indicate that there are points in alarm/trouble. The alarm/trouble LED shall only extinguish when all alarm/troubles are cleared from the loop.

2.2.11 It shall be possible to command test, reset and alarm silence from both the FACP and the central console.

2.2.12 FACP switches shall allow authorized personnel to accomplish the following, independent of the central console:

Initiate a general alarm condition.

Silence the local audible alarm.

It shall be possible to acknowledge (Silence the local FACP audible without silencing the alarm indicating devices (hooters).

Reset all zones (Logical Point Group) / points, after all initiating devices have returned to normal.

Perform a complete operational test of the microprocessor and memory with a visual indication with each board.

Test all panel LEDs for proper operation without causing a change in the condition of any zone (Logical Point Group)

Walk Test

2.2.13 Software zones/loops shall be circuited and protected by Fault Isolation Modules such that in the event of a zone/loop short-circuit, not more than twenty (20) devices shall be left non-functional.

2.2.14 Intelligent Smoke and thermal sensors shall be located as shown and shall report sensed levels in analog form.

2.2.15 Monitor modules shall be provided to monitor and address contact-type input devices. The monitor module shall be supervised by FACP.

2.2.16 The FACP shall process the true continuous analog signal from the sensors. In addition, the FACP shall further process all analog values for pre-alarm limits to prompt the operator for early maintenance. If a sensor value increases to an above normal level or a pre-alarm limit for an extended duration, the FACP shall communicate maintenance pre-alarm. Any time sensor value transitions beyond the secondary and higher limit value, an alarm initiation and report shall be issued.

Limits and sensor values shall be displayed, modifiable, and reported in decimal values.

The FACP shall have Drift Compensation facility to compensate for environment. The FACP shall have the ability to recalibrate Pre-alarm and Alarm limits if required, after comparing each sensor's operating characteristics with the set sensitivity. This should be carried out at least once in every 24 hours. FACP should annunciate trouble conditions when sensor(s) is beyond compensation range (excessively dirty sensor).

The FACP should be UL listed / FM approved or EN 54 approved to provide the sensitivity measurement and documentation required by NFPA72E.

2.2.17 FACP shall have real-time clock to prevent loss of time and date in case of failure of power supplies.

2.2.18 The display on FACP shall provide indication for AC Power, System Alarm, System Trouble/Security Alarm, Display Trouble and Signal Silence.

2.2.19 Minimum two different password levels will be provided to prevent unauthorized System control or programming.

2.2.20 Operator control switches for Signal Silence, lamp Test, Reset, System Test and Acknowledge shall be provided.

2.2.21 The FACP should truly field programmable. This would mean that in the event of change of any logic, detector / zone sequence alteration, the operator can initiate the FACP panel to reconfigure the above parameters.

2.2.22 The FACP should have a degraded mode of operation. In the event of the CPU failure the field devices (detectors & modules) should be able to take a decision degrade mode to ensure reliability even during failure.

2.2.23 Power supply unit of FACP shall have following characters:

The main power supply shall be 230 VAC $\pm$ 10%, 50 Hz $\pm$ 1% and shall in turn provide all necessary power of the FACP.

It shall provide a battery charger for 24 hours for standby power using dual-rate charging technique for fast battery recharge.

It shall provide a very low frequency sweep earth fault detect circuit, capable of detecting earth faults on sensitive addressable modules.

It shall provide indication for battery voltage and charging current.

2.2.24 For ease of service, all wiring terminal blocks shall be plug-in type and shall have sufficient capacity for 18 to 12 AWG wire termination. Fixed terminal blocks shall not be acceptable.

3. DETECTORS & ADDRESSABLE DEVICES

3.1 GENERAL FEATURES COMMON TO ALL DETECTORS

Compatibility: All automatic fire detectors shall be interchangeable without requiring different mounting bases or alterations in the signal panel.

Sensitivity: On average 30 mgs of burned material per cu.m. (as measured in a 1 cu.m. chamber or .5% obs/ft) shall release an alarm sensitivity which shall be adjustable according to the use of the space.

Power Consumption: Each detector shall use the minimum of power, for economic circuits, so that it shall have capacity to connect at least 240 devices & detectors (120 detectors+120 devices) in one loop.

Built-in-response indicator: Each detector shall incorporate indicator "LED" at the detector which shall blink during normal condition and light up on actuation of the detector to locate the detector which is operated. The detector shall not be affected by the failure of the response indicator lamp.

e. Maintenance: All detectors shall be fitted either with plug-in system or bayonet type connections only, from the maintenance and compatibility point of view.

Construction: The detector shall be vibration and shock proof. When disassembling for cleaning purposes, its components must not be damaged by static over voltage.

Atmospheric and Thermal Disturbance: The detector shall so designed as to be practically immune to environmental criteria such as air currents, humidity, temperature fluctuations, pressure and shall not trigger false alarm, due to the above conditions.

Continuous Operation: An alarm release shall not effect a detector's functioning. After resetting the alarm, the detector shall resume operation without any readjustment.

Adaptability to ambient conditions: Detectors shall be designed for adaptability to humid locations. No performance deterioration shall be acceptable.

ADDRESSABLE HEAT DETECTORS

Heat detectors shall be intelligent and addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel loops. Minimum to 240 intelligent detectors and devices in any combination should connect to one loop.

Heat Sensors shall be intelligent and addressable devices and shall connect to one of the C.I.E. loops.

The Sensors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the C.I.E., send data to the C.I.E. representing the analogue level the temperature at the sensor.

3.3 ADDRESSABLE SMOKE DETECTOR

The intelligent smoke detector shall be an addressable device that is designed to monitor a minimum of photoelectric technologies in a device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires.

The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).

An output connection shall be provided in the base to connect an external remote alarm LED.

3.4 ADDRESSABLE OPTICAL BEAM SMOKE DETECTOR

The intelligent addressable optical beam smoke detector shall be an addressable device that is designed to monitor a minimum obstruction to photoelectric properties in a path. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration.

The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in and then have the ability to automatically change the setting as the environment changes.

An output connection shall be provided in the base to connect an external remote alarm LED.

3.5 ADDRESSABLE MANUAL STATIONS

Addressable manual stations shall be provided to connect to the Fire Alarm Control Panel loops. The manual stations shall on command from the Control Panel send data to the panel representing the state of the manual station.

Stations shall be suitable for surface mounting as shown on the plans, or semi-flush mounting, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor unless otherwise specified by applicable building codes.

3.6 ADDRESSABLE MONITOR MODULE

The monitor module shall provide address-setting and shall also store an internal identifying code which the Fire Alarm Control Panel shall use to identify the type of device. Modules using binary jumpers are not acceptable. An indication shall be provided which shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

3.7 RESPONSE INDICATOR

In addition to built-in response indicator in each detector, secondary response indicator of LED type shall be provided outside the rooms wherever asked for by the Architect/Interior Designer, for indication of fire through detector in the room. The design & colour shall be as per Interior Designer approval.

3.8 CONTROL MODULE

The control module shall provide address-setting and shall also store an internal identifying code which the control panel shall use to identify the type of device. Modules which use binary jumpers are not acceptable. An indication shall be provided which shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.

3.9 ADDRESSABLE HOOTERS

All field hooters should preferably be addressable and software configurable. All hooters should be able to provide at least a minimum of 3 different tones, which should be user

configurable. The minimum decibel level of each hooter should be 90db. All hooters should be UL/FM listed.

3.10 OTHER DEVICES

Fault-isolation of fire zones (Logical Point Group) / circuit modules shall be provided to enable part of a fault-tolerant loop to continue operating when a short occurs in the loop.

4. FUNCTIONAL REQUIREMENTS

4.1 INTELLIGENT SYSTEM DEVICES

- a. Each device shall be assigned a unique address via electronic addressing. Address selection via rotary switch are also acceptable.
- b. Devices shall receive power and communication from the same pair of conductors.

4.2 SENSORS

All fire sensors shall mount on a common base to facilitate the changing of sensor type if building conditions change. The base shall be incompatible with conventional detectors to preclude the mounting of a non-intelligent device.

Each sensor shall contain an LED which shall blink each time the sensor is scanned by the FACP. If the FACP determines that the sensor is in alarm, the FACP shall command the sensor LED to get latched on.

Each sensor shall be capable of being tested for alarm via command from the FACP.

Each sensor shall respond to FACP scan for information with its type identification to preclude inadvertent substitution of another sensor type. The FACP shall continue operation with the detector installed but shall initiate a mismatch (trouble) condition until the proper detector is installed.

Each sensor shall respond to FACP scan for information with an analog representation of measured fire-related phenomenon (smoke density, particles of combustion, temperature). Systems which only monitor the presence of conventional detector in an addressable base shall not be acceptable.

4.3 INPUT DEVICES

The input device shall provide an addressable input for N.O. or N.C. contact devices such as manual stations etc.

The input device shall provide a supervised initiating circuit. An open-circuit fault shall annunciate at the FACP (subsequent alarms shall be reported).

The device shall contain an LED which will blink upon being scanned by the FACP. Upon determination of an alarm condition, the LED shall be latched on.

4.4 AUTOMATIC FUNCTIONS AT FACP

The alarms shall be displayed at the FACP on an LCD display. The display shall indicate the device in alarm by ID number, the appropriate alarm state, and the current time and date. It shall also display a point description of minimum 32 characters and, the respective analog value. The display shall also contain a minimum 40 characters alarm message. It shall be possible to see the number of acknowledged alarms, number of current fire alarms, number of trouble conditions and number of other miscellaneous alarms in the system. The FACP printer shall print out same information displayed on the LCD display. The LCD display and printer shall be powered directly from the panel.

4.5 MANUAL FUNCTIONS AT FACP

- i. At any given time, operator shall have the following manual capabilities at FACP by means of switches located behind a key-locked cover:

Initiate an alarm summary display on the FACP LCD display. This display shall step through all currently active alarms in the system.

Initiate a summary printout of all currently active alarms on the FACP printer.

Initiate an "all-point summary" printout on the FACP printer recording the status of each system point (initiating circuits, indicating circuits etc.)

If the alarm is ignored by an operator than the history of same to be available

ii. At any time, the operator shall have following manual capabilities at the FACP under password control; Operator privileges and ID numbers of up to four digits shall assignable by the main operator or designated alternate. Actions taken by operators shall automatically be printed on the FACP printer with operator initials, time and date.

Commands output points to different mode. Such commands shall be printed with selected descriptors ON/OFF/AUTO, OPEN/CLOSE, DAY/NIGHT etc. In addition, command shall be used to ISOLATE or DISCONNECT points. When isolated, alarms and troubles shall be received but not acted upon.

Modify system parameters. Alphanumeric key pad shall be provided for operators to modify the following parameters :

Change sensor alarm and pre-alarm threshold

Update date and time

Change point descriptors

Change action message

Disable a point

Change sensor verification time

Change password

Activate/deactivate indicating output control point

Control-by-event programs on line

Select a system status report for printing on the printer from the control station. The following real time reports shall be provided:

All point log.

Alarm summary

Trouble summary

Status summary

Sensitivity log

Disabled points log.

Isolated points log

Disconnected points log

Logical group points log

The sensitivity log shall print the analog value of each addressable analog sensor.

Select printing of a trend sensitivity log which when enabled, shall print minimum last 24 analog values for every addressable analog sensor taken at predetermined intervals. Systems which limit the number of addressable analog sensors which can be trended are not acceptable.

Select a sequence of programmed commands which can be automatically executed, in sequence, via a single command.

Perform a walk-test function such that a operation can be periodically checked out for all initiating devices on a zone. In walk test mode, all initiators on the selected zone shall automatically be isolated. As each device is placed into an alarm or trouble condition, the FACP shall print the condition and automatically reset the device. No audible signals shall be initiated from the zone to prevent disruption of building occupants. If a zone is inadvertently left in the walk-test mode, it shall automatically reset to normal after a five-minute idle time is exceeded.

4.6 SYSTEM SUPERVISION

In the normal supervisory condition, only the "POWER" ON, and "RUN" conditions, shall be illuminated. The LCD display shall display "System Normal" and the current time and date.

The LCD display shall indicate the loss of power condition and the printer shall record the same. Following restoration of normal AC power, the trouble indicators shall be automatically reset and the printer shall record the 'return to normal condition'.

The LCD display shall indicate the loop in trouble and the printer shall record same.

The LCD display shall indicate trouble and the printer shall record same. Operation of a momentary "Silence" switch shall silence the audible trouble signal but the visual "Trouble"

LEDs shall remain ON until the malfunction has been corrected and the system has reset. The FACP printer shall record this action.

4.7 PROGRAMMING OF FACP

The LCD display and printer programming shall be accomplished on site by means of QWERTY keypad inbuilt in panel which shall plug into the FACP. Modules requiring off-site programming are not acceptable. LCD shall initiate test of all addressable sensors in the system.

Programming functions shall include alarm/trouble type assignment, point descriptor assignment, alarm message assignment etc. Data file for the LCD display and a printer shall be stored in EEPROM.

5.0 FIRE CONTROL SEQUENCES

Upon activation of fire alarm devices:

FACP will display the exact address & alarm in the panel.

The Central Control Station shall switch OFF the AHUs of the affected floor fire damper and toilet exhaust fans while the AHUs on the other floors shall remain operational so as to keep the area under positive pressure. Staircase pressurization fans shall be operated through the fire alarm system.

The lifts alarms (provided by lift) shall be tied to the Fire Alarm System. The Fire Alarm System shall function as follows:

In the event of a fire, a signal will be provided by the Fire Alarm System to return all lifts to ground floor.

Should an emergency alarm originate from an individual lift, an audible alarm shall sound at Fire Control Station.

When an alarm is detected

All include annunciating devices on the floor one above and one below shall sound.

The air handling unit for the floor shall be stopped.

The air handling unit on the floor above and the floor below shall be started unless those floors are also in alarm.

If the alarm has not been acknowledge at the central panel within one minute, all audible annunciating devices on the floor above and the floor below shall sound.

If the alarm has not been acknowledged at the central panel within three minutes, all audible annunciating devices on the building shall sound.

FIRE FIGHTING (FF)

General:

Fire safety in building has become very important consideration in construction and maintenance. A normal office building has fire load in the form of large quantity of papers and furnishing. Buildings like Hospitals, Laboratories, Auditorium, Libraries, and Museum etc. require fire safety provisions by virtue of their type of occupancy and importance irrespective of their height.

The design and installation of a fire fighting system is of utmost importance.

The fire fighting installation on completion will have to be got cleared from the local fire fighting authorities (Fire Service) for its efficacy, suitability and usability by the Fire Service in the event of a fire.

Following types of water based fixed fire fighting installations are normally provided in buildings:

Wet Riser.

Down Comer.

Automatic Sprinkler. The design of fire fighting system for a building shall base as per the provisions in National Building Code of India (Part IV) (Amended up to date) and also considering the provisions in the Development Control Rules of local body/authority.

The operating pressure of individual hydrant shall be between 5.5 kg/cm² to 3.5 kg/cm² and the operating pressure of the furthest level hydrant from main pump shall be minimum 3.5 kg/cm².

The pipeline will be designed in such a way that it should be possible to get discharge at any location.

Specifications:

This part deals with the specifications of following pumps:

Specification No(s)

- | | |
|-----------------------------------|--------------|
| 1. Main Fire Pumps (Single Stage) | (FF-MFP/SSC) |
| 2. Main Fire Pumps (Multi Stage) | (FF-MFP/MS) |
| 3. Jockey Pumps | (FF- MFP/JP) |
| 4. Booster Pumps | (FF-MFP/BP) |

Scope:

Supplying, installing, testing, perfect aligning, proper levelling and commissioning of Fire service main/jockey/booster pump single/multi stage having specified discharge and head with required HP or similar to with minimum parameters, confirming to IS: 1520 with specified size of suction and delivery pipes, coupled with squirrel cage A.C. induction motor. The pump set shall be erected in alignment on cement concrete foundation. The Main Fire pumps should be able to deliver minimum operating pressure of 3.5 kg/cm² at highest and farthest hydrant.

Selection of Main Fire Pumps (Single & Multi Stage Centrifugal type) shall be as per Table No. 13.1/1, & 13.1/2 and, whereas the selection of Jockey Pump (Centrifugal type) & Booster Pump (Centrifugal type) shall be as per Table No. 13.1/3 & 13.1/4 respectively.

Material:

Pump Body:

The centrifugal pumps shall conform to IS 1520. The pump casing shall be of heavy section close grained cast iron and designed to withstand 1.5 times the

working pressure. The casing shall be provided with shaft seal arrangement as well as flanges for suction and delivery pipe connections as required.

Impeller:

The impeller shall be bronze. This shall be shrouded type with machined collars. Wear rings, where fitted to the impeller, shall be of the same material as the impeller. The impeller surface shall be smooth finished for minimum frictional loss. The impeller shall be secured to the shaft by a key.

Shaft:

The shaft shall be of stainless steel EN-8/ C – 40 and shall be accurately machined. The shaft shall be balanced to avoid vibration at any speed within the operating range of the pump.

Shaft Sleeve:

The shaft sleeve shall be of bronze.

Bearing:

The bearing shall be of stainless steel and of ball or roller type suitable for duty involved. These shall be grease lubricated and shall be provided with grease nipples /cups. The bearings shall be effectively sealed against leakage of lubricant or entry of dust or water.

Shaft seal:

The shaft seal shall be mechanical type so as to allow minimum leakage. A drip well shall be provided beneath the seal.

Motor:

Suitable HP squirrel cage induction motor, TEFC (totally enclosed fan cooled) synchronous speed 2900 RPM, suitable for operation on 415 volts, 3 phase 50 Hz. AC with IP 55 protection for enclosure, horizontal foot mounted type with Class-‘F’ insulation, conforming to IS-325.

Body: Cast iron

Rotor Shaft: Stainless steel

Bearing:Refer specification for bearing under Pump above.

Winding:Class ‘F’ insulated copper winding.

Base plate:Fabricated from Mild Steel, foundation bolts etc.

Cement Concrete Foundation: Cement, Sand, and Water, in 1:2:4 ratio.

Anti Vibrating Pads: Made from high quality rubber of specified grade and strength.

Hardware: Mild Steel

Method of Construction:

The surface of the pump foundation should be chipped with pneumatic hammer or sharp pointed chisel. The teak wood box of appropriate size shall be placed and filled with cement concrete in 1:2:4 ratio with 20 to 25 mm stone metal and required size and strength of foundation nut & bolts. The necessary curing & finishing shall be done in approved manner. The M.S. fabricated base plate of suitable size & strength should be fixed with anti-vibration rubber pads. Proper levelling and alignment shall be observed before tightening of foundation bolts. Both the pump and motor shall be placed on common base plate frame with perfect alignment, proper levelling. The pump should be connected to pipe line with M.S. flanges, gaskets, nut bolt etc and shall be checked for the leakages. The coupling guard shall be provided with nut bolts of required size. The pump shall be tested for 3.5 kg/cm² pressure at highest and farthest point of the building for minimum 2 hours. The necessary test certificate from manufacturer of pump and motor shall be produced. The motor should have efficiency more than 90% and power factor above 0.80.

Mode of Measurement:

Executed quantity shall be measured on number basis.

Table No. 13.1/1

Fire Fighting pump (Single Stage Centrifugal)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
30	2900	1400	56	80/65
50	2900	1800	76	80/65
75	2900	2400	76	100/80

Table No. 13.1/2

Table No. 13.1/3

Jockey Pump (Centrifugal type)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
15	2900	240	56	50/32
20	2900	240	105	50/32

Table No. 13.1/4

Booster Pump (Centrifugal type)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
7.5	2900	450	35	50/32
10	2900	468	40	50/32

13.6 Pipes (FF-PP)

Pipes

Specification No (FF-PP)

Scope:

Supplying erecting C class (Heavy Duty) galvanized iron pipe, ISI mark of specified diameter with screwed sockets, Joints & necessary G.I. fittings such as sockets, check nuts, elbows, bends, tees, reducers, enlarger, plugs, etc. including electric resistance welding (ERW), fixing with clamps & all connected works such as excavation, drilling holes in wall, slabs, backfilling & making good the damages.

Material:

The galvanized iron pipes shall be of type and diameter as specified and shall comply with I.S. 1239--1973 and 1969 for the specified type. The specified diameter of the pipes shall refer to the inside diameter of the bore pipes. The fittings of which the galvanizing has been damaged shall not be used. For the firefighting works, the C Class pipes and accessories shall be used.

Anti-Corrosive Protection On Under Ground Pipe:

Corrosion protection tape shall be wrapped on M.S. Pipes to be buried in ground. This corrosion protection tape shall comprise of coat tar/asphalt component supported on fabric of organic or inorganic fiber and minimum 4 mm. thick and conform to requirement of IS: 10221-Code of practice for coating and wrapping of under ground mild steel pipe line. Before application of corrosion protection tape all foreign matter on

pipe shall be removed with the help of wire brush and suitable primer shall be applied over the pipe thereafter. The primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Both primer and tape shall be furnished by the same manufacturer. Corrosion protection tape shall then be wound around the pipe in spiral fashion and bounded completely to the pipe. There shall be no air pocket or bubble beneath the tape. The overlaps shall be 15 mm. and 250 mm. shall be left uncoated on either end of pipe to permit installation and welding. This area shall be coated and wrapped after the pipe line is installed. The tapes shall be wrapped in accordance with the manufacturer's recommendations. If application is done in cold weather, the surface of the pipe shall be pre-heated until it is warm to touch and traces of moisture are removed and then primer shall be applied and allowed to dry.

No joint shall be located in the thickness of the walls.

If the pipe is required to be cut and the end threaded, the burns of the cut end shall be filled smooth and any obstruction in the bore shall be entirely eliminated. The rate includes wastage in cutting etc.

When the pipe is to be fixed to walls it shall be fixed with standard bracket, clips or holder bates keeping the pipe about 12mm clear of the wall. The pipe shall be fixed to the wall horizontally and vertically and parallel to one another when more than one pipe is laid unless unavoidable. The supporting clips, etc., for the pipe shall be spaced at about two meters or so as necessary. When holes are not left during construction they shall be cut into the walls or slabs, etc., to pass the pipe through or to fix clamps. etc., after fixing of the pipes, clamps etc., these shall be neatly made good.

Pressure Testing:

All piping shall be tested to hydrostatic test pressure of at least one and a half times the maximum operating pressure, but not less than 10 kg/cm² for a period not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-Charge. Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.

System may be tested in sections and such sections shall be securely capped.

Pressure gauges may be capped off during pressure testing of the installation.

Method of Construction:

Galvanized iron pipes of specified diameter and type and galvanized iron fittings with ERW shall be erected on MS angle support with one coat of red oxide primer and two coats of Post Office fire red enamel paint duly tested to 1.5 times of working pressure.

Excavating and back filling trenches including dewatering, cutting through walls, floor, etc., and making site good.

Laying, jointing, and fixing the pipe with the fittings including cutting pipes, wastage and threading the ends.

At all the road crossings the pipes shall be laid lower than the crust of the road.

During excavation if, any other service pipes (Water, electric, telephone, etc) come across, these shall be carefully protected and supported. Any damages done shall be made good.

The pipe shall be laid on a well compacted bed in the trench. The trench after laying the pipe shall be refilled except at the joints in layers and manually rammed. Care shall be taken to see that no earth, etc., gets inside the pipes. The filling shall be kept raised by about 5 cm. for subsequent settlement. Bedding and cushioning of murum, good earth, or sand shall be provided for the pipe in case of trench through rock. The trench at the joints shall be filled similarly after satisfactory testing of the pipe. Any surplus excavated stuff shall be disposed of satisfactorily without causing nuisance.

Mode of Measurement:

Measurement shall be for one metre of each type and diameter of pipe laid complete with fittings, clamps etc., as specified.

The lengths shall be measured net on the straight and bends along the center line of the pipes and fittings correct up to a cm.

13.7 Valves (FF-VL)

Foot Valve with Strainer (-ve suction)

Scope:

Specification No (FF- VL/FV)

Supplying and installing cast iron foot valve of specified diameter with strainer conforming to IS: 4038 with Gun metal seat (flapper), nut bolts, gasket, washers etc. for negative suction.

Material:

Housing, seat discs and disc plates: Grey cast iron

Hinge pins and disc guide: High tensile Stainless Steel bars

Strainers: a) Grey cast iron, b) Galvanized steel

Disc faces: a) Vegetable tanned leather (Min. 3 mm. thick), b) Leaded tin bronze, c) Natural rubber (with reinforcement of cotton canvas), d) Synthetic rubber (with reinforcement of cotton canvas)

Flange jointing nature: a) Compressed fibre board or rubber minimum 1.5 mm thick. The fibre board shall be impregnated with chemically neutral oil and shall have

a smooth and hard surface. b) Compressed asbestos fibre.

Method of Construction:

The footwall with strainer shall be fitted with provided flange, gaskets, nut bolts to be erected at required position and fitted firmly to pipe with proper alignment so as the joints should be leak proof with shellac and other material required including necessary labour and required tools and plants

Mode of Measurement:

Executed quantity shall be measured on number basis.

B)End line strainer (+ ve suction)

Specification No (FF- VL/ELS)

Scope:

Supplying and installing end liner strainer of specified diameter as per IS: 907, fabricated out of brass perforated sheet of 14 SWG (2.0 mm. thick) duly with brazing to flange or pipe with nut bolts, gaskets, washers etc, in position for only suction in an approved manner.

Material:

Body:Cast Iron

Strainer screen: Stainless steel/Brass screen of 1mm thick perforated sheet with 3 mm diameter holes.

Flange: Cast iron / M.S. sheet

Method of Construction:

End line strainer with strainer shall be fitted with provided flange, gaskets, nut bolts etc, and to be erected at the end of suction pipe, including labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

C) Sluice valve

Specification No (FF- VL/SV)

Scope:

Supplying and installing cast iron double flange sluice valve of specified diameter conforming to IS: 780, ISI mark, having cast iron body and gun metal working parts with nut bolts, gaskets etc. and tested to 1.5 times of working pressure, in an approved manner.

Material:

Body: a) Brass, b) Lead tin bronze

Bonnet or cover: a) Lead tin bronze, b) Forged brass, c) Brass

Stuffing box, disc hinge, check nut, stem nut, disc retaining nut, gland, gland nut, gland flange, body seat rings and disc or wedge facing rings (where renewable): a) Lead tin bronze, b) Extruded brass rod, c) Forged brass, d) Brass
Stem, hinge pin and plug: a) Extruded brass rod, b) High-tensile brass, c) Forged Brass

Ball (for ball type check valves): Chromium steel

Nut bolts: Mild steel

Hand wheel: Cast iron

Gasket: Compressed asbestos fibre

Gland packing: a) Hemp and jute, b) Asbestos

Spring: Phosphor bronze wire

Seating ring: Synthetic rubber

Method of Construction:

The double flange sluice valve shall be fitted with provided flange, gaskets, Nut bolts, etc. to be fitted to pipe, accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

D) Butterfly valves

Specification No (FF- VL/BFV)

Scope:

Supplying & installing cast iron double flange butterfly valve of size 75/80mm.dia confirming to IS: 13095 having cast iron body, FG 220 Nitrite rubber replaceable seat with Moulded 'O' ring, C.I. powder coated disc flow control complete & tested to 1.5 times of working pressure in an approved manner.

Material:

Body: Cast iron Spheroid graphite iron Carbon steel

Disc: a) Cast iron Spheroid graphite iron carbon steel, b) Stainless steel Gun metal c) Aluminum bronze

Shaft: a) Stainless steel, b) Carbon steel Aluminum bronze Nickel copper alloy

Seating ring/Seal retaining ring: a) Stainless steel, b) Gun metal aluminum bronze deposited metal suitable for duty or resilient material

Seat: Elastomers

Shaft bearing seals: Manufacturer's standards suitable for duty

Internal fastenings: Stainless steel
External bolting: Carbon steel: tensile strength 390 n/mm or MPa

Method of Construction:

The double flange butterfly valve shall be fitted with provided flange, gaskets, Nut bolts etc. to be fitted to pipe, accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

.E) Non Return Valves

Specification No (FF- VL/NRV)

Scope:

Supplying and installing double flange NRV of specified diameter conforming to IS: 5312 (Part-I), ISI mark, having cast iron body and gun metal working parts with nut bolts, gaskets, etc. and tested to 1.5 times of working pressure in an approved manner.

Material:

Body, cover, door, bearing holder: Grey cast iron
Hinge pin, door pin and door suspension pin: Stainless steel
Body seat rings: Leaded tin bronze
Door face ring: Leaded tin bronze
Bearing bushes/ Bearing block: Leaded tin bronze
Plugs for hinged pin/Air release plug: Leaded tin bronze
Bolts: Carbon steel
Nuts: Carbon steel
Gaskets: Rubber
Hinges: Grey cast iron
P N Rating and Test Pressure:

S No.	PN Rating	Test for	Test Pressure (Gauge) MPa	Test Duration in minutes
1	PN 1.0	Body	1.5	5
		Seat	1.0	2
2	PN 1.6	Body	2.4	5
		Seat	1.6	2

Method of Construction:

The double flange NRV shall be fitted to pipe with provided flange, gaskets, and Nut bolts etc, accessories with washers, spring washers, and check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

F) Gate Valves

Specification No (FF- VL/GV)

Scope:

Supplying & installing gun metal gate valve of specified diameter having threaded ends, conforming to IS: 778, ISI mark, along with G.I. threaded nipple.

Material:

Body: a) Brass, b) Lead tin bronze
 Bonnet or cover: a) Lead tin bronze, b) Forged brass, c) Brass
 Stuffing box, disc hinge, check nut, stem nut, disc retaining nut, gland, gland nut, gland flange, body seat rings and disc or wedge facing rings (where renewable): a) Lead tin bronze, b) Extruded brass rod, c) Forged brass, d) Brass
 Stem, hinge pin and plug: a) Extruded brass rod, b) High-tensile brass, c) Forged Brass
 Ball (for ball type check valves): Chromium steel
 Nut bolts: Mild steel
 Hand wheel: Cast iron
 Gasket: Compressed asbestos fibre
 Gland packing: a) Hemp and jute, b) Asbestos
 Spring: Phosphor bronze wire
 Seating ring: Synthetic rubber

Method of Construction:

The Gate Valve shall be fitted to pipe with provided flange, gaskets, and Nut bolts etc, accessories with washers, spring washers, and check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

.) Hydrant Valves (Landing Valves)

Specification No (FF- VL/HV)

Scope:

Supplying and installing gun metal single outlet hydrant valve Morris pattern, oblique type, conforming to IS:5290, ISI mark, with G.M. blanks cap and M.S. or G.I. chain in an approved manner.

Material:

Valve Body, bonnet, stop valve, Check nut, female outlet: Bronze/ Aluminium alloy or Stainless Steel

Valve spindle: Bronze/ Aluminum alloy or Stainless Steel

Hand Wheel: M.S. or C.I. (Black painted)

Spring: Made of phosphor wire.

Washer, Gasket: Rubber

Blank Cap: ABS plastic.

Method of Construction:

The hydrant valve shall be connected with provided flange, gaskets, Nut bolts etc. with use of required tools and plants.

The water discharge shall be not less than 900 lpm for single head and 1800 lpm for double head valves at 7 kg / cm²

Mode of Measurement:

Executed quantity shall be measured on number basis.

13.8 Fire Fighting Accessories (FF-FFA)

A) Priming Tank

Specification No (FF- FFA/PT)

Scope:

Supplying & Installing One piece Moulded HDP / Fibre water tank of required capacity with necessary plumbing material on provided M.S. structural supports in an approved manner.

Material:

Priming Tank: HDPE/ Fiber of good quality material

Gate Valves: As per (FF- VL/GV) above.

Method of Construction:

The Priming tank shall be installed on provided M.S. structural supports with 20/25 mm dia. inlet valve and 50 mm dia. outlet valve with provided necessary G.I. piping up to delivery of main fire pump before non-return valve.

Mode of Measurement:

Tank capacity will be measured on litre basis. (i.e. per litre)

B) Hose Reel

Specification No (FF-FFA/HRD)

Scope:

Supplying and installing wall mounting swinging Hose reel drum as per IS: 884 and fitted with 19 mm dia 22.5 meter long high pressure polypropylene (Polyhose) pipe as per IS: 444 (type III) G.M. chrome plated nozzle and 19 mm dia and G.M. gate valve on the inlet pipe with necessary M.S.

Bracket for holding Hose reel drum fitted in position with wall fasteners, in an approved manner.

Material:

Hub and sides: Aluminum Alloy/Mild steel/ Aluminum sheet

Wall Bracket: Cast iron / Mild steel.

Hose tube (20 mm): Thermoplastic (Textile Reinforced) Type-2, (Nominal internal dia) as per IS- 12585

Nozzle with branch Pipe: Brass as per IS 8090

Stop Valve (Ball Valve) : Gun metal.

Method of Construction:

shall The Wall Mounting swinging Hose reel drum with Gun Metal Nozzle, gate valve, be connected on M.S. bracket with provided flange, gaskets, Nut bolts etc. with use of required tools and plants. The water flow rate shall be not less than 24 LPM and the range of jet shall be not less than 6 metre.

Mode of Measurement:

Executed quantity shall be measured on number basis.

.C) Hose pipe for Hose reel

Specification No (FF-FFA/HOP)

Scope:

Supplying & erecting high pressure polypropylene hose pipe 20 mm. dia as per IS 444- type III & IS 446-1980 type I fabricated from polyester core braided with high tensile textile yarn suitable for erection of 19 mm Gun Metal Chrome plated nozzle.

Material:

The Hose pipe material: Polypropylene, the lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity and splits. The tensile strength shall be minimum 5.00 MPa and shall withstand for 10.2 kg/cm²

Nozzle: Chrome plated gun metal

Method of Construction:

The hose pipe shall be connected with provided couplings.

Mode of Measurement:

Executed quantity shall be measured on per meter basis.

D) Rubber Hose Pipe

Specification No (FF-FFA/RHP)

Scope:

Supplying & erecting high pressure rubber hose pipe 20 mm. Dia as per IS 446- 1978 (type I) & IS 444- 1978 (type II) fabricated lead moulded with high tensile yarn braided rubber hose pipe suitable for erection of 19 mm gun metal Chrome plated nozzle.

Material:

Hose pipe material: Rubber. The lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity, and splits. The tensile shall be minimum 5.00 MPa and shall withstand pressure of 10.2 kg/cm²

Nozzle: Chrome plated gun metal

Method of Construction:

The hose pipe shall be connected with provided couplings.

Mode of Measurement:

Executed quantity shall be measured on per meter basis.

E) Controlled Percolation Hose Pipe

Specification No (FF-FFA/CPH)

Scope:

Supplying fire fighting C P (Controlled Percolation) Hose pipe of 63 mm in diameter, conforming to IS: 8423, and 15 metre in length, fitted with male and female G.M. coupling confirming to IS: 903, ISI mark.

Material:

Hose pipe material: Synthetic cotton yarn confirming to IS 8423 and shall be made of jacket or cotton or synthetic material or their combination. It shall be tested as specified in IS and shall withstand for pressure 10.2 kgf/cm² and should not burst before a pressure of 35.7 kg/ cm² is reached.

Coupling: Gun metal confirming to IS 903

Method of Construction:

Hose pipe of 15 metre length with male and female Gun metal coupling shall be connected as per direction.

Mode of Measurement:

Executed quantity shall be measured on number basis.

F) R.R.L Hose Pipe

Specification No (FF-FFA/RRL)

Scope:

Supplying fire fighting R.R.L. Hose pipe, conforming to IS: 636 (Type-A) 15 metre length, fitted with male and female G.M. coupling confirming to IS: 903, with ISI mark.

Material:

Hose pipe material: Rubber lined woven jacketed & 63mm in dia., the lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity and splits. The tensile shall be minimum 5.00 MPa and shall withstand pressure of 10.2 kg/ cm²

Coupling: Gun metal

Method of Construction:

Hose pipe of 15 metre length with male and female Gun metal coupling shall be connected as per direction.

Mode of Measurement:

Executed quantity shall be measured on number basis

G) Canvas Hose Pipe

Specification No (FF-FFA/CHP)

Scope:

Supplying fire fighting canvas Hose pipe, conforming to IS: 4927 and 15 metre length, fitted with male and female G.M. coupling conforming to IS: 903, with ISI mark.

Material:

Hose pipe material: Canvas

Coupling: Gun metal

Method of Construction:

Canvas hose pipe 15 metre in length with male and female Gun metal coupling including necessary labour, material and use of required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis

H) Nozzles

Specification No (FF-FFA/NZ)

Scope:

Supplying G.M. branch pipe of 63 mm diameter with specified length fitted with 20 mm diameter detachable hexagonal nozzle confirming to Is: 903, ISI mark.

Material:

Nozzle: Chrome plated Gun metal

Method of Construction:

Gun metal hexagonal nozzle fitted with required tools and plants including necessary labour, material, etc.

Mode of Measurement:

Executed quantity shall be measured on number basis.

I) Fire Brigade connection

Specification No (FF-FFA/FBC)

Scope:

2 Supplying and installing fire brigade Header of 150 mm Ø, G.I. 'C' class pipe having Nos. of 100 mm 'T' outlet with 100 mm Ø flange, fitted with 2 Nos. of G.M. fire branching inlet connection, each consisting of 2 Nos. 63 mm dia. G.M. male inlet for supplying water in fire tank.

Material:

Pipe material: G.I. 'C' class (Heavy duty)

Branching Inlet: Gun metal

Male Inlet: Gun metal

Method of Construction:

In case under ground storage tank is not approachable by fire tenders, a 4 way 63 mm diameter instantaneous male inlet connection is provided at street level and connected to UG tank with 1 meter length of 150mm. diameter under ground pipe.

The whole unit shall be placed in provided MS box made of 2 mm thick MS sheet with openable glass cover.
Mode of Measurement:
Executed quantity shall be measured on number basis

J) Siamese connection (Fire service Inlet)

Specification No (FF-FFA/SMC)

Scope:

Supplying and installing fire brigade Header (Siamese Connection) of 150 mm Ø, G.I. 'C' class pipe having 2 Nos. of 100 mm 'T' outlet with 100 mm Ø flange, fitted with 2 Nos. of G.M. male inlets with spring type NRV for supplying water to Wet riser.

Material:

Pipe material: G.I. 'C' class

Branching Inlet: Gun metal

Male Inlet: Gun metal

Non Return Valve: As per (FF- VL/NRV)above.

Method of Construction:

In order to facilitate feeding of water in the system by fire service, a 4 way 63 mm diameter collecting head shall be provided and connected with each riser/down comer and the ring main with non return valveand with provided butterfly/slucice valve. This should be located at a place where fire brigade tender can reach.

The whole unit is placed in provided MS box made of 2 mm thick MS sheet with open-able glass cover.

Mode of Measurement:

Executed quantity shall be measured on number basis

K) Air Cushion Tank (Air Vessel)

Specification No (FF-FFA/ACT)

Scope:

Supplying and installing Air Vessel of 300 mm Ø 1.5 mtr. in height M.S. Tank fabricated from M.S. black ERW pipe, conforming to I.S.: 3589, having 6mm thickness, dish end at both ends, duly welded with 300 mm Ø pipe, having inlet of 100 mm Ø, duly fitted with 100 mm Ø sluice valve and 20/25 mm Ø draw in with G.M. gate valve, to be installed inside pump house along with provided M.S. angle tripod.

Material:

Air Vessel:MS ERW pipe confirming to IS 3589

Tripod:MS angle of size 75 x 75 x 5mm

Method of Construction:

300mm dia, 1.5 metre height air vessel, Gate Valve, flanges, MS angle Tripod including necessary labour, material and use of required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis

L) Air Release Valve

Specification No (FF-FFA/ARV)₂₇

Scope:

Supplying and erecting Air release cock of 20/25 mm Ø made from G.M. with necessary G.I. coupling for fixing on top of Air vessel or on wet riser.

Material:

Air release Valve: Gun metal

Coupling: G.I. Method of Construction:

Air release Valve with necessary GI Coupling shall be fixed on top of wet riser with required labour, tools, etc. Mode of Measurement:

Executed quantity shall be measured on number basis

M) Pressure Gauge

Specification No (FF-FFA/PG)

Scope:

Supplying and installing pressure gauge of 100 mm Ø. 0-300 PSI or 0-21 kg/cm² square fitted with 12/15 mm Ø. pad cock valve, and G.I. pipe, elbow etc. as per requirement in an approved manner.

Material:

Pressure Gauge: 100 mm diameter made from Brass metal.

Cock valve, elbow, and pipe: G.I

Method of Construction:

The 100 mm dia pressure gauge with G I cock valve, erected with GI Pipe including accessories, with required labour, tools, etc, as directed by the Engineer-in-charge.

Mode of Measurement:

Executed quantity shall be measured on number basis

N) Pressure Switch

Specification No (FF-FFA/PS)

Scope:

Supplying and installing pressure switch with 12/15 mm Ø isolation valve, G.I. nipple, elbow etc. in an approved manner.

Material:

Pressure switch: Brass metal

Isolation valve, elbow, Nipple: G.I

Method of Construction:

The Pressure switch with G I isolation valve, and necessary GI fittings (elbow, Nipple) fitted with required labour, tools, etc.

Mode of Measurement:

Executed quantity shall be measured on number basis

O) Orifice plate

Specification No (FF-FFA/OP)

Scope:

Supplying and erecting one no. Brass orifice plate having 6 mm. thick with specified outer diameter and suitable inner diameter to reduce the pressure between 3.2 kg/cm² to 5.5 kg/cm²

Material:

Body:Stainless steel 6 mm thick

Method of Construction:

The Orifice plate shall be placed before the hydrant valve.

Mode of Measurement:

Executed quantity shall be measured on number basis

Sprinklers

Specification No (FF-SPR)

Scope:

Supplying and erecting 15 mm (1/2") dia. NBCM Body chrome finished, pendent type quartzoid bulb sprinkler.

Material:

Chrome plated sprinkler bulb having 680 / 780C fixed temperature rating UL listed.

Method of Construction:

The sprinklers bulb shall be fitted to sprinklers pipe line and tested for required pressure.

Mode of Measurement:

Executed quantity shall be measured on number basis.

NOTES FOR HANDING OVER

Following instructions / documents shall be supplied in Triplicate (with soft copies also) during handing over of the site. The final payment against commissioning shall be released only after completion of the following activities / submission of documents.

Air Balancing of the entire system report.

As built drawings of the following.

Ducting drawing with air quantities indicated for various areas.

Plant room / equipment layout / AHU layout.

Refrigerant/Ch.water piping layout.

Electrical wiring drawing.

Electrical Panel drawing.

Only those drawing shall be submitted as per the system installed at site.

Temperature readings chart, recorded during air balancing (indoor & outdoor).

Compressor HP/LP Settings for all compressors in the equipment.

Maintenance Manual / Operation Manual.

Operating Instruction Board duly laminated.

Official Handing Over Report.

All submittal (initial test reports) for any BOQ items should be incorporated in this document.

All the above shall be handed over (spiral binding set) to the Consultant which shall be then forwarded to the Client after duly checking of the same.

15.0FormofCompletionCertificate

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

Description HP/KW Type of Starting

- (a)
- (b) Other plants:
- (c) If the work involves installation of overhead line and/or underground cable. (d) (i) Type & description of overhead line.
 - (ii) Total length and no. of spans
 - (iii) No. of street lights and its description.
- (b) (i) Total length of underground cable & its size.
 - (ii) No. of joints: End joint : Tee joint:
 - St. through joint: H. Earthing
 - i) Description of earthing electrode. ii) No. of earth electrodes.
 - iii) Size of main earth lead. III. Test results:
 - (a) Insulation resistance
 - (i) Insulation resistance of the whole system of Conductors to earth Mega ohms
 - (ii) Insulation between the phase conductor and neutral
 - Between Phase R and neutral. Mega ohms
 - Between Phase Y and neutral. Mega ohms
 - Between Phase B and neutral. Mega ohms
 - (iii) Insulation resistance between the phase conductors in case of polyphase supply.
 - Between Phase R and Phase Y Mega ohms
 - Between Phase Y and Phase B Mega ohms
 - Between Phase B and Phase R Mega ohms
 - (b) Polarity test
 - Polarity of won linked single pole branch switches. (c) Earth continuity test
 - Maximum resistance between any point in the earth continuity conductor including metal conduits and main earthing lead... . Ohms
 - d) Earth electrode resistance
 - Resistance of each earth electrode
 - (i) Ohms (ii) Ohms (iii) Ohms (iv) Ohms (e) Lighting protective system
 - Resistance of the whole of lightning protective system to earth before any bonding is effected with earth electrode and metal in/on the structure ...Ohms.

TECHNICAL SPECIFICATIONS FOR HVAC WORK

The scope of HVAC works include Design, approval from consultant, client, execution, demolition of existing HVAC systems, commissioning of the new system as per committed

approvals, and handover of both the demolished systems and the newly executed HVAC system to the client in line with requirements.

VRV/VRF SYSTEM

The Variable Refrigerant Flow (VRF / VRV) System should be air cooled, split type air conditioning system consisting of singular condensing units connected to multiple indoor units, each having the capability of individual set point control. The system should have the ability to connect each condensing unit to required indoor units of different types and capacities on one refrigerant circuit. The system is to be of the cooling type. Each Condensing unit should incorporate at least one inverter based scroll/ rotary compressor & two fixed scroll/ rotary compressors, to obtain 10% to 100% step less capacity control for enhanced Power saving. The Indoor units should be provided with Corded Remote Control as a standard accessory.

Refrigerant

The Entire Condensing unit and Evaporating unit should be Factory assembled and tested .The units should come with an initial charge of refrigerant R410A / other equivalent refrigerant. Any additional refrigerant is to be added at site.

Ambient conditions

To be capable of operating within a wide range of ambient temperatures, the Condensing units should be capable of provide cooling within an ambient range of 5 Deg. C to 43 Deg. C. D.B. The regulation in Refrigerant flow is to be achieved by inverter based scroll/rotary compressor, head pressure control (by varying fan speeds) and hot gas bypass connection.

Refrigerant Piping Distance Limits

To be capable of refrigerant piping runs up to 150m between the condensing unit and indoor units with 50m level difference without any oil traps or double risers. The Oil Equalizing line should be inside the Condensing unit, to avoid 'inverted' oil traps at site.

Condensing Units

They shall be fully weatherproofed, factory assembled and pre-wired with all necessary electronic and refrigerant controls. The casing shall be from mild steel panels coated with a baked enamel finish. Provide the condenser coil fins with a corrosion resistant finish. Larger Condensing Units shall incorporate 3 compressors in condensing units with at least one inverter scroll/rotary compressor and other two fixed speed scroll/rotary compressors. The design shall be modular type allowing for side by side installation of the condensing Units.

Fan Motor Speed Control:

The condensing unit fan motors to have at least two speed operations to maintain constant head pressure control in all ambient temperatures and modes of operation.

Outdoors units of the VRV / VRF system shall be compact air cooled type.

The compressor shall be of the high efficiency complaint scroll design with an EER of not less than 11.1 BTUH/watt (COP of not less than 3.25) at ARI rating conditions. Each compressor shall have in-built overloads, HP and LP controllers and mounted on vibration isolators.

“Coated PE Fins (with special acryl pre-treatment)” for Al fins of Condenser Coils is mandatory for increased durability to salt corrosion.

Compressors

The compressor shall be highly efficient at least one inverter based scroll/rotary compressor & two fixed scroll/rotary compressors. The compressors shall have electronic controls, capable of loading and unloading to follow the variations on cooling using the latest axial compliant sealing technology. The microprocessor panel should incorporate control for precise monitoring of status of the system.

Heat Exchanger

The heat exchanger shall be constructed from seamless copper tubes mechanically bonded to aluminum fins to form a cross fin coil. The aluminum fins shall be treated with an anti-corrosion film.

Refrigerant Circuit

The refrigerant circuit shall be complete with condensing unit with refrigeration compressors, motors, fans, condenser coils, electronic expansion valve, solenoid valves, 4 way valve, distribution headers, capillaries, filters, shut down valves, service ports, receivers and accumulators and all other components which are essential for safe and satisfactory operation.

Safety Devices

Provide the following safety devices as a part of the outdoor unit: High pressure switch, fuses, crank case heater, fusible plug, over current protector.

Oil Recovery

Equip the unit with an oil recovery system to ensure stable operation for systems with long refrigerant piping. Operate the oil recovery system after the first hour of operation and then every consecutive 4 hours of operation. Also fit high efficiency oil separators to the discharge side of the compressor together with factory fitted oil equalization system.

Selection Switches

Fit the condensing unit printed circuit board (PCB) with selection switches for the length of pipe work, emergency operation switches and service mode switches, together with LED indications for operation / fault indication.

Refrigerant Pipe work

The scope of Refrigerant Piping work shall include Supply, installation, testing and commissioning all interconnecting pipe work between the condensing unit and the Indoor units. The piping shall be refrigerant quality seamless copper tube with brazed connections and with the appropriate Distribution joints and headers. The piping should be routed at site in such a manner, that brazed joints in the Ref. Piping are kept to a minimum. During brazing, pass dry nitrogen through the pipe work. For outdoor piping, the pipes, after insulation, should be covered with Woven Glass Cloth 125 gsm finished in U/V Treated, pigmented Epoxy for Outdoor Piping, as per relevant code. All refrigerant pipes shall be insulated with elastomeric nitrile rubber of adequate thickness as per manufactures standards or ASHARE Guidelines whichever is stringent and the same shall be submitted to consultant or client for approval.

Joint Orientation

The Distribution refrigeration pipe joints and headers shall be located in an appropriate orientation to enable correct distribution of refrigerant. The Distribution Joints should be factory insulated with pre-formed sections of EPDM / Equivalent.

Cleanliness of piping

All pipe work must be kept clean and free from contamination to prevent breakdown of the system. Seal all pipe ends and keep sealed until immediately prior to making a joint.

Pressure Testing

The piping shall be vacuum dehydrated immediately after installation of pipe work and prior to sealing of insulation joints and start up of equipment & pressure tested to 3,800kPa; held for a minimum of 24 hours & checked for leaks and repaired if necessary. Following this, the pipe work to be vacuum dehydrated to (-755mmHg) and held for one to four hours depending on the pipe length.

Fixing Pipe work

Pipes shall be layed on GI cable tray of adequate size and supports shall be fixed at minimum of 2 meter centers with suitable saddling arrangement. Exposed Refrigerant pipes on the terrace shall be covered with openable GI Cable trays.

1.1.1 General

The system selected is a modular system, with number of indoors connected to centrally located outdoor units, as per detail designing given in the tender. The outdoor units for all the system shall be air cooled type and mounted on terrace of the building. Indoor units in various areas shall be as per enclosed drawings/ Bill of Quantities.

Wherever feasible in open spaces or large rooms the indoor units shall be logically split and connected to separate outdoor units.

All the VRV air conditioners shall be fully factory assembled, wired, internally piped & tested. The outdoor unit shall be pre-charged with first charge of R410a refrigerant. Additional charge shall be added as per refrigerant piping at site. All the units shall be suitable for operation with 415 V $\pm$ 10%, 50 Hz $\pm$ 3%, 3 Phase supply for outdoor units & 230 V $\pm$ 10%, 50 Hz $\pm$ 3%, 1 Phase supply for indoor units.

The VRV system shall provide stable, trouble free & safe operation, with flexibility of operating desired indoor units. The outdoor units must be capable of delivering exact capacity proportional to the number of indoor units switched on & the heat load in the air conditioned area. The proportional operation shall be achieved by varying speed of the compressor in the outdoor units.

The operation of the VRV system shall be through independent wired remote controllers/ wireless controller as specified. The entire system shall be controlled by a system controller and shall be integrated through BACNET protocol with an intelligent building management system. The system controller shall be able to control start / stop on time schedule and also provide common fault from the system. The BMS will be provided by others.

1.1.2 Outdoor Units

Outdoor units of the VRV system shall be compact air cooled type.

All the compressors of the outdoor units must be hermetically sealed scroll/Rotary type. Each module of outdoor unit must have at least 1 inverter compressor, suitable to operate at varying heat load proportional to indoor requirement.

The outdoor units shall be suitable to operate within an ambient temperature range of – 5 Deg C to 43 Deg C, in cooling mode & 20 Deg C to 15 Deg C in heating mode

The outdoor units must be suitable for up to 150 m refrigerant piping between outdoor unit & the farthest indoor units, total piping of 300 m for all the indoor units. Allowable level difference between outdoor unit & indoor units shall be 50 m in case of outdoor unit on top &

40 m in case of outdoor unit at bottom. Allowable level difference between various indoor units connected to one outdoor unit shall be up to 15 m.

Back up operation, in case of failure of one of the compressors of outdoor unit, for single module outdoor units or failure of one of the modules in case of multiple module outdoor units shall be possible. The VRV outdoor unit shall always be supplying at least 33% of back up operation, of the full load capacity.

The outdoor unit shall employ system of equal run time for all the compressors, inverter on / off type, within each outdoor unit – Single Module or Multi Module.

The outdoor units shall be suitable to operate within an ambient temperature range of – 5 Deg C to 43 Deg C, in cooling mode.

Air cooled condenser shall have Axial Flow, upward throw fan, directly coupled to fan motors with minimum IP 55 protection. The outdoor unit condenser fan shall be able to develop external static pressure up to 7.5 mm of H₂O. The outdoor unit should be with canopy at top to protect from heavy rain.

The entire operation of outdoor units shall be through independent remotes of indoor units. No separate Start/ Stop function shall be required.

Starter for the Outdoor Unit compressor shall be “Direct on Line” type. Inverter compressor of the unit shall start first & at the minimum frequency, to reduce the inrush current during starting. Specification for starter panels furnished in below electrical section.

Refrigerant control in the outdoor unit shall be through Electronic Expansion Valve. Complete refrigerant circuit, oil balancing/ equalizing circuit shall be factory assembled & tested.

Noise level of outdoor units shall not exceed 65 dB (A) at a distance of 1.5 m from the unit.

The outdoor units shall conform to Technological Guideline for Harmonic Suppression – JAE 9702-1995. High Harmonic Environmental Target Level for Power Distribution system shall be 5%.

Outdoor units shall be complete with following safety devices:

- High pressure switch
- Fan driver overload protector
- Over current relay
- Inverter Overload Protector
- Fusible Plug
- Short Circuit Protection

Unit shall be supplied with

- Installation manual
- Operation Manual
- Connection Pipes
- Clamps

Ceiling Mounted duct type units

These units shall be ceiling suspended with suitable supports to take care of operating weight of the unit, without causing any excessive vibration & noise. The cold air supplied by these units will be supplied to the area to be air conditioned, through duct system specified in the tender.

Each indoor unit must have electronic expansion valve operated by microprocessor thermostat based temperature control to deliver cooling/ heating as per the heat load of the room.

The unit casing shall be Galvanized Steel Plate.

Unit must be insulated with sound absorbing thermal insulation material,

The noise level of unit at the highest operating level shall be selected to meet the noise criteria specified for each area.

The unit must be able to develop external static pressure of 25mm (250Pa) at the specified air quantities – to match the specified supply air ducting, grills and extract grills plus 5Pa.

Unit must have Thermal Fuse for fan motor protection, in case of motor heating.

Each indoor unit shall have factory installed as standard equipment, maintenance free long-life filter and resin net with mold resistant.

The unit will be connected in series to a suitable outdoor unit & it must be possible to operate the unit independently, through corded/ cordless remote specified in the bill of quantities.

Treated Fresh Air units

These units shall be ceiling suspended with suitable supports to take care of operating weight of the unit, without causing any excessive vibration & noise. The cold air supplied by these units will be supplied to the area to be air conditioned, through duct system specified in the tender.

Each indoor unit must have electronic expansion valve operated by microprocessor thermostat based temperature control to deliver cooling/ heating as per the heat load of the room.

The unit casing shall be Galvanized Steel Plate.

Unit must be insulated with sound absorbing thermal insulation material,

The noise level of unit at the highest operating level shall be selected to meet the noise criteria specified for each area.

The unit must be able to develop external static pressure of 25mm (250Pa) at the specified air quantities – to match the specified supply air ducting, grills and extract grills plus 5Pa.

Unit must have Thermal Fuse for fan motor protection, in case of motor heating.

Each indoor unit shall have factory installed as standard equipment, maintenance free long-life filter and resin net with mold resistant.

The unit will be connected in series to a suitable outdoor unit & it must be possible to operate the unit independently, through corded/ cordless remote specified in the bill of quantities.

Hi-wall type units

Wall mounted units must be compact & stylish design that does not detract from the décor of the room.

Each indoor unit must have electronic expansion valve operated by microprocessor thermostat based temperature control to deliver cooling/ heating as per the heat load of the room.

The unit must have provision of adding drain pump kit if required & specified. The drain pump must be suitable to lift drain up to 1000 mm from the bottom of the unit.

Unit must be insulated with sound absorbing thermal insulation material,

Polystyrene/Polyethylene foam. The noise level of unit at the highest operating level shall not exceed 46 dB (A), at a vertical distance of 1.5 m from the grille of the unit.

The unit shall be supplied with Resin Net filter²⁷ with Mold Resistance. The filter shall be easy to remove, clean & re install.

The unit grille must be washable with soap solution.

It shall be possible to set minimum 5 steps of discharge angle by remote controller.

It shall be possible to fit drain pipe from either side of the unit (Left or right)

The unit will be connected in series to a suitable outdoor unit & it must be possible to operate the unit independently, through corded/ cordless remote specified in the bill of quantities. The entire system shall be controlled by a system controller and shall be integrated through BACNET protocol with an intelligent building management system if specified in bill of quantities. The system controller shall be able to control start / stop on time schedule and also provide common fault from the system. The BMS will be provided by others.

Cassette - Round Flow:

Designed for low-noise operation, these AC's ensure pleasant air conditioned environment.

They are easy to install and give you high quality cooling and healthy breathing indoor air.

Available in 1.0, 1.5, 2, 3 and 4 TR

Sleek and stylish, goes with any modern décor

Quiet and efficient air flow in 360 deg. orientation with improved temp. Distribution

The air filter has an anti-mould & antibacterial treatment that prevents the growth of mould generated from dust or moisture.

Programmable Timer

Power-saver compressor

Fuzzy logic

Integrated drain pump

Non flocking surfaces, which repel dirt& also easy to clean.

Cassette – One Way / Two Way:

Designed for low-noise operation, these AC's ensure pleasant air conditioned environment.

They are easy to install and give you high quality cooling and healthy breathing indoor air.

Available in 1.0, 1.5, 2, 3 and 4 TR

Sleek and stylish, goes with any modern décor

Quiet and efficient air flow in 360 deg. orientation with improved temp. Distribution

The air filter has an anti-mould & antibacterial treatment that prevents the growth of mould generated from dust or moisture.

Programmable Timer

Power-saver compressor

Fuzzy logic

Integrated drain pump

Non flocking surfaces, which repel dirt& also easy to clean.

1.2.1 Specification for Controls System for VRF air conditioning system:

Wired/Wireless Remote Controller:

Wired/Wireless remote controller shall be supplied as specified in the “Bill of Quantities”

The controller must have large crystal display screen, which displays complete operating status.

The digital display must allow setting of temperature with 1 Deg C interval.

Remote shall be able to individually program by timer the respective times for operation start and stop for a period of 1 week.

Remote shall have 24 hrs. Clock function.

Programming can be enabled or disabled. Provide scheduling of start / stop and temperature limit – 5 settings per day.

Remote must be equipped with thermostat sensor in the remote controller that will make possible more comfortable room temperature control

The remote shall be able to monitor room temperature & preset temperature by microcomputer & can select cool/ heat operation mode automatically.

The remote must constantly monitor malfunctions in the system & must be equipped with a “self diagnosis function” that let know by a message immediately when a malfunction occurs.

It shall be possible to wire the remote up to 500 RMT in case of wired remote controller.

Compact light receiving unit to be mounted into wall or ceiling shall be included in case of wireless remote controller if applicable.

2 FANS

2.1.1 Toilet Exhaust Fan:

All Toilet Exhaust Fans as per BOQ Specification. Fan shall installation with necessary accessories as per Manufactures guideline . Exhaust air shall carry through G.I Ducting / Pipe & Outlet of shall be 45 angle with decorative louvers & Bird screen. Fan shall be installed with necessary cabling work (interconnect with toilet lighting).

2.1.2 Performance Data

All fans shall be selected for the middle range & lowest operating noise level. Capacity ratings, power consumption, with operating points clearly indicated, shall be submitted and verified at the time of testing and commissioning of the installation.

2.1.3 Testing

Capacity of all fans shall be measured by an anemometer. Measured air flow capacities shall confirm to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current

3 AIR DISTRIBUTION SYSTEM

3.1.1 Scope

The scope of this section comprises supply fabrication, installation and testing of all sheet metal ducts, supply, and installation, testing and balancing of all grilles, registers and diffusers. All to be in accordance with these specifications and the general arrangement shown on the drawings.

3.1.2 Duct Materials

Galvanizing shall be Class VII – light coating of zinc, nominal 180gm/sq.m surface area and Lock Forming Quality prime material along with mill test certificates. In addition, if deemed necessary, samples of raw material, selected at random by owner’s site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense.

Application	Material
1) Ducting for HVAC work.	Cold rolled sheets continuous galvanized with zinc coating as per class VII - Light Coating of zinc, Nominal 180 gm/Sq. m surface area.
2) Supports & duct flanges	Mild steel structural steel sections
3) Gasket	Foamed/neoprene rubber 3.2 mm (1/8”) min.
4) Bonding/sealant	Mastic sealant

3.1.3 Gauges, Bracing by Sizes of Duct

All ducts shall be fabricated from galvanized steel of the following thickness as per IS - 655, as indicated as below:

Longer Side (mm)	Minimum Sheet Thickness(mm)		Minimum Sheet Thickness(Gauge)	
	GI	Aluminum	GI	Aluminum
750 and below	0.63	0.80	24	22
751 to 1500	0.80	1.00	22	20
1501 to 2250	1.00	1.25	20	18
2251 & above	1.25	1.60	18	16

3.1.4 Fabrication Standards & Equipments

All duct construction and installation shall be in accordance with SMACNA/ IS - 655 standards. In addition ducts shall be factory fabricated utilizing the following machines to provide the requisite quality of ducts.

A coil (Sheet metal in Roll Form) line to facilitate location of longitudinal seams at corners/folded edges only, for required duct rigidity and leakage free characteristics. No longitudinal seams permitted along any face side of the duct.

All ducts, transformation pieces and fittings to be made on CNC profile cutter for requisite accuracy of dimensions, location and dimensions of notches at the folding lines.

All edges to be machine treated using lock formers, flangers and rollers for turning up edges.

3.1.5 Duct Construction

Girth angles and companion flanges shall be mitered and welded at corners and riveted to duct sheets at 75 mm (3") centers. Flanged joints shall be made with 9.5 mm (3/8") GI bolts spaced at 100 mm (4") centers and provided with 3.2 mm (1/8") foamed/neoprene rubber gasket. All joints and seams shall be rendered air tight with mastic sealant. Longitudinal seams shall be inside groove of Pittsburgh type.

Standard elbows with a R/D ratio of not less than 1.25 shall be used as far as possible. Where space restrictions do not permit use of standard radius elbow with less R/D ratio square elbow with equally space double thickness vanes may be used. Length of tape ducts shall be at least four times the maximum size difference between the ends.

All duct lining for acoustic insulation shall be carried out as specified under sec "NOISE & VIBRATION" before the duct is installed in position.

Samples of sheet from each lot selected at random by Engineer's site representative shall be subject to approval & gotten tested for thickness and zinc coating at Contractor's expenses.

All ducts shall be fabricated and installed in workmanlike manner, generally conforming to relevant BIS Codes.

All ducts shall be fabricated and installed in workmanlike manner, conforming to relevant SMACNA/IS codes.

Ducts so identified on the Drawings shall be acoustically lined and insulated from outside as described in the section "Insulation" and as indicated in schedule of Quantities. Duct dimensions shown on drawings, are overall sheet metal dimensions inclusive of the acoustic lining where required and indicated in Schedule of quantities.

The fabricated duct dimensions should be as per approved drawings and care should be taken to ensure that all connecting sections are dimensionally matched to avoid any gaps.

Ducts shall be straight and smooth on the inside with longitudinal seams shall be airtight and at corners only which shall be either Pittsburgh or snap button as per SMACNA/IS practice, to ensure air tightness.

All exposed ducts upto 60 cm width within conditioned spaces shall have slip joints - or flanged joints. The internal ends of slip joints shall be in the direction of air flow. Ducts and accessories within ceiling spaces, visible from air conditioned areas shall be provided with two coats of mat black finish paint.

Changes in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Air-turns (vanes) shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence.

Ducts shall be fabricated as per details shown on Drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees, or angles, of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

All sheet metal connection, partitions and plenums, required to confine the flow of air to and through the filters and fans, shall be constructed of 18 gauge GSS / 16gauge aluminum, thoroughly stiffened with 25mm x 25mm x 3mm galvanized steel angle braces and fitted with all necessary inspection doors as required, to give access to all parts of the apparatus. Access doors shall be not less than 45cm x 45cm in size.

Plenums shall be shop/factory fabricated panel type and assembled at site. Fixing of galvanized angle flanges on duct pieces shall be with rivets heads inside i.e. towards GS sheet and riveting shall be done from outside.

Self adhesive Neoprene rubber / UV resistant PVC foam lining 5mm nominal thickness instead of felt, shall be used between duct flanges and between duct supports in all ducting installation.

All ducts shall be installed generally as per tender Drawings, and in strict accordance with approved shop drawings to be prepared by the Contractor.

The Contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent of these Specifications and Drawings. The work shall meet with the approval of Engineer's site representative in all its parts and details.

All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstruction in the building, whether or not the same are shown on the Drawings. Where necessary to avoid beams or other structural work plumbing or other pipes, and conduits, the ducts shall be transformed, divided or curved to one side (the required area being maintained) all as per the site requirements.

If a duct cannot be run as shown on the Drawings, the Contractor shall install the duct between the required points by any path available, in accordance with other services and as per approval of Engineer's site representative.

All duct work shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of galvanized steel rods and galvanized steel angle/channel under ducts at no greater than 2 meter centre to centre distance. All vertical duct work shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting. Galvanized steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods and angles/channels shall be hung through these cleats. Wherever use of metal insert plates is not feasible, duct support shall be through dash/anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods shall then hang through the cleats.

Ducting over furred ceiling shall be supported from the slab above, or from beams, after obtaining approval of Owner's site representative. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other Contractor's work in the building.

Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick TF quality expanded polystyrene around the duct and totally covered with fire barrier mortar for complete sealing.

All ducts shall be totally free from vibration under all conditions of operation. Whenever ductwork is connected to fans, ductable units that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve atleast 10 cm long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting ductwork rigidly held by independent supports on both sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation. Duct shall not rest on false ceiling and shall be in level from bottom. Taper pieces shall taper from top.

3.1.6 Duct Supports

Duct supports shall be as follows:

Duct perimeter (mm)	Supporting Angle/ rod	Location
Up to 1500	40 x 40 x 5 mm (1' F x 1' F) x (5/4") MS angle with 9 mm (3/8" tie rod)	At Transverse Joints
From 1500 to 2500	40 x 40 x 6 mm (1 1/2 x 1 1/2 x 1/4") MS angle with 12.5 (1/2") mm tie rod	At Transverse Joints
Over 2500	50 x 50 x 6 mm (2 x 2 x 1/4") MS angle with 15 mm (5/8") tie rod	At Transverse Joints

Additional supports should be taken wherever the engineer-in-charge instructs. The tendered has to include the price of supports in ducting rates even if he has to take the supports from purling. The supports from purling should be taken without making holes by drilling/gas cutting the purling/main frame. Additional purling if required by HVAC contractor will be in HVAC contractor's scope of works.

All duct supports, flanges, hangers shall be painted with red oxide and black enamel paint after installation.

Ducts connecting to air moving apparatus shall be through fire resistant double canvas cloth. The flexible connection shall not be less than 75 mm and not more than 200 mm

3.1.7 Dampers

Dampers shall be multi-blade type with opposed blades or parallel blades of Aluminium Aerofoil construction rotating in permanently lubricated ball/roller bearings. Blades shall be 250 mm (10") max. Width and 1200 mm (48") maximum length mounted in a 50 mm (2") channel frame. Blades shall be connected with suitable linkage for gang operation by an operating rod extending beyond the frame and insulation if any and terminating in a locking quadrant with damper position indicator. Damper larger than 1200 mm (48") in width shall be furnished in multiple sections. Dampers should be located in branch ducts to facilitate balancing of the system.

Dampers shall be manual or motorized as shown on drawings and BOQ. All actuators shall be rated for actual duty conditions. The selection of same shall be submitted by contractor for approval.

All the dampers shall be of Min.18 G GI Frame with 18 G extruded Aluminum blades.

3.1.8 Supply and Exhaust Air Terminals:

Finish of all the air diffusing equipment shall be approved by architect before installing. Supply and return air terminals shall be made of Min 20 G extruded aluminum section as mentioned in BOQ.

Supply air grilles shall be Single/double deflection type with horizontal face bars and vertical rear bars placed in a rigid marginal frame. Bars shall be shaped and paced at 18 mm (3/4") centers with swaged pivot pins positively holding the deflection setting under all conditions of velocity and pressure. All grilles shall be provided with integral opposed blade, grille face key operated dampers.

Return grilles shall have fixed face bars shaped and set at 18 mm (3/4) centers. Bars shall be set at suitable deflection for vision proof installation. The grilles shall be complete with rigid marginal frames and shall be matching with the supply grilles.

Ceiling diffusers shall be round/square/rectangular face flush type horizontal air diffusion pattern. Diffusers shall have ample margins to minimize ceiling smudge. All supply air diffusers shall be provided with face operated volume control dampers.

Linear diffusers/grilles shall be die formed, flush mounted type with single or double directional air flow. The diffuser/grille shall be in a mild steel frame with minimum 20 mm margin. All linear air diffusing equipment shall be fitted with a distribution sheet metal plenum. The ends of all linear grilles/ diffusers should be with end flanges.

Mild steel grilles and diffusers shall be fabricated out of 1.0 mm mild steel and painted with two coats of red oxide. All duct collars terminating on to a grille or diffuser shall be given two coats of black paint for a length of 300 mm from inside. Grilles and diffusers shall be selected for an aerodynamic noise power not in excess of NC 30.

3.1.9 Measurements For Ducting

Unless otherwise specified, measurements for ducting for the project shall be on the basis of centre-line measurements described herewith:

Duct Work shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the centre of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections.

Plenums shall also be measured in similar manner.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the centre line distance between the flanges of the duct section.

For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centre line.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles with double nuts for supports, rubber strip 3 mm thick between duct and support, vibration isolator suspension where specified or required, inspection chamber / access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the Specifications. These accessories shall NOT be separately measured nor paid for.

Special Items for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith:

Grilles and registers - width multiplied by height, excluding flanges. Volume control dampers shall form part of the unit rate for registers and shall not be separately accounted.

Diffusers - cross section area for air flow at discharge area, excluding flanges. Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted.

Linear diffusers - shall be measured by cross-sectional areas and shall exclude flanges for mounting of linear diffusers. The supply air plenum for linear diffusers shall be measured with ducting as described earlier.

Fire dampers - shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel. No special allowance shall be payable for extension of cross section outside the air stream.

Flexible connection - shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth.

3.1.10 Testing & Balancing

After the installation of the entire air distribution system is completed in all respects, all ducts shall be tested for air leaks by smoke tes as per standards.

The entire air distribution system shall be balanced using an anemometer. Measured air quantities at fan discharge, at various outlets and return air shall be identical to or less/excess than 5 percent in excess of those specified and quoted.

Branch duct adjustments shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any time.

Complete air balance report shall be submitted for scrutiny and approval, and four copies of the approved balance report shall be provided with completion documents.

4 INSULATION

4.1.1 Scope

The scope of this section comprises the supply and application of insulation conforming to these specifications.

4.1.2 Material Thermal Insulation

Insulation material for Duct & Pipe insulation shall be closed cell Elastomeric Nitrile Rubber. Thermal conductivity of the insulation material shall not exceed 0.038 W/moK or 0.212 BTU / (Hr-ft²-oF/inch) at an average temperature of 30oC. Density of the nitrile rubber shall be 40-60 Kg/m³. The product shall have temperature range of -40 oC to 105oC. The insulation material shall be fire rated for Class 0 as per BS 476 Part 6: 1989 for fire propagation test and for Class 1 as per BS 476 Part 7:1987 for surface spread of flame test. Water vapour permeability shall be not less than 0.024 perm inch (2.48 x 10⁻¹⁴ Kg/m.s.Pa i.e. $\mu=7000$: Water vapour diffusion resistance). The material shall have approval from the Chief Fire Officer if required. Material shall also be FM global approved.

4.2 Acoustic Insulation

Internal Insulation material for Duct insulation shall be 25mm thick 48kg/m³ fiber glass faced with RP tissue and covered with 26G perforated aluminum sheets.. Density of the nitrile rubber shall be Min 120 Kg/m³, NRC 0.6. The product shall have temperature range of

–20 oC to 85oC. The insulation material shall be fire rated for Class 0 as per BS 476 Part 6: 1989 for fire propagation test and for Class 1 as per BS 476 Part 7:1987 for surface spread of flame test. The material shall have approval from the Chief Fire Officer if required. Material shall also be FM global approved.

4.3 Under deck Insulation

The insulation material shall satisfy the following requirements: -

Material	Thickness	Density
	(mm)	(Kg/cu.m)
For Under deck Insulation on exposed Roof		
TF Quality EPS	50	16

Insulation material for under deck insulation of exposed concrete slab shall be 50mm thick TF quality Expanded Polystyrene of 16 Kg/m³ fixed to slab with 8 5/20 grade hot bitumen and mechanically fastened at suitable intervals using GI screw washer & GI diagonal wires. The insulation shall be covered with 36 G Aluminums Foil. Insulation work to be coordinated with other agencies and repair to be included by contractor as per site requirement.

Thickness of the insulation shall be as specified for the individual application. Each lot of insulation material delivered at site shall be accompanied with manufacturer's test certificate for thermal conductivity values, density, water vapor permeability and fire properties. Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for thermal conductivity and density at Contractor's cost. Adhesive used for sealing the insulation shall be non-flammable, vapor proof adhesive strictly as per manufacturer's recommendations.

4.1.2 Application of Insulation

i) Application of Duct Thermal Insulation

External thermal insulation shall be provided as follows:

The thickness of nitrile rubber shall be as shown on drawing or identified in the schedule of quantity. Following procedure shall be adhered to:

Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work. Measurement of surface dimensions shall be taken properly to cut closed cell elastomeric rubber sheets to size with sufficient allowance in dimension. Cutting of nitrile rubber sheets shall be done with adjustable blade to make 90° cut in thickness of nitrile rubber sheet. Hacksaw or blades are not acceptable tools for cutting the insulation.

Material shall be fitted under compression and no stretching of material shall be permitted. A thin film of adhesive shall be applied on the back of the insulating material sheet and then on to the metal surface. When adhesive is tack dry, insulating material sheet shall be placed in position and pressed firmly to achieve a good bond. All longitudinal and transverse joints shall be sealed by providing 6 mm thick 50 mm wide nitrile rubber tape. The adhesive shall be strictly as recommended by the manufacturer.

ii) Application of Duct Acoustic Insulation

Internal Acoustic insulation shall be provided as follows:

The thickness of fiber glass faced shall be as shown on drawing or identified in the schedule of quantity. Following procedure shall be adhered to:

Duct surfaces shall be cleaned to remove all grease, oil, dirt, etc. prior to carrying out insulation work. Measurement of surface dimensions shall be taken properly to cut fiber glass sheet with sheets to size with sufficient allowance in dimension. Cutting of fiber glass sheets shall be done with adjustable blade to make 90° cut in thickness of fiber glass sheets. Hacksaw or blades are not acceptable tools for cutting the insulation.

Material shall be fitted under compression and no stretching of material shall be permitted. Provide external thermal insulation to entire length of duct in addition to acoustic lining in accordance with the specifications. The duct sizes shall be adjusted to compensate the thickness of internal insulation.

iii) Application of Under deck Insulation on exposed Roof

Under deck insulation shall be 50mm thick TF Quality expanded polystyrene (32 Kg/m³). Under deck surface of ceiling shall be cleaned and made dirt free. Insulation panels shall be pasted on this surface with black CPRX compound. 28g wire net shall be tightened around insulation so as to avoid any kind of sagging. Ends of net shall be overlapping by at least 25mm. Overlaps shall be screwed with galvanized screws to avoid rusting.

4.4 Protective coating over Thermal Insulation

To provide mechanical strength and protection from damage all pipe / duct insulated with nitrile rubber as indicated in BOQ shall be covered with fiberglass fabric of 7 mil minimum thickness.

Insulated pipes & ducts exposed to UV rays shall be covered with fiberglass fabric. Over fabric one coat of fire proof epoxy or acrylic compound shall be applied. The coat shall be allowed to cure to non stick state. Subsequently second coat of compound shall be applied to give a tough and smooth finish to the insulated surface.

4.5 Measurement of Insulation

Duct insulation and acoustic lining shall be measured on the basis of surface area along the centre line of insulation thickness. Thus the surface area of externally thermal insulated or acoustically lined duct shall be based on the perimeter at the centre of thickness of insulation, multiplied by the centre-line length of ducting including tapered pieces, bends, tees, branches etc. as measured for bare ducting. In the case of tapering pieces, their average perimeter shall be considered.

5. Specification for Hot Dip Galvanizing Process

(for Mild Steel Used For Earthing, Cable Trays Or Junction Boxes For Electrical Installation.)

General Requirements

i) Quality of Zinc

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS:209-1992.

ii) Coating Requirement

Minimum weight of zinc coating for mild steel flats with thickness up to 6 mm in Accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square meter shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs, rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing.

DATA SHEET FOR INDOOR UNITS

Make	
Model	
Capacity@19°C WBT&27°CDBT	
Capacity chart at various indoor WBT attached?	YES/NO
Air Flow:	
Speed-1 (CFM)	
Speed-2 (CFM)	
Speed-3 (CFM)	
Ext. static available (mmWG)	
Dimensions:	
Width (mm)	
Depth (mm)	
Height (mm)	
Grill Dimensions:	
Width (mm)	
Depth (mm)	
Height (mm)	
Weight (Kg.)	
Refrigerant Piping Connections:	
Liquid (mm)-Ø ID&OD	
Gas (mm)-Ø ID&OD	
Drain Piping (mm)	
Sound Level	
Speed-1 (dB)	
Speed-2 (dB)	
Speed-3 (dB)	28

BlowerMotorRating-(KW)	
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DATA SHEET FOR INDOOR UNITS

Make	
Capacity @35°C ambient DBT, 19°C inside WBT	
Capacity @40°C ambient DBT, 17.2°C inside WBT	
Capacity rating chart at varying loads, indoor WBT And ambient DBT attached?	Yes/No
Deration chart for piping attached?	Yes/No
No. of compressors	
No. of inverter-compressors	
Capacity control range(%)	
No. of capacity control steps	
Type of Compressor	
Make & Model of Compressor	
No. of fans	
Airflow (cfm) at free discharge	
Airflow at 6mm WG static	
Dimensions:	
Width (mm)	
Depth (mm)	
Height (mm)	
Space required for maintenance on length side (mm)	
Space required for maintenance on width side (mm)	
Weight (Kg)	
Total power consumed at 100% load	
Sound level (dB) at 3m	
Refrigerant	
Refrigerant charge (Kg)	
Oil	
Oil charge (L)	
Piping connection suction (mm)	
Piping connection liquid (mm)	
Interface for connectivity to Lon works/Modbus provided?	Yes/No
Cost of interface included?	Included/indicated extra

REFRIGERANT PIPING

PARENT MATERIAL:

The parent material used for air-conditioning system refrigerant piping should be Copper tubes, pipes and fittings conforming to following specifications:

1. Material composition should be conforming to C-1220 (JIS-H-3300) or C-12200 (ASTM). It should have a minimum Copper content of 99.9% and Phosphorus content between 0.015% and 0.040%. It should have low residue (below 0.038g/sqm). The material should also be as

per the RoHS norms specified by EU; that is, Mercury, Chromium and Lead contents below 1000ppm, and Cadmium content below 100 ppm.

Physical properties of the material should conform to JIS-H-3300 or ASTM-B-68&B-75, should be tested for Tensile/elongation/hardness/grain size tests as per ASTM-B-280.

3. Dimensional tolerance should be as per JIS-H-3300 or ASTM-B-251. The tubes should be tested using non-destructive eddy current test before the final anneal, as per JIS-H-3300 or ASTM-E-243.

4. Heat treatment should be carried out in non-oxidizing atmosphere to ensure oxygen-free and Cuprous oxide-free surface.

5. Proper certificates describing composition and results of all tests carried out must be supplied with each consignment. These certificates, along with check results for dimensional and thickness accuracy are recommended to be carried out for every delivered lot, should be maintained till handing over of the project.

6. Semi hard pipes should be used for main header piping, where as soft piping should be used for piping connecting refrigerant joint with machine termination.

7. Minimum wall thickness for soft tubes should be 0.8mm for 1/4", 3/8" & 1/2" tubes, 0.99mm for 5/8" & 3/4" tubes. Minimum wall thickness for semi hard pipes should be 0.8mm for 3/8", 1/2", 5/8", 3/8" & 7/8", 0.88mm for 1", 0.99mm for 1.1/8", 1.1mm for 1.1/4" & 1.3/8", 1.32mm for 1.1/2" and 1.43 mm for 1.5/8" pipes.

8. Wall thickness for elbows and fittings should be minimum 0.2 mm more than corresponding pipe/tube size.

9. For sizes up to 3/8" pulley type benders should be used and brazed joints should be avoided as far as possible. Similarly, for pipes of size 7/8" or more, one side expanded pipes must be used and use of couplings should be minimized as it leads to increase in number of joints.

10. Elastomeric Nitrile insulation of fire class "O" should be used for insulation, having thickness of 13 mm for liquid pipes and 19 mm for suction pipes. For systems not having expansion device in outdoor units, insulation may not be carried out if so recommended by manufacturer.

PIPING DESIGN:

1. Contractor should study the tender / GFC drawings carefully, and should carry out detailed survey of site, relating the drawings with site, and understand the system design and site limitations.

2. Contractor should also collect final architectural and reflected ceiling plans from client and study the drawings for any mis-matches with the HVAC drawings received.

3. Contractor should discuss any such mis-matches and any doubts regarding system design with the consultant and get all doubts clarified.

4. Before commencement of piping work, proper shop drawings must be generated by the contractor, and same should be got approved from the consultant. The drawings must clearly indicate schematic flow diagrams for various circuits, pipe sizes, description and quantities for refrigerant joints, indoor and outdoor unit models and room / block / floor names, pipe routes, levels for horizontal pipes, details regarding insulation type and thickness and surface treatment for insulation, typical and critical sections and any other details to explain the entire piping layout to the installer.

5. Pipe sizing and routing must be carried out taking into consideration various site constraints and VRF system manufacturer's recommendations.

Care should be taken to design piping as per the manufacturer's recommendation for maximum piping total length, maximum piping length after first tapping, vertical height difference between outdoor and indoor unit set and necessary corrections should be carried out in outdoor unit capacity if required.

REFRIGERANT PIPING INSTALLATION WORK:

1. The installer must first study the shop drawings in detail with respect to the site condition and point out any fouling / alternatives to the agency prepare shop drawings and necessary revisions must be carried out in the drawings, to be approved by consultant.

The layout must be marked on the true ceiling and any civil openings required should be marked and got done from concerned agency.

3. Supports as described in BOQ / specifications should be installed, leaving adjustable free length for supports.

4. Before installation, the pipes and tubes must not be removed from their original packing. Proper storage of piping is a must to maintain the temper of the pipes/tubes. Any abrasion on ends/surface, or any ingress of dirt/dust must be avoided. Proper Polyethylene sheets should be used for covering the pipes and tubes, while wooden pellets and soft expanded Polyethylene / rubber sheets should be used as floor supports.

5. Necessary loops / slopes must be followed as recommended by VRF system manufacturer.

6. Pipes must be cut to required sizes using cutting tools recommended by VRF system manufacturer.

7. Using proper quality of brazing set, Oxygen/Acetylene and Copper brazing rods having minimum 2% Silver content.

8. During brazing, Nitrogen must be filled in the Copper piping at a mild positive pressure and must be kept bleeding out continuously, to prevent any oxidation of parent material.

9. After piping work, each circuit should be pressure tested as per the VRF system manufacturer's recommendation and as per the procedure described in the following paragraphs. A certificate mentioning the test pressure, time of first and final pressure readings, make, model, serial number, range and least count of the gauge used, along with a copy of valid calibration certificate must be maintained, duly signed by the inspecting technician, and client/PMC representative.

10. After pressure testing, insulation must be completed out as per the material, make and thickness mentioned in the approved shop drawing. The joints of insulation must be sealed by minimum 50 mm wide Aluminium adhesive tape. Care should be taken to avoid any air gaps between pipe / tube and insulation sleeves, and between two insulation sleeve joints.

11. Proper tagging must be carried out to trace the piping to respective indoor and outdoor circuits.

12. The pipes exposed to sunlight must be covered/cladded/treated to prevent damage from UV radiation and bird pecks/tampering, as mentioned in the BOQ. The claddings should be made out of 26 GA aluminium sheet or G.S.S. sheet. While cladding, care should be taken to avoid penetrating the insulation by screws. Short screw set metallic traps should be used for securing cladding sheets. Instead of cladding, glass cloth, with two coats of protective resin should be used.

13. While charging refrigerant, manufacturer's recommendations must be strictly followed, and charging must be carried out using proper charging hose, gauge manifold with calibrated gauges and electronic weigh scale. Further leak check using a gas leak

detector should be carried out. Charging must be carried out after proper evacuation of the piping. The quantity of refrigerant to be charged should be calculated by totalizing the liquid pipe volume as per the manufacturer's recommendation.

RECOMMENDATIONS FOR PRESSURE TESTING:

Refrigerant pipes carry refrigerant at pressures different from atmospheric pressure. When pressure inside pipes is more than atmospheric pressure, refrigerant may escape to the atmosphere, causing commercial loss due to loss of refrigerant, inefficient system performance or even system break down and contamination of surroundings. When pressure inside the pipes is less than atmospheric pressure, such as in case of suction pipes of some low temperature refrigeration machines, or during pump-down cycle of normal air-conditioning systems, leakages in pipes lead to ingress of air and moisture, causing severe system damage. Therefore, it is a must that the refrigerant piping is thoroughly tested for leakages.

Pressure testing for any piping must be carried out at a pressure higher than the maximum operating pressure within the system. It is recommended that the pressure recommended by manufacturer be followed very strictly. Testing at lower pressures may lead to non-detection of some small leakages, while testing at higher pressures may lead to damage to some factory manufactured components within the system.

Generally, for R-410 systems a pressure of around 600 psig is used. For R-22, commonly used pressure is 450 psig.

Nitrogen is the most common gas used for carrying out pressure testing. It has numerous advantages, some of which are listed below:

1. Nitrogen is easily available as a commercial gas packed in easy to handle cylinders.
2. Nitrogen, being the most abundant component of the atmosphere, is safe for leaking out without contaminating the atmosphere.
3. Nitrogen is less costly as compared with other gases.
4. Nitrogen is safe for handling and testing.
5. Nitrogen does not readily react with system components

Pressure gauge/s used for testing must be calibrated and a calibration certificate with traceability to a Government (National) Physical Laboratory must be documented. The gauge should be capable of measuring pressure at least 10% above the reading to be recorded.

PROCEDURE FOR CARRYING OUT PRESSURE TEST

- 1) Ensure that the piping to be tested is properly secured / supported and the openings have been sealed off as per manufacturer's recommendation.
- 2) Install pressure gauge/s at strategic location/s where it shall not be tampered with, at the same time, should be easily visible.
- 3) Install a valve and connecting tubing so that the open end of the tube reaches the cylinder outlet without moving the cylinder.
- 4) Connect the tube to the cylinder and after ensuring proper connection, crack open the cylinder valve, keeping an eye on the pressure gauge. Let the pressure rise to around 10 psig.
- 5) Check for proper sealing of all flanged / flange nut joints or valves / valve glands looking for noise of escaping Nitrogen and seal same.

- 6) Open the cylinder valve again and raise the pressure to 200 psig.
- 7) Check the pipeline for major leakages at brazed joints, elbows, valve glands, equipment end connections and pipe seams with the help of soap water. Make up the leaks by tightening nuts. If the leaks are in brazed joints, flush out Nitrogen and carry out necessary re-brazing.
- 8) Open the cylinder valve again and increase the pressure to 150 psig less than the final test pressure. Repeat leak check as above.
- 9) Open the cylinder valve again and slowly raise the pressure to the manufacturer recommended pressure. Carry out a thorough leak check.
- 10) Record the pressure and time. Let the pressure stand for 24 hours without tampering. Check the pressure again after 24 hours. If pressure has dropped; the piping should be checked very thoroughly for minor leakages. It is important to follow this 24 hours period as it gives enough time to detect minute leakages, and it removes the doubt created by thermal expansion of Nitrogen (as after exact 24 hours, ambient conditions are generally same).
- 11) In case of piping extending to lengths more than 30 m and / or having more than 20 site fabricated joints, the pressure should be recorded after 24 hours as well as after 48 hours, so that all leakages are detected and made up.
- 12) After detecting and making up any leak, the pressure testing must be carried out once again from beginning.

DOCUMENTATION RECOMMENDED FOR ENSURING PROPER QUALITY ASSURANCE:

1. Manufacturer's certificate with every Delivery Challan declaring composition of parent material
2. Signed and approved Shop drawings approved by Consultant, prior to start of work
3. Pressure test report signed by Client/PMC/Consultant representative
- False Ceiling closure checklist duly signed by Client/PMC/Consultant representative

DRAIN PIPING

All condensate drains should be routed with proper slope to nearest drain point through UPVC pipes. Pipes above false ceiling must be insulated with 9mm thick Nitrile rubber insulation. Pipes buried inside walls or below flooring must be insulated as above and further wrapped with 3mm thick tar felt/bituminous cloth.

Pipes above false ceiling must be supported at every 1m distance and must not be allowed to have sags. In the event of more than one drains being connected to same pipe, "U" traps should be used between indoor machine and common drain header.

Drain piping must be hydro-tested with the help of colored water held in pipes for 24 hours at a pressure of 1 Kg/sqcm. After testing, the open ends should be properly plugged with removable plugs and a certificate of drain pipe testing and plugging should be submitted prior to closing false ceiling/closing shaft/making up wall or partition chasing.

INSULATION

The scope of this section comprises the supply and application of insulation conforming to these specifications.

Insulation material be closed cell Elastomeric Nitrile Rubber or Thermal conductivity of the insulation material shall not exceed 0.038W/moK or 0.212BTU/(Hr-ft²-oF/inch) at an average temperature of 30oC. Density of the nitrile rubber shall be 40-60Kg/m³. The product shall have temperature range of -40oC to 105oC. The insulation material shall be fire rated for Class O as per BS476Part6:1989 for fire propagation test and for Class I as per BS 476Part7, 1987 for surface spread of flame test. Water vapour permeability shall be not less than 0.024 per m inch (2.48x10⁻¹⁴ Kg/m.s.Pa.e.μ=7000:Water vapour diffusion resistance). The material shall have approval from the Chief Fire Officer. Material shall also be FM global approved.

Thickness of the insulation shall be as specified for the individual application in the BOQ. Each lot of insulation material delivered at site shall be accompanied with manufacturer's test certificate for thermal conductivity values, density, water vapor permeability and fire properties. Samples of insulation material from each lot delivered at site may be selected by Owner's site representative and gotten tested for thermal conductivity and density at Contractor's cost. Adhesive used for sealing the insulation shall be non-flammable, vapor proof adhesive strictly as per manufacturer's recommendations.

All refrigerant and condensate drain piping shall be insulated in the manner specified herein. Before applying insulation, all pipes shall be brushed and cleaned. All MS pipes shall be provided with a coat of zinc chromate primer.

Insulating material in tube form shall be sleeved on the pipes. On piping, slit opened tube from insulating material shall be placed over the pipe and adhesive shall be applied as suggested by the manufacturer. Adhesive must be allowed to tack dry and then press surface firmly to gether starting from buttend and working towards centre. Wherever flat sheets shall be used it shall be cut out in correct dimension using correct tools. Scissors or Hacksaw-blade shall not be allowed. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations. All longitudinal and transverse joints shall be sealed by providing 6mm thick, 50mm wide nitrile rubber tape. The adhesive shall be strictly as recommended by the manufacturer. The insulation shall be continuous over the entire run of piping, fittings and valves. All valves, fittings, joints, strainers etc. in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above. Valves bonnet, yoke and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

Manufacturer's installation manual shall be submitted and followed for full compliance. All insulation work shall be carried out by skilled workmen specially trained in this kind of work. All insulated pipes shall be labeled (S.R. or R.R.) and provided with 300mm wide band of paint along circumference at every 1200mm for colour coding. Direction of fluid shall also be marked. Un-insulated MS pipes shall be painted throughout and direction of fluid marked. All painting shall be as per relevant BIS codes.

PROTECTIVE COATING OVER NITRILE RUBBER INSULATION (DUCTING & PIPING)

To provide mechanical strength and protection from damage all pipe/duct insulated with nitrile rubber as indicated in BOQ shall be covered with fibre glass fabric of 7 mil minimum thickness, this fabric shall be factory laminated with the nitrile rubber insulation & the fabric to be black in color.

Insulated pipes & duct exposed to UV rays shall be covered with fibre glass fabric. Over fabric one coat of fire proof epoxy or acrylic compound shall be applied. The coat shall be allowed to cure to non stick state. Subsequently second coat of compound shall be applied to give a tough and smooth finish to the insulated surface.

INSULATION-UNDERDECK

MATERIAL

Insulation material shall be Closed Cell Elastomeric Nitrile Rubber

Thermal conductivity of elastomeric nitrile rubber shall not exceed 0.035 W/(m.K) at an average temperature of 0°C

The insulation shall have fire performance such that it passes Class 1 as per BS476 Part 7 for surface spread of flame as per BS 476 and also pass Fire Propagation requirement as per BS476 Part 6 to meet the Class 'O' Fire category as per 1991 Building Regulations (England & Wales) and the Building Standards (Scotland) Regulations 1990

Moisture Diffusion Resistance Factor or 'μ' value shall be minimum 7,000.

Thickness of the insulation shall be as specified for the individual application

All chilled water, refrigerant and condensate drain pipe shall be insulated in the manner specified herein. An air gap of 100 mm shall be present between adjacent insulated surfaces carrying chilled water or refrigerant and also between the insulated surface and the wall to allow natural ventilation without affecting its external surface coefficient of heat transfer.

Before applying insulation, all pipes shall be brushed and cleaned. All Pipe surfaces shall be free from dirt, dust, mortar, grease, oil, etc. Nitrile Rubber insulation shall be applied as follows:

Insulating material in tube form shall be sleeved on the pipes.

Adhesive must be allowed to tack dry and then press surface firmly together starting from butt ends and working towards centre.

Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations.

The insulation shall be continuous over the entire run of piping, fittings and valves.

All valves, fittings, joints, strainers, etc. in chilled water piping shall be insulated to the same thickness as specified for the main run of piping and application shall be same as above.

Valves bonnet, yokes and spindles shall be insulated in such a manner as not to cause damage to insulation when the valve is used or serviced.

The detailed application specifications are as mentioned separately. The manufacturer's trained installer shall only be used for installation.

RECOMMENDED ADHESIVE:

In all cases, the manufacturer's recommended Adhesive shall be used for the specified purpose.

INSTALLATION EXPOSED DIRECTLY TO SUNLIGHT:

For installations exposed to sunlight, after giving 36 hours curing time for the adhesive apply manufacturer's recommended UV/Mechanical Protection. Please refer the separate detailed guidelines on UV/Mechanical Protection and choose the right product, as needed for specific requirement.

DUCTING

GENERAL

The scope of this section comprises supply fabrication, installation and testing of all sheet metal/ aluminium ducts, supply, and installation, testing and balancing of all grilles, registers and diffusers. All to be in accordance with these specifications and the general arrangement shown on the Drawings.

The ducting shall be factory fabricated and assembled at site. Fabricating of ducts at site using lock forming machines shall also be accepted.

FABRICATION OF DUCTING AT SITE EXCEPT "TO SUITE AT SITE" PIECES WILL NOT BE ALLOWED. THE "TO SUITE" PIECES WILL REQUIRE PRIOR APPROVAL FROM ENGINEER-IN-CHARGE OR ARCHITECT.

The ducts shall be fabricated from galvanized steel sheets class VIII conforming to IS:277 latest edition (120gm/sq.m).

Galvanised sheet shall possess light coating of zinc nominal 120gm./sq.m surface area (total coating on both sides) and Lock Forming Quality prime material along with test certificates. In addition if deemed necessary, samples of raw material, selected at random by Owner's site Engineer - in - Charge shall be subject to approval and tested for thickness and zinc coating at Contractor's expense.

DUCT MATERIALS

All duct work, sheet metal thickness and fabrication unless directed otherwise, shall strictly meet requirements, as described in IS: 655-1963 with amendment - I (1971 edition).

The gauges, joints and bracings for sheet metal duct work shall further conform to the provisions as mentioned in this section.

Ducts larger than 450 mm shall be cross-broken duct sections upto 1200-mm length may be used with bracing angles omitted.

Changes in section of duct work shall be affected by tapering the ducts with as long a taper as possible but not less than 1:4 ratio. All branches shall be taken off at not more than 45 Deg. Angles from the axis of the main duct unless otherwise approved by the Engineer-in-Charge.

All ducts shall be supported from the ceiling / slab by means of M.S. rods of sizes as given above with M.S. angle at the bottom.

INSTALLATIONS

During the construction, the Contractor shall temporarily close duct openings with sheet metal covers to prevent debris to enter into the ducts and to maintain opening straight and square, as per direction of Engineer-in-Charge.

Great care should be taken to ensure that the duct work does not extend outside and beyond height limits as noted on the drawings.

All ductwork shall be of high quality approved galvanised sheet steel guaranteed not to crack or peel on bending or fabrication of ducts. All joints shall be tight and shall be made in the direction of airflow. The ducts shall be reinforced where necessary, and must be secured in place so as to avoid vibration of the duct on its support.

All air turns of 45 degrees or more shall include curved metal blades or vanes arranged so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration. All ducts shall be fabricated and installed in accordance with modern design practice. The sheet metal gauges and fabrication procedures as given in I.S.S. specifications shall be adhered to and shall be considered as an integral part of these specifications. Turning vanes shall also be provided in masonry ducts as per schedule of quantities.

The duct work shall be varied in shape and position to fit actual conditions at building. All changes shall be in accordance with accepted H.V.A.C. duct design and subject to the approval of the Engineer-in-Charge.

Self adhesive Neoprene rubber/ UV resistant PVC foam lining 5mm thickness shall be installed between duct flanges as well as between all connections of sheet metal ducts to walls, floor columns and filter casings. Sheet metal connections shall be made to walls and floors by means of galvanised steel angles anchored to the building structure with anchor bolts and with the sheet bolted to the angles. Sheet metal connections shall be as shown in the drawings or as directed by Engineer-in-Charge.

The ducts shall be supported from the structure by means of suitable supports as mentioned below by means of threaded G.I. rods anchored to RCC slab using metallic expansion fasteners. In no case the duct will be rested upon the false ceiling / boxing or on supports grouted in the wall.

HANGERSFORDUCT:

Duct Size(mm)	Spacing (M)	Size of MS Angle (mmx mm)	Size of Rod Dia (mm)
Upto750	2.4	32x3	8
751to1500	2.0	40x3	10
1501to2250	2.0	50x3	12
2251toabove	2.0	50x3	12

Additional hangers shall be provided inducts near smoke / fire dampers corrections and at bends.

Accessories such as damper blades and access panels are to be of materials of appropriate thickness and the finish similar to the adjacent ducting, as specified.

Joints, seams, sleeves, splitters, branches, take off and supports are to be as per duct details as specified or as decided by Engineer-in-charge.

Joints requiring bolting or riveting may be fixed by hexagon nuts and bolts, stove bolts or buck bolts, rivets or closed centre to privets or spot welding. Sale tapping screws must not be used. All fixing must have a permanently non-corrosive finish such as cadmium plating or galvanising as appropriate. Spot welds and bronze welds are to be coated on all surfaces with zinc rich paint as approved by Engineer-in-charge.

The flexible joints are to be fitted to the suction and delivery of all fans.The material is to be normally double heavy canvass or as directed by Engineer-in-charge.On all circular spigots them flexible materials are to be screwed or clip band with adjustable screws or toggle fitting. For rectangular ducts the material is to be flanged and bolted with a backing flat or bolted to mating flange with backing flat.

The flexible joints are to be not less than 75mm and not more than 250mm between faces. The ductwork should be carried out in a manner and at such time as not to hinder or delay the work of the other agencies especially the boxing or false ceiling Contractors.

INSTALLATION PRACTICE

The Contractor shall provide and neat lyric tall sheet metal work as may be required to carry out the intent of this Specification sand Drawings. The work shall meet with the approval of Owner's site representative in all its parts and details.

All necessary allowances and provisions shall be made by the Contractor for beams, pipes or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes and conduits the ducts shall be transformed, divided or curved to one side (the required area being maintained) all as per the site requirements.

If adduct cannot be run as shown on the drawings, the contractors shall install the duct between the required points by any path available in accordance with other services and as per approval of Owner's site representative.

THE GAUGE JOINTS AND BRACING FOR SHEET METAL DUCT WORK SHALL BE AS FOLLOWING

Maximum Side (mm)	Thickness of GI Sheet (mm)	Type of Transverse Joint Connections
Upto 750*	0.63	TDF FLANGES
751 to 1500	0.80	TDF FLANGES
1501 to 2250	1.00	TDF FLANGES
2250 TO ABOVE**	1.25	TDF FLANGES
Maximum Side (mm)	Thickness of GI Sheet (mm)	Type of Transverse Joint Connections

All exhaust ducts shall have TDFFL respective of the duct size.

**Ducts 2250mm and larger require special field study or hanging, supporting methods and also bracing for duct size above 1501mm.

MISCELLANEOUS

All ducts above 450mm are to be cross-braced to provide rigidity to the ducts.

All duct work joints are to be true right angle or approaching with all sharp edges removed. Sponge rubber gaskets also to be provided behind the flange of all grilles.

Each shoot from the duct, leading to a grill, shall be provided with an air deflector to divert the air into the grille through the shoot.

Inspection doors measuring at least 450mm x 450mm are to be provided in each system at an appropriate location, as directed by Engineer-in-charge.

Diverting vanes must be provided at the bends exceeding 600mm and at branches connected into the main duct without a neck.

Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations. Additional supports are to be provided where required for rigidity or as directed by Engineer-in-charge.

The ducts should be routed directly with a minimum of directional change.

The duct work shall be provided with additional supports/Hangers, wherever required or as directed by the Engineer-in-Charge, at no extra cost.

All duct supports flanges, hangers and damper boxes etc. shall be given 2 coats of red oxide paint before installation and one coat of aluminium paint after the erection, at no extra cost.

All iron flanges to be welded electrically and holes to be drilled.

All the angle iron flanges to be connected to the GSS ducts by rivets at 100mm centres. The GSS ducts should be lapped 6mm across the flanges.

The ducts should be supported by approved type supports at a distance not exceeding 2.4 meters. Sheet metal connection pieces, partitions and plenums required shall be constructed of 1.25 (18 gauges) sheet though roughly stiffened with 40mmx40mmx3mm angle iron braces and fitted with access doors.

Splitter damper must be provided wherever ducts are bifurcating. No extra payment shall be made separately since these form part of air-circulating system.

Kitchen exhaust ducting shall be with 18 GGI sheets (irrespective of duct size). Suitable access doors shall be provided every 3m. Provision shall be made for fire fighting agency to install duct

Mounted sprinklers at every 3m. Generally exhaust ducts shall have slope towards kitchen hood.

Ducts so identified on the Drawings shall be acoustically lined and insulated from outside as described in this section "Insulation" and as indicated in schedule of Quantities. Duct dimensions show on drawings, are overall sheet metal dimensions inclusive of the acoustic lining where required and indicated in Schedule of quantities. The fabricated duct Dimensions should be as per approved drawing and care should be taken to ensure that all connecting sections are dimensionally matched to avoid any gaps.

Ducts shall be straight and smooth on the inside with longitudinal seams shall be airtight and at corners only which shall be either Pittsburgh or snap butt onto ensure air tightness.

All ducts upto 75cms width within conditioned spaces shall have slip and drive (C&S/SS) joints. The internal ends of slip joints shall be in the direction of airflow. Care should be taken to ensure that S/SSC is attached to a remounted on the longer side of the duct and Cleat on the shorter side. Ducts and accessories within ceiling spaces, visible from air-conditioned areas shall be provided with two

Coats of matt black finish paint.

Changes in dimensions and shape of ducts shall be gradual (between 1:4 and 1:7). Air-turns (vanes) shall be installed in all bends and duct collars designed to permit the air to make the turn without appreciable turbulence.

Ducts shall be fabricated as per details shown on Drawings. All ducts shall be rigid and shall be adequately supported and braced where required withstanding seams, tees, or angles, of ample size to keep the ducts true to shape and to prevent buckling, vibration or breathing.

All sheet metal connection, partitions and plenums, required to confine the flow of air to and through the filters and fans, shall be constructed of 18 gauge GSS/16 gauge aluminium, thoroughly stiffened with 25mmx25mmx3mm galvanized steel angle braces and fitted with all necessary inspection doors as required, to give access to all parts of the apparatus. Access doors shall be not less than 45cmx45cm min size.

Plenums shall be shop/factory fabricated panel type and assembled at site. Fixing of galvanized angle flanges on duct pieces shall be with rivet heads inside i.e. towards GS sheet and riveting shall be done from outside.

Self adhesive Neoprene rubber/UV resistant PVC foam lining 5mm nominal thickness instead of felt, shall be used between duct flanges and between duct supports in all ducting installation.

The Contractor shall provide and neatly erect all sheet metal work as may be required to carry out the intent of these Specifications and Drawings. The work shall meet with the approval of Owners site representative in all its parts and details

All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid be other structural work, plumbing or other pipes, and conduits, the ducts shall be transformed, divided or curved to one side (the required area being maintained)all as per the site requirements.

If a duct cannot be run as shown on the drawings, the contractor shall install the duct between the

Required points by any path available in accordance with other services and as per approval of owner's site representative.

All duct work shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed from galvanized steel rods and galvanized steel angle/channel or a pair of brackets, connected by galvanized steel rounder ducts. The spacing between supports should be not greater than 2.0 meter. All vertical ductwork shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting. Galvanized steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods shall be hung through these cleats. Wherever use of metal insert plates is not feasible, duct support shall be through dash/anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods shall then hang through the cleats or fully threaded galvanized rods can be screwed into the anchor fasteners.

Ducting over furred ceiling shall be supported from the slab above or from beams after obtaining approval of Owner's site representative. In no case shall any duct be supported from false ceiling hangers or be permitted to rest on false ceiling. All metal work in dead or furred down spaces shall be erected in time to occasion no delay to other contractor's work in the building.

Where ducts pass through brick or masonry openings, it shall be provided with 25mm Thick TF quality expanded polystyrene around the duct and totally covered with fire barrier mortar for complete sealing.

All ducts shall be totally free from vibration under al conditions of operation. Whenever duct work is connected of air handling units or blower coil units that may cause vibration In the ducts, ducts shall be provided with a flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve at least 10c m long securely bonded and bolted on both sides. Sleeve shall be made smooth and the connecting duct work rigidly held by independent supports on both sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation. Duct shall not rest on false ceiling and shall be in level from bottom. Taper pieces shall taper from top.

DAMPERS

All duct dampers shall be opposed blade louver dampers of robust 16 GGSS construction for blades and 18 GGSS for casing and tight fitting³⁰. The design, method of handling and control shall be suitable for the location and service required.

Dampers shall be provided with suitable links, levers and quadrants as required for their proper operation. Controller setting device shall be made robust, easily operable and accessible through suitable access door in the duct. Every damper shall have an indicating device clearly showing the damper position at all times.

Dampers shall be placed in ducts at every branch supply or return air duct connection, whether or not indicated on the Drawings, for the proper volume control and balancing of the air distribution system.

FIREDAMPERS

Whenever a supply/return duct crosses from one fire zone to another, its shall be provided with approved fire damper of at least 1½ hour fire rating as per UL555/1995 tested by CBRI. This shall be curtain type fire damper.

Fire damper blades shall be one piece folded high strength 16 Gauge galvanised steel construction. In normal position, these blades shall be gathered and stacked at the frame head providing maximum air passage and preventing passing air currents from creating noise or chatter. The blades shall be held in position through fusible link of temp 70oC.

In case of fire, the intrinsic energy of the folded blades shall be utilized to close the opening. The thrust of the suddenly released tension shall instantly drive the blades down and keep it down without the use of springs, weights or other devices subject to failure.

Fire damper sleeves and access doors shall be provided with in the duct in accordance with the manufacturer's recommendation.

The contractor shall also furnish to the Owner, the necessary additional fusible links (spares), as recommended by the manufacturer, at the time of commissioning of the installation.

SUPPLY AND RETURN AIR REGISTERS

Supply & return air registers shall be of either steel or aluminium sections as specified in schedule of quantities. Steel construction registers shall have primer Coat finish where as extruded aluminium registers shall be either Anodized or Powder Coated as specified in Schedule of Quantities. These registers shall have individually adjustable louvers both horizontal and vertical. Supply air registers shall be provided with key operated opposed blade extruded aluminium volume control damper anodized in matt black shade.

The registers shall be suitable for fixing arrangement having concealed screws as approved by Architect. Linear continuous supply cum return air register shall be extruded aluminium construction with fixed horizontal bars at 15Deg.inclination & flange on both sides only (no neon top & bottom).The thickness of the fixed bar louvers shall be minimum 5.5 mm in front and 3.8 mm in rear with rounded edges. Flanges on the two sides shall be 20mm/30mm wide as approved by Architect. The grilles shall be suitable for concealed fixing. Volume control dampers of extruded aluminium anodized in black colour shall be provided in supply air duct collars. For fan coil units horizontal fixed bar grilles as described above shall be provided with flanges on four sides, and the core shall be & suitable for clip fixing, permitting its removal without disturbing the flanges.

All registers shall be selected in consultation with the Architect. Different spaces shall require horizontal or vertical face bars and different width of margin frames. These shall be procured only after obtaining written approval from Architect for each type of register.

All registers shall have as of continuous rubber/ foam gasket between the periphery of the register and the surface on which it has to be mounted. The effective area of the registers for air flows shall not be less than 66 percent of gross face area.

Registers specified with individually adjustable bars shall have adjustable pattern as each grille bar shall be pivot able to provide pattern with 0 to +45 degree horizontal arc and up to 30 degree deflection down wards. Bars shall hold deflection settings under all conditions of velocity and pressure. Bar longer than 45cm shall be reinforced by set-back vertical members of approved thickness.

All volume control collar dampers shall be anodized aluminium in at black shade.

SUPPLY AND RETURN AIR DIFFUSERS

Supply and return air diffusers shall be as shown on the Drawings and indicated in Schedule of Quantities. Mild steel diffusers/dampers shall be factory coated with rust-resistant primer. Aluminium diffusers shall be powder coated & made from extruded aluminium section as specified in schedule of quantities.

Rectangular Diffusers shall be steel /extruded aluminium construction, square & rectangular diffusers with flush fixed pattern for different spaces as per schedule of quantities. These shall be selected in consultation with the Architect. These shall be procured only after obtaining written approval from Architect for each type of diffuser.

Supply air diffusers shall be equipped with fixed air distribution grids, removable key-operated volume control dampers, and anti-smudge rings as required in specific applications, and as per requirements of schedule of quantities. All extruded aluminium diffusers shall be provided with removable central core and concealed key operation for volume control damper.

Linear Diffuser shall be extruded aluminium construction with removable core, one or two way blow type. Supply air diffusers shall be provided with volume control/balancing dampers within the supply air collar. Diffusers for different spaces shall be selected in consultation with the Architect, and provided as per requirements of schedule of quantities. All diffusers shall have volume control dampers of extruded aluminium construction anodized in mat black shade.

Slot Diffuser shall be extruded aluminium construction multi slot type with air pattern controller provided in each slot. Supply air diffusers shall be provided with Hit & Miss volume control dampers in each slot of the supply air diffusers. Diffusers for different paces shall be selected in consultation with the Architect and provided as per requirement of Schedule of Quantities.

DOCUMENTATION&MEASUREMENTSFORDUCTING

All ducts fabricated and installed should be accompanied and supported by proper documentation viz:

a) Bill of material/Packing list for every duct section supplied.

Measurement sheet covering each fabricated duct piece showing dimensions and external surface area along with summary of external surface area of duct gauge-wise.

Each and every duct piece to have a tag number, which should correspond to the serial number, assigned to it in the measurement sheet. The above system will ensure speedy and proper site measurement and verification.

Unless otherwise specified, measurements for ducting for the project shall be on the basis of center line measurements described here with

Duct work shall be measure do the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising over all width and depth, including the corner joints, in the center of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections.

Plenums shall also be measured in a similar manner.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, where as for tapered circular ducts, the diameter of the section midway between large and small diameter shall be adopted, the length of tapered duct section shall be the center line distance between the flanges of the duct section.

For special piece slike bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centre line.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flange sand gaskets for joints, nuts and bolts, hanger sand angles with double nuts for supports, rubberstrip

5mm thick between duct and support, vibration isolator suspension where specified or required, inspection chamber/access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the specifications. These accessories shall NOT be separately measured nor paid for.

SpecialI tems for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith:

1. Grilles and registers- width multiplied by height, excluding flanges. Volume control dampers shall for part of the unit rate for registers and shall not be separately accounted.
2. Diffusers - cross-section area for air flow at discharge area, excluding flanges Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted.
3. Linear diffusers-shall be measured by cross-sectional area sand shall exclude flanges for mounting of linear diffusers. The supply air plenum for linear diffusers shall be measured with ducting as described earlier.

Fire dampers -shall be measured by their cross sectional area perpendicular to the direction of airflow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, electrical actuators and panel. No special allowance shall be payable for extension of cross-section outside the air stream.

Grilles, diffusers, collar dampers & VCD shall have a minimum measurable area of 1sqft or 0.1sqmtr.

TESTING AND BALANCING

After the installation of the entire air distribution system is completed in all respects, all ducts shall be tested for air leaks by visual inspection.

The entire air distribution system shall be balanced using a nanemometer. Measured air quantities at fan discharge and at various outlets shall be identical to or less/excess than 5 percent in excess of those specified and quoted. Branch duct adjustments shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any time. Complete air balance report shall be submitted for scrutiny and approval, and four copies of the approved balance report shall be provided with completion documents.

Video Conference

- a. Remote, NTSC/PAL;
- b. Cables: HDMI cables, CAT 5E LAN cable, CAT 5E SHLD cable, 1 HDCI , HDCI Mini, Power: India BIS.
- c. Warranty - Partner Premier support for period of 5 years

Technical Specifications

=====

1. Video standards: H.264 AVC, H.264 High Profile, H.265, RTV, H.239, H.264 video error concealment Support .

Video Inputs: 1 HDCI/1 HDMI/1 USB

VIDEO OUT: 2x HDMI, Touch display compatible

2. VIDEO RESOLUTION: Capable to support 4K, 30 fps (TX and RX) from 2048 Kbps, 1080p, 60 fps from 1740 Kbps, 1080p, 30 fps from 1024 Kbps, 720p, 60 fps from 832 Kbps, 720p, 30 fps from 512 Kbps, 4SIF/4CIF, 60 fps from 512 Kbps, 4SIF/4CIF, 30 fps from 128 Kbps, SIF (352 x 240), CIF (352 x 288), From 64 kbps, QCIF (176 x 144) from 64 kbps, w288p from 128 Kbps, w448 from 384 Kbps, w576p from 512 Kbps

3. CONTENT VIDEO RESOLUTION

Input: UHD (3840 x 2160), HD (1920 x 1080p), WSXGA+ (1680 x 1050), UXGA (1600 x 1200), SXGA (1280 x 1024), WXGA (1280 x 768), HD (1280 x 720p), XGA (1024 x 768), SVGA (800 x 600).

4. Output: UHD (3840 x 2160), WUXGA (1920 x 1200), HD (1920 x 1080), WSXGA+ (1680 x 1050), SXGA+ (1400 x 1050), SXGA (1280 x 1024), HD (1280 x 720), XGA (1024 x 768)

5. Content frame rate: 5–60 fps (up to 4K resolution at 15 fps in call)

6. CONTENT SHARING: Poly Content App support, Apple AirPlay, Miracast, 1x HDMI input

7. AUDIO INPUT: Capability to support up to three 1x IP microphone arrays, Up to 4x Clink2 Microphones or Sound Structure (using Poly Microphone IP)

8. AUDIO OUTPUT: 1x HDMI, 1x 3.5 mm stereo line-out

9. OTHER INTERFACES: 3x USB , 1x USB-C, 1x RS-232, 8-pin mini-DIN, Bluetooth 5.0, WiFi 802.11a/b/g/n/ac (MIMO) Multichannel

10. AUDIO STANDARDS AND PROTOCOLS: 22 kHz bandwidth with Polycom Siren 22 technology, G.719 (M- Mode), 14 kHz bandwidth with Polycom Siren 14 technology, G.722.1, 7 kHz bandwidth with G.722, G.722.1, 3.4 kHz bandwidth with G.711, G.728, G.729A

11. NETWORK: IPv4 support, 1x 10/100/1G Ethernet, Auto- MDIX, 3x 10/100/1G LLN supporting POE+/PSE, H.323 and/or SIP up to 6 Mbps, Polycom Lost Packet Recovery (LPR) technology, Dynamic bandwidth allocation, Reconfigurable MTU size, RS232 with

REST and CLI API support, Web Proxy support—Basic, Digest and NTLM, Simple Certificate Enrollment Protocol(SCEP)

Single USB port functionality to use the system as an external camera, microphone and speaker when connected to a Laptop/PC.

12. SECURITY

- a. Media encryption (H.323, SIP): AES-128, AES-256,
- b. H.235.6 support,
- c. Authenticated access to admin menus, web, interface and APIs,
- d. PKI/Certificate Management:- TLS 1.2, 1.1, 1.0, Self-signed and CA-signed certificate support, CRL and OCSP-based certificate revocation checking
- e. Local account password policy configuration
- f. Security profiles
- g. Local account and login port lockout
- h. Secure defaults
- i. Remote logging with support for TLS

SECTION 7
FORM OF BID

FORM OF BID

Description of the Works:

Address

**Executive Officer,
Shree Siddhivinayak Ganapati Temple Trust,
Mumbai**

1. We offer to execute the Works described above and remedy any defects therein in conformity with the conditions of Contract, specification, drawings, Bill of Quantities and Addenda for the sum(s) of

2. We undertake, if our Bid is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the document.
3. We agree to abide by this Bid for the period of * _____ days from the date fixed For receiving the same, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
4. Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
5. We understand that you are not bound to accept the lowest or any tender you may receive.

Signature _____ in the capacity of duly authorized to sign bids
for and on behalf of _____
(in block capitals or typed)

Address

Witness Address Occupation

Address

Witness Address Occupation

SECTION 8
BILL OF QUANTITIES
(SCHEDULE – B)

BILL OF QUANTITIES

Preamble

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, Conditions of Contract, Technical Specifications and Drawings.
2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract.
3. The rates and prices tendered in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract, include all constructional plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the Contract.
4. The rates and prices shall be quoted entirely in Indian Currency.
5. A rate or price shall be entered against each item in the Bill of Quantities, whether quantities are stated or not. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
6. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, and where no Items are provided the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
7. General directions and descriptions of work and materials are not necessarily repeated or summarized in the Bill of Quantities. References to the relevant sections of the contract documentation shall be made before entering rates or prices against each item in the Bill of Quantities.
8. The method of measurement of completed work for payment shall be in accordance with the specification for Public Works Department and as directed by Engineer-In-Charge.
9. Errors will be corrected by the Employer for any arithmetic errors pursuant to Clause 29 of the Instructions to Bidders.

BILL OF QUANTITIES

SI. No	Description of Item (with brief specification and reference to book of specification)	Quantity	Unit	Rate		Amount
				In Figures	In Words	
	Attached Separately					

Note:

1. Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be defined covered by the other rates and prices in the bill of quantities (Refer: ITB Clause 13.2 and Conditions of Contract Clause 43.3).
2. Unit rates and prices shall be quoted by the bidder in Indian rupee [ITB Clause 14.1].
3. Where there is a discrepancy between the rate in figures and words, the lower of the two will govern.
4. Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern.

SCHEDULE – B

NAME OF WORK : Proposed Structural, Civil & Interiors including Electrification, Fire Fighting, HVAC of the Existing Main Temple and Pratikshalaya Structure at Siddhivinayak Temple, Prabhadevi.

Note:

- (1) Unit rates and prices shall be quoted by the bidder in Indian Rupee [ITB Clause 14.1].
- (2) Where there is a discrepancy between the rates in figures and in words, the rate in words will govern. [ITB Clause 27.1 (a)].
- (3) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by quantity, the unit rate quoted shall govern [ITB Clause 27.1(b)].
- (4) The rates to be quoted excluding of the GST.
- (5) List of Enabling works (attached) has to be considered in quote.

SECTION 9

SECURITIES AND OTHER FORMS

MODEL FORM OF BANK GUARANTEE BOND

(On Stamp Paper of worth Rs. 500/-)

In consideration of the Governor of Maharashtra (hereinafter referred to as "The Government") having agreed to exempt _____ (hereinafter referred to as "The Contractor") from depositing with the Government in cash the sum Of Rs. _____ (Rupees _____ only) being the security deposit payable by the Contractor to the Government under the Terms and conditions of the agreement dated the _____ day _____ of _____ and made between the Government of the one part and the Contractor of the other part (hereinafter referred to as "the said agreement") for _____ as security for the observance and performance by the Contractor of the terms and conditions of the said agreement, on the contractor furnishing to the Government a guarantee in the prescribed form of scheduled bank in India being in fact these present in the like sum of Rs. _____ (Rupees _____ only). We _____ BANK / LIMITED registered in India under _____ Act and having one of our local Head Office at _____ do hereby:

1. Guarantee to the Government:
 - a. Due performance and observance by the Contractor of the terms, covenants and conditions on the part of the Contractor contained in the said agreement, AND
 - b. Due and punctual payment by the Contractor to the Government of all sums of money, losses, damages, cost charges, penalties and expenses payable to the Government by the Contractor under or in respect to the said agreement
2. Undertake to pay to the Government on demand and without demur and notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding filed in any court of tribunal relating thereto the said sum of Rs. _____ (Rupees _____ only) or such less sum may be demanded by the Government from us our liability hereunder being absolute and unequivocal and agree that.
3. A) The guarantee herein contained shall remain in full force and effect during the subsistence of the said agreement and that the same will continue to be enforceable till all the dues of the Government under or by virtue of the said agreement have been duly paid and its claims satisfied or discharged and till the Government certifies that the terms and conditions of the said agreement have been fully, properly carried out by the Contractor.
B) We shall not be discharged or released from the liability under this guarantee by reasons of
 - i. any change in the constitution of the bank or the Contractor or
 - ii. any arrangement entered into between the Government and the Contractor with or without our consent;
 - iii. any forbearance of indulgence shown to the Contractor;
 - iv. any variation in the terms covenant or conditions contained in the said agreement;
 - v. any time given to the Contractor or;

vi. any other conditions or circumstances under which, in law, a surety would be discharged.

C) Our liability hereunder shall be joint and several with that of the Contractor as if we were principal debtors in respect of the said sum of Rs. _____
(Rupees _____ only) and

D) We shall not revoke this guarantee during its currency except with the previous consent in writing of the Government.

IN WITNESS WHEREOF the common on seal of _____ has been hereunto affixed this _____ day of _____ 20 _____. The common seal of _____ was pursuant to the resolution of the Board of Directors of the Company dated the _____ day of _____ herein affixed in the presence of

1. _____

2. _____

INDENTURE FOR SECURED ADVANCES FORM 31

(for use in cases in which the contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time)

This indenture made the _____ day of . 20
BETWEEN _____ (hereinafter called the contractor which expression shall where the context so admits or implies be deemed to include his executors, administrators and assigns) or the one part and the Employer of the other part.

Whereas by an agreement dated _____ (hereinafter called the said agreement) the contractor has agreed.

AND WHEREAS the contractor has applied to the Employer that he may be allowed advanced on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges)

AND WHEREAS the Employer has agreed to advance to the Contractor the sum of Rupees _____ on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances attached to the Running Account bill for the said works signed by the Contractor on _____ and the Employer has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works.

Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees _____ on or before the execution of these presents paid to the Contractor by the Employer (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid the Contractor doth hereby covenant and agree with the Employer and declare as follows:

- 1) That the said sum of Rupees _____ so advanced by the Employer to the Contractor as aforesaid and all or any further sum of sums advanced as aforesaid shall be employed by the Contractor in or towards expending the execution of the said works and for no other purpose whatsoever.
- 2) That the materials detailed in the said Account of Secured Advances which have been offered to and accepted by the Employer as security are absolutely the Contractor's own property and free from encumbrances of any kind and the contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnified the Employer against all claims to any materials in respect of which an advance has been made to him as aforesaid.
- 3) That the materials detailed in the said account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the

Engineer.

- (4) That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the Engineer or any officer authorized by him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same required by the Engineer.
- (5) That the said materials shall not be any account be removed from the site of the said works except with the written permission of the Engineer or an officer authorized by him on that behalf.
- (6) That the advances shall be repayable in full when or before the Contractor receives payment from the Employer of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the Employer will be at liberty to make a recovery from the Contractor's bill for such payment by deducting there from the value of the said materials than actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.
- (7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing of the Employer shall immediately on the happening of such default be repayable by the Contractor to be the Employer together with interest thereon at twelve per cent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs, charges, damages and expenses incurred by the **Employer** in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the **Employer** to reply and pay the same respectively to him accordingly.
- (8) That the Contractor hereby charges all the said materials with the repayment to the Employer of the said sum of Rupees _____ and any further sum of sums advanced as aforesaid and all costs, charges, damages and expenses payable under the represents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the power contained therein if and whenever the covenant for payment and repayment here-in-before contained shall become enforceable and the money owing shall not be paid in accordance there with the Employer may at any time thereafter adopt all or any of the following courses as he may deem best:
 - (a) Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the contractor in accordance with the provisions in that

behalf contained in the said agreement debiting the contractor with the actual cost of effecting such completion and the amount due to the contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the contractor, he is to pay same to the Employer on demand.

- (b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the Employer under these presents and pay over the surplus (if any) to the Contractor.
 - (c) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.
- (9) That except in the event of such default on the part of the contractor as aforesaid interest on the said advance shall not be payable.
- (10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been here-in-before expressly provided for the same shall be referred to the Employer whose decision shall be final and the provision of the Indian Arbitration Act for the time being in force shall apply to any such reference.

In witnessed whereof the parties there to have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the presence of:

Signed, Sealed and Delivered by the said _____

in the presence of:

Binding Signature of Employer _____

Binding Signature of Contractor _____

Letter of Acceptance

(Letterhead paper of the Employer)

(Date)

To

_____ (Name and address of the Contractor)

Dear Sirs,

This is to notify you that your Bid dated _____ for execution of the _____ (name of the contract and identification number, as given in the Instructions to Bidders) for the Contract Price of Rupees _____ (_____) (amount in words and figures), as corrected and modified in accordance with the Instructions to Bidders¹ is hereby accepted by our agency.

You are hereby requested to furnish Performance Security, in the form detailed in Para 34.1 of ITB for an amount equivalent to Rs. _____ within 10 days of the receipt of this letter of acceptance valid up to 28 days from the date of expiry of defects Liability Period i.e. up to _____ and sign the contract, failing which action as stated in Para 34.3 of ITB will be taken.

Yours faithfully,

Veena Patil
Executive Officer
Shree Siddhivinayak Ganapati
Temple Trust, Mumbai,
Prabhadevi, Mumbai 400028

Issue of Notice to proceed with the work

(Letterhead of the Employer)

_____ (Date)

To

(Name and address of the Contractor)

Dear Sirs,

Pursuant to your furnishing the requisite security as stipulated in ITB Clause 34.1 and signing of the Contract for the construction of _____ at
Bid Price of Rs _____

You are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

Veena Patil
Executive Officer
Shree Siddhivinayak Ganapati
Temple Trust, Mumbai,
Prabhadevi, Mumbai 400028

Agreement Form

Agreement

This agreement, made the _____ day of _____ between _____ (name and address of Employer) [hereinafter called "the Employer] and _____ (name and address of contractor) hereinafter called "the Contractor" of the other part.

Whereas the Employer is desirous that the Contractor execute _____ (name and identification number of Contract) (hereinafter called "the Works") and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein , at a cost of Rs. _____

NOW THIS AGREEMENT WITNESSETH as follows :

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the conditions of contract hereinafter referred to and they shall be deemed to form and be read and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the contract.
3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
4. The following documents shall be deemed to form and be ready and construed as part of this Agreement as set forth in contract clause 2.3

In witnessed whereof the parties there to have caused this Agreement to be executed the day and year first before written.

The Common Seal of _____
was hereunto affixed in the presence of:

Signed, Sealed and Delivered by the said _____

in the presence of:

Binding Signature of Employer _____

Binding Signature of Contractor _____

SECTION 10
TESTING OF MATERIALS

**NAME OF WORK :- Proposed Structural & Allied Repairs to the Siddhivinayak
Temple Structure, Prabhadevi, Mumbai.**

JOB NO. :-

Sr. No.	MATERIAL	Description of Test as per Q.C. Norms
1	Cement	Carrying out Standard Consistency, Fineness, Specific Gravity, Setting Time (Initial & Final), Compressive Strength, Soundness
2	Aggregate	Carrying out Water Absorption, Specific Gravity, Impact Value ICrushing Value.
3	Fine Aggregate	Carrying out Fineness Modulus (Sieve Analysis), Silt & Clay Content
4	Bricks	Carrying out Water Absorption (Set of 5 Bricks), Compressive Strength(Set of 5 Bricks), Efflorescence JSet of 5 Bricks}.
5	Flooring of Natural Stone	Carrying out :- (Kota, Marble, granite, Tandur.etc.- Water absorption Specific gravity)
6	Ceramic/Vitrified Tiles	Carrying out Water Absorption, Modulus of Rupture (Set of 6 Tiles)
7	Permeability Test.	Carrying out Permeability Test.
8	Concrete	Carrying out Compressive Strength OF C.C. Cube (Set of 3 cubes).
9	Concrete Mix Design	Carrying out Concrete Mix Design (With all Tests on basic materials)
10	Permeability	Carrying out permeability Test.
11	Hollow Blocks/ Solid Blocks	Carrying out Density Test. (Set of 3 Blocks), 58 Compressive Strength. (Set of 8 Blocks), Water Absorption Test.(Set of 3' Btocks)
12	Water	Carrying out PHValue, Sulphate & Chloride Content.
13	Wood	Carrying out Density, Moisture Content.
14	Flush Door	Carrying out Knife Test, Adhesion Test, End Immersion 61 Test.
15	Plywood	Carrying out Determination of Resistance to dry heat, Determination of Moisture Content, Determination of Density, and Thickness of Plywood.
16	G.I.Pipes	Carrying out Weight per running meter,Diameter of pipe & wall thickness of pipe,

Sr. No.	MATERIAL	Description of Test as per Q.C. Norms
17	Zinc coating	Carrying out Weight of Zinc coating per sq. m.
18	PVC Pipes (NONPLASTIS/ZED1)	Carrying out Weight per running meter,Diameter of pipe & wall thickness of pipe
19	Steel Anti- Corrosive	Carrying out Resistance to applied Voltage. (1 Hr. Test) (Set of 2 Bars).
20	Steel Bar Testing	STEEL BAR TESTING Carrying out Upto 16 mm (Set of 3 Bars)

SECTION 11
LIST OF MATERIAL BRANDS

NAME OF WORK :- Proposed Structural, Civil & Interiors including Electrification, Fire Fighting, HVAC of the Existing Main Temple and Pratikshalaya Structure at Siddhivinayak Temple, Prabhadevi.

LIST OF APPROVED MATERIALS - CIVIL		
Sr. No.	DESCRIPTION	APPROVED MAKES
1	Cement	ULTRATECH / BIRLA / AMBUJA / ACC
2	Reinforcement Steel (Fe 415 / 500 grade)	TATA / SAIL / VIZAG / JINDAL
3	Structural Steel	TATA / SAIL / VIZAG / JINDAL
4	Acrylic Polymer	FOSROC / SUNANDA / Krishna Conchem / BASF or Equivalent
5	Micro concrete	FOSROC / SUNANDA / Krishna Conchem / BASF or Equivalent
6	Epoxy	FOSROC / SUNANDA / Krishna Conchem / BASF or Equivalent
7	Rust remover / Rust Passivator	FOSROC / SUNANDA / Krishna Conchem / BASF or Equivalent
8	Waterproofing compound	FOSROC, Pidilite. Struco Excel, CICO, Sunanda or Equivalent
9	Aluminum Sheet For Gutter / Valley Gutter	JINDAL, HINDALCO Or Equivalent
10	Oil bound Distemper	SHALIMAR, BERGER, ICI, ASIAN Or Equivalent
11	External acrylic-based cement paint	SHALIMAR, ASIAN, ICI, Jotun, NEROLAC, SNOWCEM Or Equivalent
12	Luxury Emulsion Paint	ASIAN, Jotun Or Equivalent
12	White Cement	BIRLA Or Equivalent
13	Sand	Only river sand after approval of the

		sample
Note:	Brand deviation if any needs to be tested for cement, steel and structural steel prior to using it for construction	
	Brand deviation if any, for other finishing items can be changed only after Prior confirmation/approval from client/Employer.	

LIST OF APPROVED MATERIALS – INTERIOR

SL.NO.	ITEM	DETAILS
1	TIMBER C.P. TEAKWOOD	AS APPROVED (BASIC RATE = Rs. 3000/- PER CFT)
2	PLYWOOD COMMERCIAL GRADE	CENTURY, GREENPLY, ARCHIDPLY, SAMRAT PLY, ANCHOR, KITLY OR APPROVED EQUIVALENT
3	PLYWOOD MARINE GRADE	SAMRAT PLY, ANCHOR , CENTURY, GREENPLY, ARCHIDPLY OR APPROVED EQUIVALENT
4	MDF INTERIOR/ EXTERIOR GRADE	ACTION TESA , CENTURY, GREENPLY, ARCHIDPLY, NUWUD OR APPROVED EQUIVALENT
5	DECORATIVE LAMINATES	GREENLAM, MERINO, ARCHIDPLY OR APPROVED EQUIVALENT
6	WOOD VENEER	TIMEX (veneer), JACKSON, URO OR APPROVED EQUIVALENT
7	SOFTBOARD	CELOTEX OR APPROVED EQUIVALENT
8	GLASS, MIRROR	MODIFLOAT, ASIA, PILCILNTON, SAINTGOBAIN OR APPROVED EQUIVALENT
9	HERMETICALLY SEALED DOUBLE GLAZING	IMPACT SAFETY GLASS, GSC TOUGHENED GLASS, TUFFGLAZE INDIA PVT. LTD.
10	ACRYLIC EMULSION PAINT	ASIAN PAINTS, BERGER, NEROLAC, DULUX OR APPROVED EQUIVALENT
11	SYNTHETIC ENAMEL	ICI, ASIAN, BERGER OR APPROVED EQUIVALENT
12	TEXTURED PAINT	ASIAN, OIKOS, SPECTRUM HERITAGE OR APPROVED EQUIVALENT
13	AUTOMOTIVE PAINT	DUCO, ICI OR APPROVED EQUIVALENT

SL.NO.	ITEM	DETAILS
14	ANTI-TERMITE PAINT	WOOD CARE, WOOD GUARD OR APPROVED EQUIVALENT
15	MELAMINE POLISH	MRF, LIGHT HOUSE, SHEENLAC OR APPROVED EQUIVALENT
16	PATCH FITTINGS	DORMA, STANLEY, GEZE OR APPROVED EQUIVALENT
17	FLOOR SPRING	DORMA, HETTICH, GEZE, STANLEY OR APPROVED EQUIVALENT
18	FLOOR SPRING FOR OTHER DOORS--?	DORMA, HETTICH OR APPROVED EQUIVALENT
19	EXPOSED DOOR CLOSER	DORMA, HETTICH, STANLEY, GEZE OR APPROVED EQUIVALENT
20	BEARING HINGES	DORMA, HETTICH, STANLEY, GEZE, HAFLE OR APPROVED EQUIVALENT
21	MORTISE HANDLE	DORMA, HETTICH, STANLEY, GEZE OR APPROVED EQUIVALENT
22	DEAD LOCK	HETTICH, DORMA, STANLEY, GEZE OR APPROVED EQUIVALENT
23	MORTISE LOCK CYLINDER	HETTICH, DORMA, STANLEY, GEZE OR APPROVED EQUIVALENT
24	PATCH DOOR HANDLE	HETTICH, DORMA/ GEZE/ STANLEY 20mm DIA 450MM LONG "D" TYPE HANDLE
25	FLOOR MOUNTED DOOR STOPPER	HETTICH, DORMA, STANLEY, GEZE OR APPROVED EQUIVALENT
26	CONCEALED TOWER BOLT	HETTICH, UNION FB 10 SS
27	TOILET DOOR INDICATOR BOLT	HETTICH, KICH IB 106 SS
28	MULTI-PURPOSE LOCK	DORSET MP 300 SS WITH 3 KEYS, EBCO OR APPROVED EQUIVALENT
29	CABINET HINGE (AUTO CLOSING)	HETTICH, DORMA, GEZE, HAFLE OR APPROVED EQUIVALENT
30	DRAWER SLIDE SYSTEM (TELESCOPIC	HETTICH, EBCO OR APPROVED EQUIVALENT
31	AUTO DOOR BOLT	DAZ

SL.NO.	ITEM	DETAILS
32	CABINET HANDLES 96mm	HETTICH , KICH, CHH 84 S OR APPROVED EQUIVALENT
33	JOINERY WORKS	NETTLEFOLD IS 1365, GI screws
34	HARDWARE FIXTURES & FITTINGS	Hettich, Kich, Godrej, Yale, SS STAR HEAD SCREW or EQUIVALENT
35	FOAM RUBBER	U FOAM, KURLON OR APPROVED EQUIVALENT
36	VITRIFIED TILES	KAJARIA, NITCO, ASIAN OR APPROVED EQUIVALENT
37	SILICON SEALANT	DOW CORNING OR APPROVED EQUIVALENT
38	GREY CEMENT	L&T 43 GRADE, BIRLA 43 OR APPROVED EQUIVALENT
39	WHITE CEMENT	JK WHITE CEMENT, BIRLA WHITE OR APPROVED EQUIVALENT
40	FROSTED FILM	BIRLA 3M, LUMAR, AVERY OR APPROVED EQUIVALENT
41	COMPOSITE ALUMINIUM INTERIOR GRADE (3MM THICK)	ALUCOLIC, TIMEX BOND OR APPROVED EQUIVALENT
42	FIBRE GLASS WOOL	ROCKWOOL, KIMCO, UP TWIGA OR APPROVED EQUIVALENT
43	110 DEG OPENING AUTO CLOSING HINGES	DORMA, HAFELE, GEZE OR APPROVED EQUIVALENT
44	OIL BASED DISTEMPER	ASIAN, BERGER, NEROLAC, DULUX OR APPROVED EQUIVALENT
45	STAINLESS STEEL	SAIL STEEL 316 GRADE OR APPROVED EQUIVALENT
46	ANTI-STATIC VINYL FLOORING	TARKETT, ARMSTRONG OR APPROVED EQUIVALENT
47	VINYL FILM FOR CLADDING	3M OR APPROVED EQUIVALENT
48	ALUMINIUM SECTIONS	JINDAL OR APPROVED EQUIVALENT
49	GI SECTION FOR PARTITIONS & FALSE CEILING	INDIA GYPSUM, LAGYP OR APPROVED EQUIVALENT
50	GLASS MOSAIC	TILE ITALIA, PALLADIO OR APPROVED EQUIVALENT
51	FALSE FLOORING	UNITED INSULATION, TESCO, METAL MATRIX OR APPROVED EQUIVALENT
52	ALUMINIUM SKIRTING	BOTTOM LINE, TESCO OR APPROVED EQUIVALENT

SL.NO.	ITEM	DETAILS
53	WALL PAPER	ARTE, MARSHALL, ENGRAPHICS OR APPROVED EQUIVALENT
54	WATER PROOFING	FOSROC, SUNANDA, SIKA OR APPROVED EQUIVALENT
55	ROLLER BLINDS	NBT, VISTA, LOUVERLINE, GRORICH OR APPROVED EQUIVALENT
56	CERAMIC WRITING BOARD	ALKON, WRITEWELL OR APPROVED EQUIVALENT
57	MODULAR GRID CEILING	AMF, ARMSTRONG OF APPROVED EQUIVALENT
58	SANITARY & CP FIXTURES	KOHLER, HINDWARE, JAQUAR OR APPROVED EQUIVALENT
59	GYPSUM BOARD	INDIA GYPSUM, LAGYP, BORAL BOARDS OR APPROVED EQUIVALENT
60	Grid False	ARMSTRONG, GYPROC OR APPROVED EQUIVALENT
61	CARPET	APPROVED EQUIVALENT SELECTED BY ARCHITECTS
62	MODULAR WORKSTATIONS	FEATHERLITE OR APPROVED EQUIVALENT OR AS SELECTED BY ARCHITECTS / CONSULTANTS
63	LOOSE FURNITURE	DREAM SEATS, Q SEATS OR APPROVED EQUIVALENT OR AS SELECTED BY ARCHITECTS / CONSULTANTS
64	MOD GLASS PARTITION SYSTEM	DEKO, INTACT, ALLOY OR APPROVED EQUIVALENT
65	CHAIRS	FEATHERLITE, WIPRO OR APPROVED EQUIVALENT OR AS SELECTED BY ARCHITECTS/CONSULTANTS
66	AUTOMATIC SLIDING DOOR	STANLEY, GEZE, DORMA OR APPROVED EQUIVALENT
67	Construction Adhesive	Rech-TR, Karakol, Myk-Laticreat
68	Wooden Adhesive	Pidilite, National
69	FRD FRAME & SHUTTERS	SAMRAT PLY, KENWOOD, ANCHOR OR APPROVED EQUIVALENT
70	FLUSH DOOR (ISI MARK)	SAMRAT PLY, GREENPLY, KENWOOD, ANCHOR OR APPROVED EQUIVALENT
71	M.S. ROLLING SHUTTERS & GRILLS	STANDARD, SWASTIK, SHUBDHWAR OR APPROVED EQUIVALENT
72	FIBRE CEMENT BOARD	BISON, SHERS, BIRLA AIRCON OR APPROVED EQUIVALENT

ELECTRICAL		
Sr. No.	Items	Makes (ISI marked)
1	PVC pipes and accessories	Precision / Avonplast / AKG / Polycab
2	Copper multi-strand wires	Polycab / Gloster / KEI / RR Kables/ Apar
3	Switches / Sockets / TV, Telephone Socket, etc. (modular) - Cat A	Anchor (Roma) / Legrand (Myline) / MK (Wrapround) / Crabtree (Anthena)
4	Air circuit Breakers (ACB)	L & T (U-power) / Siemens (WT / WL) / ABB (Emax) / Schneider (NW / NT) / Legrand
5	MCCB	L & T (D-sine) / Siemens (3VT / 3VL) / ABB (Tmax) / Schneider (Compact NSX) / Legrand
6	MCB / ELCB / RCCB / ISOLATORS / DISTRIBUTION BOARDS	L & T / ABB / Schneider / Legrand/Hager/Havells
7	SFU / Fuse Switch Unit	Schneider / Siemens / L & T / Crompton / ABB / Legrand
8	HRC Fuses	L & T / Siemens / ABB / Legrand
9	Fan Regulator	To match with the switch / sockets
10	Cables	KEI / RR Kabel / Gloster / Apar
11	Cable Glands	Bracco / Siemens / Comet / Jainson / controlwell
12	Cable Jointing	Raychem / CCI – Xycon / Cabseal / M Seal
13	Ceiling fans	Crompton / Bajaj / Anchor / Orient / Usha / Khaitan/SK Smart
14	Exhaust / Pedestal Fan	Crompton / Bajaj / Anchor / Orient / Usha / Almonard / Khaitan
15	Fixture LED	Philips / Panasonic / Bajaj / Crompton / Wipro
16	Telephone Wire / Cables	Finolex / Tata (Lucent) / ITL / Skytone / Gemscab / Delton / National / L&T / Polycab
17	Cable Tray & Race Ways (Factory Fabricated)	Slattco / Profab / Globe / Rico Steel / Indiana / Sadhana / Legrand
18	Network cable	Digisol / Schneider / Avaya/ Systemax / Dlink
19	GI pipes	Zenith / Tata / Jindal
20	UPS	APC / Su Kam / Delta / Amara Raja / V-Guard / Emerson / Socomec / Consul neowatt
21	Terminal Block	Connectwell / Elmex / Wago
22	Network Switch + Storage box/Racks	Sony / Bosch / Digisol / Hikvision / D link

23	EPABX	Alcatel / Siemens / NEC / Avaya / LG
24	Projector	Epson / LG / Sanyo / NEC / Panasonic / Toshiba
25	Video conferencing setup	Tandberg / Polycom / Colcom / Cisco
26	TV + Monitors	LG / Samsung / Sony / Toshiba / Panasonic / Philips / Colcom / Cisco

LIST OF PREFERED MATERIALS

Sr.No.	ITEMS	MAKE/BRANDS
1	PVC Armoured./Unarmoured.Cables (Copper) / Allum	RR Kables, Polycab ,Apar,Havells
2	PVC inulated Aluminum / Copper Wire with stranded conductors. (FRLS/FR Grade)	RR Kables, Polycab .Apar.Havells
3	PVC Rigid Conduits / Casing-n- capping	Finolex , Precision, Diamond, Modi, Asian, Press fit
4	Electrical Fittings (Fluorescent, CFL, MV, Metal halide etc.)	Philips, Bajaj, Crompton, Wipro,
5	Ceiling Fans, exhaust Fans	Crompton, Orient, Usha, Almonard
6	HRC switch Fuse unit, changeover	GEC, L&T, Siemens , Cutler
7	Cable Gland & lugs	Siemens, Dowels, Braco
8	Industrial Sockets	Siemens, Cutler Hammer(BCH), C&S
9	Fluorescent Tubes & Bulbs	Philips, Crompton, Bajaj, Wipro,
10	Electronic Fan Regulator (Step Type)	Anchor, Roma, Greatwhite,
11	MCB's, RCCB, RCBO (All Pols)	L&T, Siemens, Crompton, Schneider, Electric (MG), ABB, Legrand
12	MS & GI Conduits	AKG or ISI Marked Approved by C.E. (Elect.)PWD Mumbai
13	Isolators, Distribution Boxes	L&T, Siemens Schneider Electric (MG), ABB,Legrand
14	Wiring Accessories: 1) Piano type switches, sockets, accessories. 2) Modular type switches, sockets,	Anchor-Roma, Legrand, GM, Schneider,L & T, Hagger, C & S,
15	Fluorescent tubes, MF/GF Lamps	Osram, Crompton, Orpat, GE, Bajaj, Philips
16	L.E.D. Fitting Indoor & Outdoor	Crompton, Philips,,Bajaj , Wipro,
17	Water Pump	Crompton Greaves, KSB, Kirloskar,
18	HT Cable	Polycab, RR Cables, KEI,Gloster
19	HT Switchgears	Simens, schneider, Crompton Greaves, ABB, L&T
20	DG Set with AMF Panel	Engine-KIROSKAR / GREAVES / CUMMINS Alternator- KIROSKAR / GREAVES /STAMFORD
21	FIRE PUMPS	KIRLOSKAR BROS. LTD / MATHER & PLATT /

Sr.No.	ITEMS	MAKE/BRANDS jje/BRANDS
22	G.I./ M.S. PIPES	: JINDAL(HISSAR) / TATA /
23	PIPE FITTINGS	BHARAT FORGE / TUBE PRODUCTS / M.S. FITTINGS / VS BRAND /
24	BUTTERFLY VALES	: AUDCO / KEY STONE / BDK / FOURESS / INTERVALVE i/New
25	NON – RETURN VALVES	: H. SARKER / CRESENT /
26	GATE VALVES (Screwed end)	: LEADER / ZOLOTO / ITAP
27	BALL VALES (Screwed end)	: LEADER / ZOLOTO / ITAP
28	STRAINERS	GUJRAT OTO FILT / GRAND FRIX
29	C.I. GATE VALVES	H. SARKER / CRESENT /
30	FLOW METRE	FORBES MARSHALL / EUREKA
31	PRESSURE SWITCH	INDFOS / SWITZER / DELTA
32	PRESSURE GAUGE	H. GURU / FIEBIG / PRICOL / BELLS CONTROL.
33	ANTICORROSIVE MATERIAL	I W L / RUSTECH
34	HYDRANT VALVES	NEWAGE / WINCO /
35	BRANCH PIPE WITH NOZZLE	NEWAGE / WINCO/
36	FIRE HOSES	NEWAGE / CRC /FIRE SHIELD
37	HOSE COUPLINGS	NEWAGE / WINCO/
38	HOSE REEL	EVERSAFE / TYCO / NEWAGE
39	HOSE BOX / FIRE DUCT SHUTTER	EVERSAFE / TYCO / NEWAGE /
40	FIRE EXTINGUISHERS	SAFEX / ACE FIRE / MINIMAX / VIJAY /FIRE SHIELD
41	SPRINKLERS	TYCO / VIKING / KIDDE
42	Sprinkler Heads	Kartar /HD/ FIRE SHIELD
43	SPRINKLER ALARM VALVE	HD / TYCO / VIKING / KIDDE
44	FLOW SWITCH	SYSTEM SENSOR / POTTER / SWITZER/ LEVCON
45	PAINT	ASIAN / BERGER / Shalimar
46	AIR RELEASE VALVES	LEADER / BAJAJ / HAWA/ Newage/Kartar / FIRE SHIELD
47	Standard G.I. Fittings	ISI Marks
48	MS/GI forged Steel Fittings	ISI Marks
49	Double /Single Headed Landing Valve	Kartar /Fire snhield/Newage/Shah
50	First Aid Hose Reel (LPCB Approved)	Kartar /Newage/Shah Bhogilal/ FIRE
51	Branch pipe	Kartar /Newage/ FIRE SHIELD
52	Fireman axe	Kartar /Newage/ FIRE SHIELD
53	Installatgion Control Volve	Kartar /Newage/ FIRE SHIELD
54	Wrapping Coating	Supreme/BTP/Shalimar
55	Pipe Clamp & Supports	Hitech/Chilly
56	GM/Forged Brass Valves	Kartar /Leader/ FIRE SHIELD
57	Sluice Valves	Kartar /IVC/Kirloskar
58	Check Valve	Kartar /Zoloto/IVC/
59	Check Valve- Dual Plate	Kartar /Zoloto/IVC/
60	Pressure Reducing Valve (Listed)	HD/Kartar /Tyco

Sr.No.	ITEMS	MAKE/BRANDS jje/BRANDS
62	Y Strainer	Sheetal/Zoloto/IVC
63	Anti Vibration Mounting & Flexible	Dunlop
64	Pressure Guage	H /Guru/Syntific/Wagree
65	MCC Panel	L&T/Siemens/ABB/Schneider
66	Cable	Polycab/RR Kables/KEI/Apar
67	Fire Alarm Panel	Honeywell/Spencer/Apollo/Simplex
68	Beam Detector	Honeywell/System Sensor/ Apollo/
69	Optical Smoke Detector	Honeywell/Spencer/Apollo/Simplex
70	Hooter	Spencer/Honeywell/Siemens
71	Manual Call Point	Spencer/Honeywell/Siemens
72	Response Indicator	Spencer/Honeywell/Siemens
73	LED type Signages	Prolight /Maxglow/Autoglow
74	Sprinkler Hose	Agelflex /Kartar/FIRE SHIELD/
75	Alarm Valve	HD/Kartar/Tyco
76	Heat Detector	Honeywell/Siemens/Apollo
77	Modules	Honeywell/Siemens/Apollo
78	Hose Cabinet	CRC Standard Fabricated
79	Live mixer	Bosch / Yamaha /Soundcraft/ Bose
80	Active Cross over stereo	Bosch / Sound Craft /Yamaha
81	Digital Signal Processor Drive Rack	DBX/Ahuja
82	Hanging Microphone	Shure/AKG/SENNHEISER /Bosch
83	Podium Gooseneck Microphone	Shure/AKG/SENNHEISER /Bosch
84	Boundary Microphone	Shure/AKG/SENNHEISER /Bosch
85	Video Conferencing Equipment	Polycom or equivalent
86	Wireless Handheld Microphone , Wireless	Shure/AKG/SENNHEISER /Bosch
87	NVR & NVR Software	Sony, Samsung, Honeywell
88	Semi Open Headphone	AKG/SENNHEISER/Yamaha
89	Surveillance Hard Disc	Seagate, WD
90	Room Monitor speaker	Bosch / Bose/Sony
91	L.E.D. Display	Samsung, Sony, Panasonic
92	Sub Woofer For fly mounts speaker	Bosch / Bose/Sony
93	Gigabyte Poe & Ethernet Switches	CISCO, Alcatel, Juniper, D-Link
94	DVD Player	Sony/Philips/Samsang
95	UTP Cable, Fiber Optic Cable, I/O, Patch	R&M, CISCO, Systimax, AMP, D-
96	Microphone Cable	Falcon/Delta/Sunplast
97	Racks	APW, WQ, Vallrack, AMS Net Tech,
98	Speaker Cable	Falcon/Delta/Sunplast
99	UPS	APC, Emerson, EATON,Socomec
100	Microphone Patch panel , Speaker Patch	MX/Neutrik/Leo
101	Octagonal Poles / High mast Poles	Bajaj, Wallmount, Crompton,
102	Telephone Cable	Finolex Polycab, Havells, Vinay , D-
103	Telephone Instruments	Panasonic, Beetel, Siemens
104	MDF Box	Roma, Legrand
105	Krone Module	Krone or ISI Marked Approved by
106	Co-axial RG11 Cable	Polycab, Finolex, RPG
107	Cat 6 Cable	Legrand, D-link, Schneider

Sr.No.	ITEMS	MAKE/BRANDS
108	Modular Telephone Socket	Anchor, Legrand, Schneider, Roma
109	VRF SYSTEM	DAIKIN / TOSHIBA / BLUE STAR
110	DX SYSTEM	DAIKIN / TOSHIBA / BLUE STAR
111	COPPER PIPING	MEX FLOW / MANDEV / RAJCO
112	UPVC/ CPVC PIPES	SUPREME / DURALINE / PRINCE
113	DIFFUSERS/GRILLS	SYSTEM AIR / COSMOS /
114	DUCTING SHEETS	JINDAL / SAIL / TATA
115	GI DUCT	ASAWA / ZECO / CAM DUCT
116	INSULATED FLEXIBLE DUCT	AUTCO/ UP TWIGA / RUSKIN
117	ELECTRICAL CABLE (FRLS)	POLYCAB / HAVELLS / FINOLEX
118	CABLE TRAY	PROFAB / PRAKASH / ENJAY
119	VCD/NRD	SYSTEM AIR / COSMOS /
120	ANCHOR FASTENERS / DUCT	GRIPPLE/ FISCHER / HILTI
121	ANTI- VIBRATION MOUNTING	DUNLOP / POLYBOND
Note: Makes other than the above if not available in market, prior approval from Engineer - in-charge is essential and the make shall be approved and have ISI mark.		

Note :-

- 1) The Contractor shall execute the work with all the material from above specified makes only. Any Deviation & or additions to any of above material make shall be get approved from Engineer-in-charge prior to commencement of work.
- 2) Before commencement of work the layout of work shall be get approved from Engineer-in- charge.
- 3) The Contractor has to submit the test report of installed material at his own cost.
- 4) The authority of Engineer-in-charge will be final in case of any deviation or change of layout at the time of actual carry out of work and no representation from contractor shall be accepted.