TENDER DOCUMENT

TENDER No.: NERO/CON/ASR/Silchar/273 dated: 10.11.2017

FOR

TENDER FOR CONSTRUCTION OF 06 NOS. TYPE-II (G+II) QUARTER IN 01 BLOCK INCLUDING INFRASTRUCTURAL DEVELOPMENT WORKS FOR ASSAM RIFLES AT SILCHAR, ASSAM

VOLUME–II

NOTICE INVITING TENDER
ADDITIONAL CONDITIONS OF CONTRACT
TECHNICAL SPECIFICATIONS
DRAWINGS
ENGINEERING PROJECTS (INDIA) LTD.
(A Govt. of India Enterprise)
NERO Guwahati-781022

SHORT NOTICE INVITING e- TENDER

TENDER FOR CONSTRUCTION OF 06 NOS. TYPE-II (G+II) QUARTER IN 01 BLOCK INCLUDING INFRASTRUCTURAL DEVELOPMENT WORKS FOR ASSAM RIFLES AT SILCHAR, ASSAM

NIT No. NERO/CON/ASR/Silchar/273 Dated: 10.11.2017

Engineering Projects (India) Ltd., on behalf of Assam Rifles invites item rate open e-Tenders through e-tendering from the eligible contractors/firms who fulfill the eligibility criteria as per the brief particulars of scope for Construction Of 06 Nos. Type-II (G+II) Quarter In 01 Block Including Infrastructural Development Works For Assam Rifles At Silchar, Assam in single stage Two Envelope system (Technical bid & Price bid) for the following works:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>NAME OF WORK</th>
<th>ESTIMATED COST (Rs.)</th>
<th>TIME OF COMPLETION</th>
<th>EMD DEPOSIT (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction Of 06 Nos. Type-II (G+II) Quarter In 01 Block Including Infrastructural Development Works For Assam Rifles At Silchar, Assam</td>
<td>89,57,000/- (Rupees Eighty Nine Lakhs Fifty Seven Thousand Only)</td>
<td>09 (Nine) Months</td>
<td>89,600/- (Rupees Eighty Nine Six Thousand only)</td>
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</table>

The brief scope of work included in this tender shall include providing all labour, materials, tools and plant, transportation to site, storage and safe custody of the materials, earthwork in excavation, earthwork in filling, PCC, RCC, flooring, drains, Sanitary & plumbing, internal electrification etc. as required in Construction of 06 Nos. Type-II (G+II) Quarter In 01 Block including Infrastructural Development Works For Assam Rifles At Silchar, Assam on item rate basis as per bill of quantities and tender conditions. Apart from above, any other service but required as per direction of EPI/DGAR for completion of works are deemed to be included in the scope of work.

The detailed scope of work is given in tender document.

Time schedule of Tender activities:
(i) Starting Date & Time for Downloading of tender documents: from 10.11.2017 (04:00 PM)
(ii) Last Date & Time for Downloading of tender documents: up to 17.11.2017 (12:00 PM)
(iii) Last Date & Time of online submission of tenders: on or before 17.11.2017 up to 02:30PM
(iv) Date & Time of online opening of tenders (Techno-Commercial Bid): 17.11.2017 at 3:00PM Pre-bid meeting at 4th Floor, Hindustan Tower Block-A, Jawahar Nagar, N.H.37, Beltola, Guwahati-781022 Assam on 13.11.2017 at 4.00 PM.

The tenderers shall submit his query for the pre-bid meeting on or before 12.11.2017 by 17.00 hours to neroguwhati@gmail.com or by post to the address given at sl.no 14 below.

Contractors who fulfill the following requirements are eligible to participate in this tender. The joint ventures/Consortium are not accepted.

a) The bidder must have experience of having satisfactorily completed following “similar works” during the last 7(seven) years ending last day of month previous to the one in which applications are invited.

i. Three similar works each of costing minimum 40% of the estimated cost of this work.

   OR

ii. Two similar works each of costing minimum 50% of the estimated cost of this work.

   OR

iii. One similar work costing minimum 80% of the estimated cost of this work.

a. The “similar works” shall mean works comprising Civil, Sanitary, Plumbing, Electrical and Internal Finishes etc. in Building work preferably in the North East Region.

b. The cost of free issue materials shall not be included in the completion cost of works.

c. For evaluation purpose, the completion cost of works mentioned in the completion certificate shall be enhanced by 7% per annum till the end of month prior to date of NIT.

d. The experience certificates issued by Government Organizations/Semi Government Organizations/State Government / Public Works Department / Central Government/Public Sector Undertakings/ Autonomous Bodies/Municipal Bodies/Public Limited Companies listed on BSE/NSE shall only be accepted for assessing the eligibility of the tenderer. However, the certificates issued by Public Limited Company can be considered only if they are supported by TDS certificates in support of value of work done by the tenderer. TDS certificate for full contract value as mentioned in the work order must match failing which the same shall not be considered.

b) Should have had average annual financial turnover of at least 30% of the estimated cost put to tender during the immediate last three consecutive financial years ending on 31.03.2017 duly supported by annual financial report (i.e. audited copies of balance sheet and profit and loss statement) or certified by Chartered Accountant along with
Income Tax return for last financial year (2015-16/2016-17). Turnover means income from construction works only.

c) Should not have incurred any loss in more than two years during the immediate last five consecutive financial years, ending 31.03.2017, Copies of balance sheet/Certificate from Chartered Accountant duly self attested by the tenderer shall be submitted.

d) Should have a Solvency of 40% of the estimated cost issued by a Bank. The Solvency Certificate should have been issued not earlier than one year of last date of submission of the tender.

e) Should have valid Permanent Account Number of Income Tax and GST registration certificate (provisional).

f) Should have valid PF Registration number. In case the bidder does not have this registration number, he shall remain bound to obtain them within one month from the date of LOI or before release of 1st R/A bill whichever is earlier.

g) Bid Capacity: The bidding capacity of the tenderer should be equal to or more than the estimated cost of the work put to Tender.
   The Bidding capacity shall be worked out by the following formula:
   \[ \text{Bidding Capacity} = [A \times N \times 2] - B \]
   Where,
   \[ A = \text{Maximum value of construction works executed in any one year during the last five years taking into account the Completed as well as works in progress ending last day of the month previous to the one in which applications invited.} \]
   \[ N = \text{Number of years prescribed for completion of work for which bids have been invited} \]
   \[ B = \text{Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited. The Tenderer is requested to furnish the existing commitments of works under execution along with stipulated period for completion of remaining for each of the work should be furnished in an affidavit on non-judicial stamp paper of value of Rs. 100/- duly certified that the particulars furnished are correct as per the Performa in Annexure –A} \]

h) Bidders who intend to get exemption from submission of Tender fee and EMD shall submit confirmation letter whether they are registered under MSME Act or not and if yes, then relevant copies of the registration letter (Registered under single point registration scheme of NSIC, Govt. of India, Ministry of MSME, New Delhi) vide Gazette Notification dated 26.03.2012 along with the form of Memorandum-2 (with the concerned DIC) certificate in the appropriate category and limit as applicable under the present tender to be enclosed in Technical Bid and a request letter for exemption from submission of Tender fee and EMD.

Further submission of Tender fee (payable to EPI) and EMD is also exempted for the bidders who had participated in the NIT No NERO/CON/ASR/Silchar/268 however such bidders are required to upload scanned copy of the earlier DD’s or Bankers’ Cheques in
the TCIL portal and copies in the physical form.

i) Even though an applicant may satisfy the eligibility criteria, EPI reserves the right for not issuing the tender document if he has record of poor performance such as abandoning work, not properly completing the work, delay in execution of work, poor quality of work, financial failure/weakness etc.

j) The experience certificates issued by Government Organizations / Semi Government Organizations/ State Government / Public Works Department / Central Government/Public Sector Undertakings/ Autonomous Bodies/Municipal Bodies/Public Limited Companies listed on BSE/NSE shall only be accepted for assessing the eligibility of the tenderer. However, the certificates issued by Public Limited Company and Private Party can be considered only if they are supported by TDS certificates/Turnover Certificate from Chartered Accountant in support of value of work done by the tenderer.

k) Completion certificates from the client shall be in the name of the company who is submitting the tender. The contractor has to produce original documents for their verification as and when demanded by EPI. The tender of any tenderer shall be rejected if on detailed scrutiny; documents submitted along with the tender are found to be unsatisfactory/forged. The decision of EPI in this regard shall be final and the binding on the tenderer.

l) Relevant experience certificates and other documents as mentioned above fulfilling the qualifying criteria duly self-attested by the tenderer shall be enclosed in Envelope-1. Completion Certificates from clients shall be in the name of the Company who is submitting the tender. The bidder has to produce original documents for verification at the time of opening of tender or as and when demanded. The Tender of any tenderer shall be rejected if on detailed scrutiny, documents submitted along with the tender are found to be unsatisfactory. The decision of EPI in this regard shall be final and binding on the tenderer.

m) Site visit for the subject tender is mandatory. The bidders shall visit the site to Study/assess the tendered work and also acquaint themselves of the prevailing local conditions before submitting their bid. Bidder has to enclose a certificate counter signed by EPI official or furnish undertaking for having visited the site.

n) The tenderers may note that they are liable to be disqualified and not considered for the opening of Price Bid if;
   a) Representation in the forms, statements and attachments submitted in the pre-qualification document are proved to be incorrect, false and misleading.
   b) They have record of poor performance during the past 10 (ten) years such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the contractor, inordinate delay in completion, consistent history of litigation/arbitration awarded against the contractor or any of its constituents or financial failures due to bankruptcy etc. in their ongoing/past projects.
c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.

d) If the tenderers attempt to influence any member of the selection committee.

EPI reserves its right to take appropriate action including disqualification of tenderer(s) as may be deemed fit and proper by EPI at any time without giving any notice to the contractor in this regard. The decision of EPI in the matter of disqualification shall be final and binding on the Tenderers.

The credentials of the Bidders shall be verified and inspection of the works, if required, to be carried out by EPI. If not found satisfactory, their bid will be considered non-responsive.

2.0 Tender documents comprising of the following are available on the website of EPI: www.epi.gov.in, CPP-Portal: www.eprocure.gov.in and as well as on TCIL portal http://www.tcil-india-electronicstender.com.

Volume I: Instructions to Tenderers, Addendum to Instructions to Tenderers, Special Instructions to Bidders for e-Tendering & General Conditions of Contract (ITT&GCC) of EPI

Volume II: a) Notice inviting Tender
b) Additional Conditions of Contract
c) Technical Specification (Civil, Sanitary Plumbing and Drainage, Electrical)
d) Tender Drawings (as mentioned in the list)

Volume III: Price bid/bill of quantity

3.0 In order to participate, the bidder should have Digital Signature Certificate (DSC) from one of the authorized Certifying Authorities.

4.0 Interested bidders have to necessarily register themselves on the portal https://www.tcil-india-electronicstender.com through M/s Telecommunications Consultants India Limited, New Delhi to participate in the bidding under this invitation for bids. It shall be the sole responsibility of the interested bidders to get them registered at the aforesaid portal for which they are required to contact M/s Telecommunications Consultants India Limited, New Delhi at following address to complete the registration formalities:

M/s Telecommunications Consultants India Limited, 6th Floor, TCIL Bhawan, Greater Kailash – 1, New Delhi 110 048
Contact No.: 011-26241790, 98683 93717/75/92
Email-ID: ets_support@tcil-india.com

They may obtain further information regarding this tender from GM (Contracts) at the address given at Clause No.14.0 below from 10:00 hours to 17:00 hours on all working days till the last date of online submission of Bidding Documents.

For proper uploading of the bids on the portal namely https://www.tcil-india-electronicstender.com (hereinafter referred to as the “portal”), it shall be the sole responsibility of the bidders to apprise themselves adequately regarding all the relevant procedures and provisions as detailed at the portal as well as by contacting M/s Telecommunications Consultants India Limited, New Delhi directly, as and when required, for which contact details are mentioned above. The EPI in no case shall be responsible for any issues related to timely or properly uploading/submission of the bid
in accordance with the relevant provisions of Section: Instruction to Bidders of the Bidding Documents.

5.0 Bidders can download the bid document from the portal without paying document fees in advance, any time from 20:00 Hrs on 04.10.2017; however interested bidders have to pay tender fees for participating in the tendering and submitting the bid. For this purpose the interested bidders shall be required to pay ₹ 5,000/- (Rupees Five Thousand only) as non-refundable document fees in the form of Demand Draft in favour of “Engineering Projects (India) Ltd.” payable at Guwahati.

6.0 E-Bids must be submitted/uploaded along with scanned copies of relevant documents as mentioned at clause no 2 of “Addendum to Instructions to Tenderers” under Single Stage Two Envelope Bidding Procedure on the TCIL portal on or before last date & time of online bid submission. Late bids will not be accepted. Under the above procedure, only first envelope (Technical Part) shall be opened in the presence of the bidders" representatives who choose to attend in person at the address given below on scheduled date & time of bid opening or may be viewed by the bidders by logging in to the portal as per features available to them. Second envelope i.e. Price part shall be opened of technically qualified bidders.

The bid must be accompanied by a Earnest Money Deposit (EMD) of 89,600.00 (Rupees Eighty Nine Thousand Six Hundred only) This can be either in the form of Crossed Demand Draft or Pay Order (in CTS form) of any Nationalized Bank/Scheduled Bank for the full amount of EMD payable favouring “Engineering Projects (India) Ltd.”, payable at Guwahati. The EMD shall be valid for minimum period of 150 days (one hundred fifty days) from the last day of submission of tender. Tenders submitted without EMD or inadequate amount of EMD shall be rejected. The bid shall be valid for 90 days from date of opening of Price Bid.

Tender fee, EMD (In original), Power of Attorney, NSIC/MSME(Registered under single point registration scheme of NSIC, Govt. of India, Ministry of MSME, New Delhi vide Gazette Notification dated 26.03.2012 along with the form of Memorandum-2 with the concerned DIC) certificate or a letter for having participated in the NIT no NERO/CON/ASR/Silchar/268 as per Clause No.1 (h) if bidder is claiming EMD/Tender fee exemption and Pass Phrase (Both for technical and financial bid in separate envelope) to decrypt the bid must be submitted in physical form at the address given at Clause No. 14.0 below on or before Last date and time of online bid submission. If the above documents are not received in time then their offer shall not be considered and EPI shall not be responsible for any postal delay in respect of submission of hard copy part of the bids.

7.0 The Terms & Conditions contained in the NIT and tender document shall be applicable.

8.0 The tenderers should note that the credentials such as value and volume of works completed, as submitted by the tenderers along with their offers shall be forwarded by EPI to Client for his opinion. The offer of tenderers against whom client does not give satisfactory remarks shall be rejected by EPI.

9.0 The corrigendum or addendum, extension, cancellation of this NIT, if any, shall be hosted on the EPI’s website/CPP portal as well as on TCIL portal http://www.tcil-india-electronic-tender.com the bidders are required to check these websites regularly for this purpose, to take into account before uploading/submission of tender. All Corrigendum and
addendum are to be uploaded duly signed & stamped with tender documents as bid Annexure.

10.0 The intending tenderers must not be or have been in litigation with EPI for last three years or at present. In case the participating tenderer(s) are found to have suppressed information in this respect the EMD submitted by him (they) shall be forfeited by EPI and his (their) tender shall be rejected. In case such suppression is detected after acceptance of his (their) tender i.e. on award of the works the order/LOI shall be withdrawn and his securities forfeited.

The tenderers should note that the credential such as value and volume of works completed as submitted by the tenderers along with their offers shall be forwarded by EPI to the owner, DGAR for his opinion. The offer of the tenderers against whom the Owner does not give satisfactory remarks shall be rejected by EPI.

11.0 The Price Bid of those bidders who are found to be prima-facie techno-commercially acceptable based on the documents submitted at the time of bid submission and also against fulfillment of conditions at sl. no. 10 above shall be opened with prior intimation to them. Hence the intending bidders must furnish their e-mail id along with the techno-commercial part. However, it is made clear that the offer of the bidders shall be accepted subject to the confirmation of authenticity of the PQ documents/ EMD /Tender fee from the concerned department/ bank. In case the PQ documents such as work experience certificate, bank solvency certificate etc submitted by a bidder is found to be fake the EMD submitted by him shall be forfeited by EPI without making any reference to him. Further such a tenderer shall be at a risk of losing his right to participate in any tender called by EPI for a minimum period of one year.

12.0 EPI reserves the right to accept any tender or reject any or all tenders or split the work of tender or annul this tendering process without assigning any reason and liability whatsoever and to re-invite tender at its sole discretion.

13.0 In case of tie-tender, where two firms are bidding lowest, EPI reserves the right to split the work among these bidders and / or EPI will reserve the right to award the tender to any one of such bidder.

14.0 Tender documents shall be issued by and submitted to:

General Manager
Engineering Projects (India) Ltd.
North Eastern Regional Office
4th Floor, Hindustan Tower, Block – A,
Jawahar Nagar, Opp. Assam Weigh Bridge
National Highway No.37,
Beltola -781022, Guwahati (Assam)
Tel No. 0361-2133687, e-mail id:neroguwahati@gmail.com

15.0 Contact details for site related quarries:
Shri R Borah, Sr Manager
Mobile No. -09774009648/09774364563

General Manager
<table>
<thead>
<tr>
<th>BID CAPACITY</th>
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<tbody>
<tr>
<td><strong>Name of the Work:</strong> CONSTRUCTION OF 06 Nos. Type-II (G+II) Quarter In 01 Block Including Infrastructural Development Works For Assam Rifles At Silchar, Assam</td>
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<tr>
<td><strong>NIT No:</strong> NERO/CON/ASR/Silchar/273</td>
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<tr>
<td><strong>ESTIMATED COST PUT TO TENDER:</strong> Rs. 89,57,000.00</td>
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</table>

Bid Capacity: The bidding capacity of the contractor should be equal to or more than the estimated cost of the work put to Tender. The bidding capacity shall be worked out by the following formula:

\[
\text{Bidding Capacity} = \left[ A \times N \times 2 \right] - B
\]

Where,

- **A** = Maximum value of construction works executed in any one year during the last five years taking into account the completed as well as works in progress
- **N** = Number of years prescribed for completion of work for which bids have been invited
- **B** = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited (Format enclosed)

<table>
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<tr>
<th>BID CAPACITY CALCULATION BY BIDDER</th>
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| SIGN & STAMP OF BIDDER |
ANNEXURE-A

AFFIDAVIT

(To be typed on Rs. 100/- non-judicial stamp paper)

I/We ...................................... aged .............. years son of ....................................... do hereby solemnly affirm and declare as follows for and on behalf of the Firm:

LIST OF EXISTING COMMITMENT AND ONGOING WORKS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Works</th>
<th>Client Name &amp; Address</th>
<th>Work Order Value (in Rs)</th>
<th>Work Executed till Date (Rs)</th>
<th>Balance Amount of work to be completed (Rs)</th>
<th>Balance period to complete the works (Total months)</th>
<th>Work to be completed in 09 months (Rs)</th>
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Balance Commitments during 09 months as per NIT Rs

It is certified that the above particulars furnished are true and correct. If any information given is found to be concealed at a later date, the Contract will be terminated forthwith without prejudice to the rights thereon consequent on termination and the bidder will be blacklisted. I/We agree for debarring tendering for one year if any facts are suppressed.

SIGN AND STAMP OF BIDDER
ADDITIONAL CONDITIONS OF CONTRACT (ACC)

1.0 The following Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract (GCC) of EPI and other conditions of the tender documents. If there are any provisions in these Additional Conditions of Contract, which are at variance with the provisions of GCC and other conditions of the tender documents, the provisions in these Additional Conditions of Contract shall take precedence.

2.0 DGAR (Director General Assam Rifles), the Owner, has selected Engineering Projects (India) Limited (EPI) as the “PMC” for “Construction Of 06 Nos. Type-II (G+II) Quarter In 01 Block Including Infrastructural Development Works For Assam Rifles At Silchar, Assam”. The works intended to be executed under the instant contract shall include (but not limited to) providing labour, tools and plants, machineries, transport and all other components including materials (except those which are specifically excluded from scope/present tender as spelt out elsewhere in the tender documents) required for completion of the works. The works are to be executed at Assam Rifles, Silchar, Assam.

3.0 Clause no 3.0 of GCC shall stand amended as below:
The items of work given in the tender documents are for general guidance of the contractors and the works shall be carried out by the contractor on item rate basis in conformity with the detailed drawing, scope of work, technical specifications, additional conditions of contract (including any addition/modification/alteration/deletion made from time to time therein found essential for completion of works). The contractor shall be deemed to have satisfied himself before tendering as to the sufficiency and correctness of his tender for the works and of the rates and prices quoted in the brief specifications, drawings, scope of work and payment (billing) schedule, which rates and prices shall, except as otherwise provided, cover all obligations under the contract and all matters and things found necessary for proper completion and maintenance of the works. It shall be responsibility of the contractor to incorporate the changes that may be in the scope of work envisaged at the time of tendering and as actually required to be executed. The contractor has quoted his rates after clearly studying the scope of work given in Tender Documents availed by him by downloading from the website at the tendering stage itself and getting fully satisfied with the various items and technical intricacies involved in the work under his scope of work as envisaged in the tender. EPI shall not entertain any claim of the contractor on account of error or omission by him in this respect except what is admitted by the client.

4.0 No mobilisation advance shall be paid and hence clause no. 8 of GCC shall stand deleted.

5.0 Safety Code:
General
Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with safety rules as stated forth herein for information and guidance:
First Aid and Industrial Injuries
(1) Contractor shall maintain first aid facilities for his employees and labours.

(2) Contractor shall make outside agreements for ambulance service and for the treatment of industrial injuries. Names of those providing these services shall be furnished to the EIC prior to start of construction and their telephone numbers shall be prominently posted in Contractor’s field office.

(3) All critical industrial injuries shall be reported promptly to the EIC, and a copy of Contractor's report covering each personal injury requiring the attention of a physician shall be furnished to the EIC.

General Rules
Smoking within the battery area, tank farm or dock limits is strictly prohibited. Violators of the no smoking rules shall be discharged immediately.

Contractors Barricades
(1) Contractor shall erect and maintain barricades required in connection with his Operations to guard or protect.
   (a) Excavations.
   (b) Hoisting areas.
   (c) Areas adjudged hazardous Contractor's or Owner's inspectors.
   (d) Owner's existing property subject to damage by Contractor's operations.
   (e) Rail road unloading spots.

(2) Contractors employee and these of his sub-contractors shall become acquainted with owner's barricading practices and shall respect the provisions thereof.

(3) Barricades and hazardous areas adjacent to but not located in normal routes of travel shall be marked by red flasher lanterns at nights.

Scaffolding:
(i) Suitable scaffolding should be provided for workmen for all works that safety be done from the ground or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder shall be given an inclination not steeper more than 1 in 4 (1horizontal and 4 vertical)

(ii) Scaffolding or staging than 4 meters above the ground or floor, swing suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise rewarded at least 3 ft.

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 maybe necessary for the delivery of materials. Such scaffolding
or staging shall be so fastened as to prevent it from swaying from the building or structure.

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

(iv) Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform of the gangway or the stairway is more than 4 metres above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in above.

(v) Safe-means of access shall be provided to all working platforms and other working places, every ladder should be securely fixed. No portable single ladder shall be over 9 metres in length while the width between side rails in rung ladder shall in no case be less than 30cms for ladder up to and including 3 metres in length. For longer ladder this width should be increased at least 5 mm for each additional foot of length. Uniform steps spacing shall not exceed 30 cms. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the site of work shall be so stacked or placed to caused anger or inconvenience to any person or public. The Contractor shall also provide all necessary fencing and light to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit, action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and pay any damages and costs which may be awarded in any such suit or action or proceedings to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.

Excavation and Trenching
All trenches 1.2 metres or more in depth, shall at all times be supplied with at least one ladder for each 50 metres length or fraction thereof.

Ladder shall be extended from bottom of the trench to at least 1 metre above the surface of the ground. The sides of the trenches which are 1.5 metres in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 metres of the edge of the trench or half of the trench width whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.

Demolition:
(i) Before any demolition work is commenced and also during the progress of the work.
(a) All road 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 shall remain electrically charged.

(c) All practical cares shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.

(ii) All necessary personal safety equipment as considered adequate by the Engineer-in-charge (i.e. EIC) should be kept available for the use of the persons employed on the site and maintained in condition suitable for immediate use, and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned.

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

(b) Those engaged in white washing and mixing or stacking of cement bags or any materials which are injurious to the eyes shall be provided with protective goggles.

(c) Those engaged in welding and cutting works shall be provided with protective face and eye shields, hand gloves etc.

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

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

(f) The Contractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 years are employed on the work of lead painting, the following precautions should be taken,

(1) No paint containing lead or lead product shall be used except in the form of paste or ready-made paint.

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

(3) Overalls shall be supplied by the Contractor to the workmen and adequate facilities shall be provided to enable the working painters to wash them during and on cessation of.
(iii) When the work is done near any place where there is a risk of drowning, all Necessary safety equipment should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

(iv) Use of hoisting machines and tackles including their attachments, anchorage and supports shall conform to the following standards or conditions:

(a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defect and shall be kept in good working order.

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

(c) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 12 years should be in charge of any hoisting machine including any scaffolding, which or give signals to the operator.

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

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

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

(vi) All Scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe conditions and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.
(vii) These safety provisions should be brought to the notice of all concerned by the displaying on a notice board at a prominent place at the work-spot. The person responsible for compliance of the safety code shall be named therein by the Contractor.

(viii) To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangements made by the Contractor shall be open to inspection by the Welfare Officer, Engineer-in-Charge or safety Engineer of the administration or their representatives.

(ix) Notwithstanding the above clauses there is nothing in these to exempt the contractor from the operations of any other Act or rules in force in the Republic of India. The works throughout including any temporary works shall be carried out in such a manner as not to interfere in any way whatsoever with the traffic on any roads or footpaths at the site or in the vicinity thereto or any exiting works whether the property of the Administration or of a third party. In addition to the above, the Contractor shall abide by the safety code provision as per C.P.W.D. Safety Code and Indian standard Safety Code framed from time to time.

(x) The contractor shall keep one earmarked vehicle such as EECO or MAGIC or equivalent with driver, fuel & lubricant for meeting any emergent condition at site till the works under the instant contract are completed and taken over by the Owner.

(xi) The contractor shall also construct a suitable office accommodation at site at his cost to ensure safe and proper custody of all drawings, documents, appliances including easy access to them and relief to the staff and other personnel in case of any exigency. The office should be fully equipped with basic facilities such as telephone, internet, regular electric and water supply, computer/ typing with printing facilities, storage of documents and datas like almirahs or file cabinets etc.

6.0 The clause no. 10.0 of GCC shall stand amended as below:
An amount @5% (Five percent) of the gross value of the running bill shall be deducted from each running bill by way of retention money. In case the EMD has been deposited by the contractor in the form of demand draft, the said amount of EMD shall be adjusted first towards the retention money and further recovery of retention money shall commence when the upto date amount of retention money exceeds the amount of EMD deposited in the form of demand draft. The retention money shall become refundable to the contractor at the end of the defects liability period free of any interest provided always that the contractor has rectified all the defects arising during the defect liability period pertaining to his scope of work, EPI did not have to incur any expenditure in setting right the defects, if any, pertaining to the contractor's scope of work, the contractor has demolished and removed all structures including foundations and withdrawn fully from the worksite and EPI has received the clearance certificate from the concerned Labour Enforcement Officer/RLC pertaining to the labour etc. deployed by him at the worksite or there is nothing on record against him in the local market affecting functions of EPI. In case EPI has been required to make any expenditure on any of these accounts EPI will
keep the retention money till the time all these matters are settled in full including recovery of the expenses, if any, made by EPI from the retention money. Further the contractor has to furnish a ‘No Claim’ certificate to EPI in confirmation of his having no claim on getting refunded the retention money to EPI at the time of claiming refund of retention money.

Further the retention money shall be released only after the contractor furnishes two numbers of bank guarantees equivalent to the value of the works of waterproofing treatment and anti-termite treatment valid for 10 years from the date of handing over of the works in the name of Chief Engineer, Head Quarters, DGAR.

7.0 Setting out 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 and 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 stakes, templates, level marks, profiles and other similar things and shall take 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 Owner. The approval thereof or joining with the Contractor by the Owner in setting out the work, shall not relieve the Contractor or any of his responsibilities. Before beginning the works, the Contractor shall at his own cost, provide all necessary reference and level posts, pegs, bamboo, flags, ranging rods, strings and other materials for proper layout of the work in accordance with the scheme for bearing marks acceptable to the Owner. The Centre, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct marks at the centre to enable a 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 responsibility. The Contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points during 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.

8.0 Responsibility 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. It is highly possible that there shall be more than one agency working at the same time at the site. The contractor shall at all times remain bound to co-ordinate with the agencies, deployed by EPI for the above works, including providing free access and making required provisions for them in
execution of works pertaining to their portion of works. He shall also remain bound to ensure uninterrupted progress of work by these agencies in a peaceful and smooth manner. He shall also remain bound to make the required changes/additions/alterations in the works done by him to accommodate the items under the scope of work of such other agencies deployed by EPI or the client. The contractor is deemed to have made the estimated allowances in this respect while quoting his rates at the tendering stage.

Even though EPI has taken all care to attach all the drawings as vetted by the client it shall be the responsibility of the contractor to interpret the drawings for completion of the works under this contract.

The list of minimum tools, plant and machinery to be provided by the contractor within the period mentioned against the respective item is given at Annexure-A.

9.0 The following shall also be read with clause number 13 of the GCC:

a) The bidder/contractor must have valid GSTIN
b) The bidder/contractor must submit as a compliance under GST Act, the invoices in GST complaint format failing which the GST amount shall be recovered/ adjusted without any prior notice from the next invoices or available dues with EPI.
c) The bidder/contractor are required to update/upload the GST/Taxes data periodically so as to avail ITC credit by EPI failing which it shall be recovered/adjusted by EPI without any prior

The rates quoted by the contractor shall be deemed to be include all taxes and duties except GST which shall be reimbursed to him subject to raising of tax invoice and filing of return and payment of tax as per GST law, failing which EPI shall no be able to honour his claims for any payment. The contractor has quoted his rates knowing fully well that submission of return and display of the same on GSTN portal is mandatory.

However, any variation in taxes and duties after submission of due date of submission of tender shall be to the owner’s account i.e. in case of any decrease in the taxes and duties shall be passed on to the owner and any increase in taxes and duties shall be borne by the Owner. Similarly, the imposition of any fresh taxes and duties shall also be borne by the Owner.

All the above reimbursements shall be admitted to the extent these are admitted by the Owner.

10.0 The following shall stand added to the clause no 20 of GCC:

The contractor shall keep EPI indemnified against all claims, damages, compensation and expenses payable, if any, in consequence of any accident, or injury sustained by any workman or any other person employed by the contractor.
11.0 The following shall stand added to the clause no 27.0 including its sub clauses of GCC of EPI:
The contractor, within 10 days of issuance of LOI (Letter of Intent) to him shall depute at least one graduate civil engineer with 5 years of post-qualification experience and one person having diploma in civil engineering with 10 years of post-qualification experience. The contractor shall also depute at least one graduate electrical engineer with 5 years of post-qualification experience or one person having diploma in electrical engineering with 10 years of post-qualification experience as and when instructed by the Engineer-charge. Should the contractor fail to provide them within such period or as directed by the Engineer-in-charge, EPI shall be at liberty to recover an amount @30,000.00 per month person from any amount including the retention money due to the contractor.

12.0 The clause no 28.3 of the GCC shall stand deleted.

13.0 No secured advance shall be paid to the contractor and hence clause no. 35.0 of GCC shall stand deleted.

14.0 The clause no. 43.2 shall stand amended as below:
The contractor shall execute the works so as to complete the works within the stipulated completion time. He shall remain bound to submit a programme of completion of items.

15.0 The following shall stand added to clause no 45.0 of the GCC:
The contractor shall at all-time remain bound to provide the samples in quantity and manner as instructed by EPI to be analysed or tested in an outside laboratory or in the field laboratory at site. The cost of testing charges is included in the prices of the contractor. EPI shall, however, be at liberty to get the materials tested independent of the contractor and the contractor shall remain bound to render all assistance to EPI in conductance of such tests including making available the materials in sufficient quantity and in time and payment of the testing charges. EPI/client shall at all times have full access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery. The contractor shall afford every facility and assistance and cost in obtaining the right and visit to such access.

EPI shall have full powers to require the removal from the premises of all materials which in their opinion are not in accordance with the specifications and in case of default, EPI shall be at liberty to employ at the expense of the contractor, other persons to remove such materials without being answerable or accountable for any loss or damage that may happen or arise to such materials. EPI shall also have full powers to require other proper materials to be substituted thereof and in case of default by the contractor, may cause the same to be supplied and all costs which may require such removal and substitution shall be to the contractor’s account.

16.0 The following shall be added to clause no 52.6 of GCC:
The field testing laboratory to be established by the contractor at his cost shall be equipped with the minimum number of testing equipment as per Annexure-B. In case...
the contractor fails to provide them EPI shall get them installed and debit the cost to the contractor.

17.0 The following provisions shall supersede that of clause no 69 of GCC wherever applicable:
No claim on account of extra / substituted / variation of items etc. pertaining to the contractor’s portion of work save and except what is admitted and paid by Owner, shall be entertained or admitted by EPI. Any claim by the contractor, if not paid by the Owner, whatsoever be the reason shall not be admitted by EPI. But under no circumstances contractor shall suspend the work on the non-settlement of rates under this clause.

18.0 In case the project execution is delayed beyond the contractual scheduled completion period due to reasons attributable to the contractor, the staff and site expenses of EPI for extended period shall be paid by him to EPI at the rate of Rs. 10,000/- per month. This shall be in addition to the the other recoveries, if applicable as per clause no 72 (including its sub clauses) of GCC and Penalties etc. if any, levied by Owner for the works pertaining to the contractor’s scope of work. The decision of EPI in this regard shall be final & binding on the contractor.

19.0 The work executed by the contractor shall be subject to audit and quality control checks from Quality Control Division & Technical Audit of EPI, Client, and Inspecting Agency of the Client and Chief Technical Examiner of Central Vigilance Commission, Govt. of India. In the eventuality of any defect/ substandard works as brought out in the report or noticed otherwise at any time during execution, maintenance period etc., the same shall be made good by the contractor without any cost to EPI. In case the contractor fails to rectify the defect/sub-standard work within the time period stipulated by EPI, EPI shall get it rectified at the risk and cost of the contractor and shall recover the amount from the dues of the contractor. Further all works Executed by the contractor shall be subject to third party testing to be deployed by EPI for which the expenses shall be borne by the contractor within his quoted rates.

20.0 Execution of Work. Once the contract is awarded a work order will be issued to the contractor and site handed over and in no case this will be issued on back date. Time for completion will commence from the date of issue of work order. Engineer in charge will be nominated by name and communicated to all concerned and during his absence relief will be given by name. Following procedures to be ensured:

(a) A Testing Laboratory will be established by the Agency or suitable tie up done with approved testing laboratory or consultancy for quality check.

(b) Following registers/documents will be maintained and produced when asked for:

- i. Hindrance recording register.
- ii. Stage passing register.
- iii. Site order book.
- iv. Inspection register.
v. Materials testing register.
v. Contractor ledger.
vii. Labour license.
viii. CAR/EAR/MCI Policy with STPI, Earthquake & TPL

(c) Monthly progress will be monitored and forwarded to all concerned.

(d) Time extension if required must be processed well in advance before existing completion date supported by documents like newspaper cutting, letter from user etc.

(e) If any willful delay from contractor is noticed suitable action taken as per contract condition and work to be completed by due date by resorting to alternate means specified in contract conditions.

(f) Quality checks to be carried out at each level to be laid down percentage wise during the process of execution.

(g) If any unforeseen delay occurs the same must be resolved by coordinating with all stakeholders.

21.0 Preparation of Running Account Register. Work carried out by the contractor should be jointly measured and entered in to the measurement book. Any mistakes in the MB will be scored and initialed. Following documents to be submitted along with RAR:

(a) Measurement Book.
(b) Photographs of the work carried out duly signed by Agency and SO1 Wks.
(c) Quality test reports from approved laboratory.
(d) Recommended Liquidity Damages for delayed works.
(e) RAR Movement slip.

22.0 Completion and Handing over of Assets to User. Once the work is completed certificate will be obtained from user and work officer of the sector and then the same will be intimated to Engineers branch for ordering Board to verify and take over assets. All construction materials and tools lying in the site will be removed and assets will be kept ready for handing over to user. A performance report of the contractor will be forwarded to the Engineers branch and all warranty will be documented and handed over to the works officer of the sector.

It is mandatory to adhere to the guidelines for executing the works pertaining to Assam Rifles. Any deviation or failure will be treated as violation of MoU and due penalty will be imposed on the Agency charges and denial of future works.

23.0 There shall be no Arbitration Clause for this Contract except between Central Public Sector Undertakings inter se / Government of India Departments / Ministries as mentioned and Clause Nos. 76.1 & 76.2 of General Conditions of Contract (GCC) shall stand amended as below:
23.1 Clause no 76.1 of GCC shall stand deleted.

23.2 Clause no 76.2 shall stand amended as below:

i) In the event of any dispute or difference relating to the interpretation and application of the provisions of the contract, such dispute or difference shall be referred by either party to the arbitration as per the instructions (Office Memorandum / Circulars) issued by Govt. of India from time to time with regard to arbitration between one Government Department and another one Government Department and a Public Sector Enterprise and Public Sector Enterprise inter se.

ii) Subject to any amendment that may be carried out by the Government of India from time to time, the procedure to be followed in the arbitration shall be as is contained in D.O. No. F.No.4(1)/2013-DPE (PMA)/FTS-1835 dated 11.04.2017 of Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises, Govt. of India or any modification issued in this regard.

24.0 EPI has awarded this contract on behalf of DGAR (Director General Assam Rifles), Owner. In case EPI ceases to or exits from the project the right and responsibility etc of EPI in the contract shall get transferred to DGAR (Director General Assam Rifles) or his nominated agency(ies).

25.0 Completion and taking over:
As soon as the works are completed the contractor shall inform EPI and EPI in turn shall inform DGAR who will nominate a board of officers for checking/verification of completed work as per the contract for final taking over of the project.

A final certificate of rectification of all defects pointed out during handing/taking over by the nominated board of DGAR and/or during defect liability period shall be obtain from the SO1(works) of the respective range prior to release of security deposit.

a) Completion certificate issued by the Engineer-in-charge specifying the handing over of the work including list of inventories (fitting & fixtures).

b) No claim certificate by the Contractor.

c) No claim certificate from the sub-agencies/vendors engaged by the Contractor.

d) Detail required for preparing as built drawings.

e) Periodical services and measurement books.

f) Drawings for layout of underground cables and details showing location of sluice valves, electric cable joints etc.
## ANNEXURE-A

### LIST OF MINIMUM TOOLS, PLANT AND MACHINERY

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital theodolite/Total station</td>
<td>One no</td>
<td>As and when instructed/required</td>
</tr>
<tr>
<td>2</td>
<td>Levelling Instruments/ Auto level</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>3</td>
<td>DG Set 50 KVA (Minimum)</td>
<td>One no</td>
<td>As and when instructed/required</td>
</tr>
<tr>
<td>4</td>
<td>Concrete chipping machine</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>5</td>
<td>5 HP Diesel pump</td>
<td>Two no</td>
<td>10 days</td>
</tr>
<tr>
<td>6</td>
<td>Diesel concrete mixer with hopper &amp; Weighing arrangement (Full bag capacity)</td>
<td>Three nos</td>
<td>15 days</td>
</tr>
<tr>
<td>7</td>
<td>Concrete Vibrators with needles</td>
<td>Ten nos.</td>
<td>15 days</td>
</tr>
<tr>
<td>8</td>
<td>Steel Shuttering</td>
<td>1000 sqm</td>
<td>Progressively by 30 days</td>
</tr>
<tr>
<td>9</td>
<td>Dumpers/trucks</td>
<td>Four nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>10</td>
<td>Excavators (JCB/Poclaine)</td>
<td>One no</td>
<td>As and when instructed/required</td>
</tr>
<tr>
<td>11</td>
<td>Welding machines</td>
<td>One no.</td>
<td>As and when instructed/required</td>
</tr>
<tr>
<td>12</td>
<td>2 HP Electric pump</td>
<td>Two nos.</td>
<td>As and when instructed/required</td>
</tr>
<tr>
<td>13</td>
<td>Utility vehicle</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>14</td>
<td>Truck mounted water tanks</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>15</td>
<td>Portable Grinder (Electric)</td>
<td>Two nos.</td>
<td>As and when instructed/required</td>
</tr>
<tr>
<td>16</td>
<td>Portable Welding Machine</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>17</td>
<td>Portable Gas Cutting Sets with hoses and regulator</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>18</td>
<td>Pipe Threading Machine</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>19</td>
<td>Pipe Bending Machine (Hydraulic)</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>20</td>
<td>Portable Drilling Machine suitable for drilling of different sizes</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>21</td>
<td>Power Hacksaw</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>22</td>
<td>Hydraulic Crimping Machine</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>23</td>
<td>Hand Crimping Tools</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>24</td>
<td>Portable Electric Blowers</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>25</td>
<td>Miscellaneous items such as slings, pulleys, tarpaulins, wooden sleepers, ladders etc</td>
<td>Assorted</td>
<td>-do-</td>
</tr>
<tr>
<td>26</td>
<td>D-spanners, Ring spanners, allen keys etc of assorted size</td>
<td>As required</td>
<td>As and when instructed/required</td>
</tr>
<tr>
<td>27</td>
<td>Cutting, twisting and combination pliers</td>
<td>Three nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>28</td>
<td>Screw drivers - both star headed and plain headed of different sizes</td>
<td>Two sets</td>
<td>-do-</td>
</tr>
</tbody>
</table>

Notes:
1) The period mentioned above shall be reckoned from the date of start of commencement of work as mentioned under this contract.

2) The quantities and list of equipment indicated are tentative and can be increased/amended as per the requirement of work OR as per the direction of Engineer-in-Charge. The above equipment list is indicative and not complete. The contractor has to deploy all the required equipment to complete all the works within stipulated specifications & time period as contract documents.

3) The contractor will not be allowed to take out equipment from the site without the written permission of Engineer-in-Charge.

(Signature and seal of the Tenderer)
<table>
<thead>
<tr>
<th>SL.No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compressive Testing machine</td>
<td>One no</td>
<td>20 days</td>
</tr>
<tr>
<td>2</td>
<td>Electrically operated Digital Weighing Machine (0-5 kg)</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>3</td>
<td>Slump test apparatus</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>4</td>
<td>Set of sieves for grading of coarse aggregates</td>
<td>One set</td>
<td>10 days</td>
</tr>
<tr>
<td>5</td>
<td>Set of sieves for grading fine aggregates</td>
<td>One set</td>
<td>10 days</td>
</tr>
<tr>
<td>6</td>
<td>Cement consistency apparatus</td>
<td>One no</td>
<td>20 days</td>
</tr>
<tr>
<td>7</td>
<td>Electrically operated oven (300 deg Centigrade)</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>8</td>
<td>Trays for sampling</td>
<td>One set</td>
<td>10 days</td>
</tr>
<tr>
<td>9</td>
<td>Apparatus for testing of cement</td>
<td>One set</td>
<td>30 days</td>
</tr>
<tr>
<td>10</td>
<td>150X150X150 CI Cube Moulds</td>
<td>18 nos</td>
<td>10 days</td>
</tr>
<tr>
<td>11</td>
<td>Vicat Apparatus with needles, Test Tubes, breakers, thick glass plates etc</td>
<td>One set</td>
<td>15 days</td>
</tr>
<tr>
<td>12</td>
<td>Measuring Cylinders, 1000ml,500 ml</td>
<td>01</td>
<td>15 days</td>
</tr>
<tr>
<td>13</td>
<td>Wash Bottles, Capacity 500 ml</td>
<td>02</td>
<td>15 days</td>
</tr>
<tr>
<td>14</td>
<td>Sink</td>
<td>01</td>
<td>15 days</td>
</tr>
<tr>
<td>15</td>
<td>Litre: Measures:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Lit</td>
<td>02</td>
<td>15 days</td>
</tr>
<tr>
<td></td>
<td>04 Lit</td>
<td>01</td>
<td>15 days</td>
</tr>
<tr>
<td></td>
<td>0.5 Lit</td>
<td>01</td>
<td>15 days</td>
</tr>
<tr>
<td>16</td>
<td>Insulation tester 0-500-1000 V hand driven</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>17</td>
<td>Insulation tester 2500/5000 V motor driven</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>18</td>
<td>Phase sequence indicator</td>
<td>One no</td>
<td>20 days</td>
</tr>
<tr>
<td>19</td>
<td>Earth megger</td>
<td>One set</td>
<td>10 days</td>
</tr>
<tr>
<td>20</td>
<td>Single phase variac</td>
<td>One set</td>
<td>15 days</td>
</tr>
<tr>
<td>21</td>
<td>3 Phase Variac</td>
<td>One no</td>
<td>20 days</td>
</tr>
<tr>
<td>22</td>
<td>AVO-meter/multimeter</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>23</td>
<td>Portable ammeter, wattmeter, voltmeter, PF meter</td>
<td>One set</td>
<td>7 days</td>
</tr>
<tr>
<td>24</td>
<td>LUX METER</td>
<td>One set</td>
<td>30 days</td>
</tr>
<tr>
<td>25</td>
<td>Clip on meters of different ranges</td>
<td>18 nos.</td>
<td>10 days</td>
</tr>
</tbody>
</table>

Notes:

1) The period mentioned above shall be reckoned from the date of start of commencement of work as mentioned under this tender.
2) The quantities of equipment indicated are tentative and can be increased as per the requirement of work OR as per the direction of Engineer-in-Charge. The above equipment list is indicative and not complete. The contractor has to deploy all the required equipment to complete all the works within stipulated specifications & time period as per contract documents.

3) The contractor will not be allowed to take out equipment from the site without the written permission of Engineer-in-Charge.

(Signature and seal of the Tenderer)
SPECIFICATION FOR CIVIL WORKS (REVISED)

1.0 GENERAL

1.01 Unless otherwise specified in the nomenclature of individual item or in the specifications, for all works mentioned in this tender, the specifications and mode of measurements shall be in accordance with C.P.W.D. specifications 2009 Volume I to VI with upto date correction slips upto the date of tender. For the item not covered under CPWD specifications mentioned above, the work shall be executed as per latest relevant standards / codes published by B.I.S (formerly ISI) inclusive of all amendments issued thereto or revision thereof, if any, upto the date of submission of tender.

All mandatory tests specified in CPWD specifications 2009 Volume I to VI with upto date correction slips shall be carried out from the approved laboratories as desired by Architect / Engineer in charge of EPI. Testing charges including cartage, conveyance etc what so ever shall be borne by the successful bidder. If after any such test and in the opinion of the Architect / Engineer In-charge of EPI any work is found defective or unsound, the same shall have to be dismantled and to be redone by the successful bidder at their own cost.

In case of BIS (formerly ISI) codes / specifications are not available for any item of work the decision of the Engineer based on acceptable sound engineering practice and local usage shall be final and binding on the successful bidder.

1.02 The rates for different items of work shall be for all heights, lifts, leads and depths except where otherwise specified in the item of work or in additional conditions appended with the tender.

1.03 The work shall be carried out in accordance with the approved drawings. The drawings shall have to be properly co-related before executing the work. In case of any difference noticed between the drawings, final decision, in writing of the Engineer-in-Charge shall be obtained by the contractor. For items, where so required, samples shall be prepared before starting the particular items of work for prior approval of the Engineer and nothing extra shall be payable on this account.

1.04 Unless otherwise specified in the bill of quantities or drawings, the rates for all the items of work shall be considered as inclusive of pumping out water if required for which no extra payment will be made. This will include water encountered from any source such as rains, floods, sub-soil water table being high or due to any other cause whatsoever.

1.05 Any cement slurry added over base surface (or) for continuation of concreting for bond the cost for the same is deemed to have in built in the item unless otherwise / explicitly stated and nothing extra shall be payable or extra cement considered for consumption on this account.

1.06 The rates for all items in which the use of cement is involved in inclusive of charges for curing.
1.07 The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work dressed the site to the satisfaction of the Engineer before the work is considered as complete.

1.08 The rate quoted for all brick / concrete work shall be deemed to include making openings and making good these with the same specifications as shown in drawings and / or as directed. No extra payment shall be made to the contractor on this account.

1.09 The quoted rate shall be for finished items and shall be complete in all respects including the cost of all material, labour tools & plants, machinery etc. all taxes, duties, levies, octroi, royalty charges, statutory levies, cess etc. applicable from time to time and any other item required but not mentioned here involved in the operations described above. EPI shall not be supplying any materials, labour, plant etc. unless explicitly mentioned so.

1.10 Random Rubble Masonry retaining wall shall be constructed as per approved drawings based on different heights at different locations and payment for the same shall be made as per the rates of respective items available in the Bill of Quantities.

1.11 Rate for plastering work (excluding washed stone grit plaster on external wall surface) shall include for making grooves, bands etc. wherever required and nothing extra shall be paid for the same.

1.12 Rates for all concrete / plaster work shall include for making drip course molding, grooves etc. wherever required and nothing extra shall be paid for the same.

2.0 SCOPE OF WORK

- RCC framed structure incorporating recommendations from latest CPWD Specifications / National Building Codes.
- RCC Raft foundation / isolated footing as per latest CPWD Specifications / National Building Codes.
- Infill to frame with First Class Brickwork as per CPWD Specification / relevant BIS Code.
- Random Rubble Masonry / Stone Masonry Work as per latest CPWD Specifications / National Building Codes.

3.0 CIVIL FINISHES

Civil finishes shall be as mentioned in the relevant drawings, specifications and schedule of finishes.
3.1 The bidder shall be responsible for structural soundness of the building / project in all respect and a certificate thereon shall be furnished by the bidder to EPI on the completion of the work.

4.0 MATERIAL

All materials shall be of standard quality and from approved manufacturer, conforming to Indian Standards or equivalent and shall have IS Mark as far as possible unless otherwise approved by Engineer-in-Charge. The contractor shall get all materials approved by Engineer-in-Charge prior to procurement and use. The contractor shall furnish manufacturers certificates, for the material supplied by him when asked for. Further to that he shall get all the materials tested from an approved test house, if asked for by the Engineer-in-Charge. The cost for all tests and test certificates shall be borne by the contractor. No separate payment shall be made for the testing. The Engineer-in-Charge shall have the right to determine whether all or any material are suitable. If any material procured or brought to site found not conforming to specifications and satisfaction of Engineer-in-Charge, the contractor shall have to remove the same immediately from the site at his own expense and without any claim for compensation due to such rejection.

The contractor shall submit documentary evidence e.g. challans, bills etc. against the construction materials brought to site as a check to ensure that the required quantities as required for execution of works as per specification have been brought to site for incorporation in the work.

The contractor shall ensure that the bought out materials are brought to site in original sealed containers or packing bearing name of manufacturer and brand.

4.1 CEMENT

General: The cement shall be ordinary Portland cement of 43/53 grade conforming to IS: 8112 / IS: 12269 of approved manufacturer, as applicable for design and drawing.

4.1.1 TESTS AFTER DELIVERY

Each consignment of cement may, after delivery at site and at the discretion of the Engineer-in-Charge, be subjected to any or all of the tests and analysis required by the relevant Indian Standard Specifications. The contractor shall bear the cost of all such tests. Engineer-in-Charge may reject any cement as a result of any tests thereof, notwithstanding the manufacturer’s certificate.

4.2 REINFORCEMENT STEEL

General: Thermo Mechanically Treated bars conforming to IS: 1786 from approved manufacturers (BIS approved) shall be used.
4.3  **BRICKS**

The bricks shall be of approved quality having a minimum compressive strength of 75 Kg / cm², best quality locally available, well burnt, sound and of uniform quality and colour. These shall be free from salt and of standard size and shall conform to IS: 1077.

The water absorption shall not be more 20% of its dry weight when soaked in cold water for 24 hours, as per IS : 3102. The tolerance limit shall be 3% for absorption.

The brick sample taken at random from the lot shall be deposited with, and be approved by the Engineer-in-Charge before being used. All subsequent deliveries shall be upto the standards of the approved sample.

4.4  **COARSE AGGREGATE**

**General:** Aggregate of sizes between 4.75 mms to 150 mms will be termed as coarse aggregate. Coarse aggregate from approved quarries and conforming to IS: 383 will only be allowed to be used for the works. Coarse aggregate for reinforced concrete work shall consists of approved broken stone aggregate free from flat laminated or elongated pieces and shall be free from any organic material and shall be within the limits of the relative grading in IS – 383 table – II. Unless otherwise shown on the drawings all coarse aggregate in reinforced concrete shall be graded crushed stone aggregate of 20mm nominal size.

For plain cement concrete 40 mm down / 20 mm down coarse aggregate as per IS : 383 shall be used as per instructions of Engineer-in-Charge.

For damp proof coarse / screed concrete above roof slab 12 mm down coarse aggregate as per IS : 383 shall be used.

4.5  **FINE AGGREGATE**

Aggregate smaller than 4.75mm and within the grading limits and other requirements set in IS: 383 is termed as Fine aggregate or sand. Fine aggregate from approved sources and conforming to the above IS specification shall only be allowed to be used for the works.

For reinforced concrete, plain cement concrete, Brick work, damp proof coarse, screed concrete etc. sand of zone I & II shall only be used. Sand shall be clean river or pit sand of approved quality and shall be free from salts, earth dust or others impurities. It shall be washed with clean water and not more than 5% fine materials shall be allowed by settlement in water and passing through 10,000 mesh sieve.

For plasters sand of zone – II / zone – III shall be used as per instructions of Engineer-in-Charge.

4.6  **Water:** Water shall be clean and reasonably free from injurious deleterious materials, generally potable water shall be used.
5.0 OTHER MATERIALS

All materials not fully specified herein and which may be used in the work shall be approved by the Engineer-in-Charge and he shall have right to determine whether all or any of the materials offered or delivered for use in the work are suitable for the purpose. Contractor shall give the samples of materials to Engineer-in-Charge and shall get it approved before procurement and use.

6.0 PLAIN AND REINFORCED CONCRETE

This section of the specification deals with cement concrete plain or reinforced for general use and covers the requirements for concrete mix design, strength and quality, pouring at all levels, form work, protection, covering, finishing, admixtures, inserts, and other miscellaneous works. The provision of the latest version of IS : 456 shall be compiled with unless permitted otherwise and any other Indian Standard Code (Latest Revision) shall form part of the specification to the extent it has referred to or applicable within this specification.

6.1 GRADE OF CONCRETE

All reinforced concrete shall be either nominal mix concrete or design mix concrete and of grade M – 20 unless otherwise specified in drawing.

6.2 NOMINAL MIX CONCRETE

In proportioning concrete, the minimum quantity of cement shall be as specified in Table I of this specification and the amount to be actually used shall be determined by weight. The quantities of fine and coarse aggregates may be determined by volume, but preferably should be by weight. If fine aggregates are moist, allowance shall be made for bulking in case of volume batching in accordance with IS: 2386 (Part III). Allowance shall also be made for surface water present in the aggregates when computing the water content. The amount of surface water shall be determined by one of the field methods described in IS: 2386 (Part III). All the above data shall be maintained properly to the satisfaction of the Engineer-in-Charge.

The water cement ratio shall not be more than specified in IS : 456 (Latest edition) for respective grade of concrete. The cement in any nominal mix concrete proportion shall be increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction so that the water cement ratio specified for a particular grade of concrete is not exceeded. No extra payment shall be made to the contractor for use of the extra cement. If nominal mix concrete made in accordance with the proportion given in IS : 456 for a particular grade does not yield the specified strength and fails to satisfy the requirements of “Acceptance Criteria” for concrete as specified in IS : 456 the cement content shall be increased as directed by the Engineer-in-Charge to obtain the specified strength at no extra cost.

The use of richer mix shall be continued until the Engineer-in-Charge instructs otherwise.
Nominal mix concrete proportioned for a given specified grade including cases where the Engineer-in-Charge directs use of additional cement over the quantity specified for the particular grade, shall not, however, be placed in a higher grade on the ground that the test strengths are higher than the minimum specified for the desired grade.

6.3 **MIX PROPORTIONS**

The mix proportions for grades of concrete specified in drawings shall be designed to obtain strength corresponding to the values specified in IS : 456 for respective grades of concrete.

Preliminary tests, as specified in the IS code or as required by the Engineer-in-Charge, shall be carried out sufficiently ahead of the actual commencement of the work with different grades of concrete made from representative sample of aggregate and cement expected to be used on the job to ascertain the ratios by weight of cement to total aggregate, of fine to coarse aggregate and water cement ratio required to produce a concrete having specified strength and sufficient workability to enable it to be well consolidated and to be worked into corners of shuttering and around the reinforcement.

**TABLE – I**

**MINIMUM CEMENT CONTENT SPECIFIED FOR DIFFERENT GRADES OF CONCRETE**

<table>
<thead>
<tr>
<th>Grade of Concrete</th>
<th>Minimum cement content per Cum of finished concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>M – 10</td>
<td>236 Kg.</td>
</tr>
<tr>
<td>M – 15</td>
<td>310 Kg.</td>
</tr>
<tr>
<td>M – 20</td>
<td>360 Kg.</td>
</tr>
<tr>
<td>M – 25</td>
<td>410 Kg.</td>
</tr>
<tr>
<td>M – 30</td>
<td>500 Kg.</td>
</tr>
</tbody>
</table>

**LIMITS OF CONSISTENCY**

<table>
<thead>
<tr>
<th>Degree of Workability</th>
<th>Slump in mm, with standard code as per IS : 1199</th>
<th>Use for which concrete is suitable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>Very Low</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Low</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Medium</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

**Note:** Not with standing the above, the slump to be obtained for work in progress shall be as per the instructions of the Engineer-in-Charge.
6.4 WORKMANSHIP

All workmanship shall be according to the latest and best possible standard.

Before starting any pour the contractor shall obtain the approval of the Engineer-in-Charge. He shall obtain complete instruction about the materials and proportion to be used, slump, workability, quantity of water per unit weight of cement, number of test cubes to be taken, type of finishing to be done, any admixture to be added, any limitation on size of pour and stopping of in case of premature stopping of pours.

Before pouring any concrete the reinforcement steel, shuttering, staging, inserts etc. are to be got checked by the Engineer-In-Charge of EPI, to be recorded in the stage passing register and to be got signed by Engineer-In-Charge of EPI. Quality of stone chips, sand etc. and availability of the same in adequate quantity shall also to be got checked by Engineer-In-Charge of EPI.

6.5 MIXING OF CONCRETE

All concrete shall be mixed in a mechanically operated mixer of minimum capacity of 14 / 10 and including mechanically operated hopper capable of ensuring of uniform distribution of the materials throughout the mass. The proportion of fine and course aggregate, cement and water shall be as determined by the mix design or according to the fixed proportions in case of nominal mix concrete and shall be approved by the Engineer-in-Charge. The quantities of cement, fine aggregate and course aggregates shall be determined by weight. The water shall be measured accordingly after giving proper allowance for surface water present in the aggregate for which regular check shall be made by the contractors.

Water shall not be added to the mix until all the cement and aggregates constituting the batch are already in the drum and dry mixed for at least one minute. Mixing of each batch shall be continued until there is a uniform distribution of the materials but in no case shall mixing be done for less than two (2) minutes and at least forty (40) revolutions after all materials and water are in the drum. When absorbent aggregates are used or when the mix is very dry, the mixing time shall be extended as be directed by the Engineer-in-Charge. Mixer shall not be loaded above their rated capacity as it prevents through mixing. If there is segregation after unloading from the mixer the concrete should be remixed.

The entire contents of the drum shall be discharged before the ingredients for the next batch are fed into the drum. No partly set or remixed or excessively wet concrete shall be used and it shall be immediately removed from the site. Each time the work stops, the mixer shall be thoroughly cleaned and when the next mixing commences, the first batch shall have 10% additional cement at no extra cost to the owner to allow for loss in the drum.
6.6  **PLACEMENT OF CONCRETE**

Form work and reinforcement shall be approved in writing by the Engineer-in-Charge before concrete is placed. The forms shall be well wetted and all shavings, dirt and water that may have collected at the bottom shall be removed before concrete is placed. Concrete shall be deposited in its final position without segregation, re-handling or flowing. The interval between adding the water to the dry materials in the mixer and the completion of the final placing including compaction of the concrete shall be well within the initial setting time for the type of cement in use or as directed by the Engineer-in-Charge.

As far as possible, concrete shall be placed in formwork by means approved by the Engineer-in-Charge and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 180 cm shall be approved by the Engineer-in-Charge. Once the concrete is deposited in its final position, it shall not be disturbed. Care should be taken to avoid displacement of reinforcement or movement of formwork.

The placing of concrete shall be a continuous operation with no interruption in excess of 30 minutes between the placing of continuous portions of concrete.

After the concrete has been placed it shall be spreaded and thoroughly compacted by approved mechanical vibration to a maximum subsidence without segregation and thoroughly worked around reinforcement or other embedded fixtures to correct form and shape. Vibrators shall not be used for pushing and shoveling concrete into adjoining areas. Vibrators must be operated by experienced men and over-vibration shall not be permitted. Hand tamping in some cases may be allowed subject to the approval to ensure that the inserts, fixtures, reinforcement and formwork are not displaced or disturbed during placing of concrete. No concrete shall be placed in open while washing of cement and sand, the concrete shall be entirely removed immediately. Suitable precautions shall be taken in advance to guard against rains before leaving the fresh concrete unattended. No accumulation of water shall be permitted on or around freshly laid concrete. Slabs, Beams and similar members shall be poured in one operation normally. In special circumstances with the permission of Engineer-in-Charge these can be poured in horizontal layers not exceeding fifty (50) cm in depth. When poured in layers, it must be ensured that the under layer, is not already hardened. Bleeding of under layer if any, shall be effectively removed. Moulding, throating, drip courses, etc., shall be poured as shown in the drawing or as desired by the Engineer-in-Charge. Holes shall be left in concrete as shown on the approved drawings or as directed by the Engineer-in-Charge.

Whenever vibration has to be applied externally the design of formwork and the disposition of vibrators shall receive special consideration to ensure efficient compaction and to avoid surface blemishes.

6.7  **CONSTRUCTION JOINTS**

Whenever work is to be interrupted, the concrete shall be rebated at the joint to such shape and size as may be required by the Engineer-in-Charge or shown on the drawings. All vertical construction joints shall be made with stop boards, which are rigidly fixed and slotted to allow for the passage or reinforcement steel. If desired by the Engineer-in-Charge, keys and or dowel bars shall be provided if so specified on the drawings or desired by the Engineer-in-Charge. Constructions joints shall be provided in positions as shown or described, the joints shall be in accordance with following:
i) In a column, the joint shall be formed about 75 mm below the lowest soffit of the beams framing into it.

ii) Concrete in a beam shall be placed throughout without a joint, but if the provision of a joint is unavoidable, the joint shall be vertical and at the middle of the span.

iii) A joint in a suspended floor slab shall be vertical, at one of the quarter points of the span and at right angle to the principal reinforcement.

iv) In forming a joint, concrete shall not be allowed to slope away to thin edge. The locations of construction joints shall be planned by the contractor well in advance of pouring and shall be got approved from the Engineer-in-Charge.

v) Construction joints in foundation of any equipment shall not be provided without specific concurrence of the Engineer-in-Charge.

vi) Before fresh concrete is placed, the cement skin of the partially hardened concrete shall be thoroughly removed and surface made rough by hacking, sand blasting, water jetting, air jetting or any other methods as directed by Engineer-in-Charge. The rough surface shall be thoroughly wetted for about two hours and shall be dried and coated with 1:1 freshly mixed cement sand slurry immediately before placing the new concrete. The new concrete shall be worked against the prepared surface before the slurry etc. Special care shall be taken to see that the first layer of concrete placed after a construction joint is thoroughly rammed against the existing layer. Old joints during pour shall be treated with 1:1 freshly made cement sand slurry only after removing all loose materials.

6.8 CASTING OF SUNKEN SLAB

12 mm long or 6 mm long polyester fibres of approved make shall be mixed with cement @ 0.25% by weight of cement i.e. 125 gms per 50 Kg bag of cement while casting of RCC slab at sunken portion.

6.9 REPAIR AND FINISHES TO CONCRETE

All concrete surface either cast-on-situ or pre-cast shall have even, clean finish, free from honey combs, air bubbles, fine or other blemishes. The formwork, joint marks for concrete work exposed to view shall be rubbed out with carborundum stone and defects patched up with a paste of 1 part sand and 1 part cement and cured. The finish shall be made to the satisfaction of the Engineer-in-Charge.

Concrete surface to be subsequently plastered or where brickwork shall be build against it shall be adequately hacked as soon as the form is stripped off so that proper bond can develop.
6.10 CURING AND PROTECTION OF CONCRETE

Newly placed concrete shall be protected by approved means from rain, sun & wind. Concrete placed below ground level shall be protected from falling earth during and after placing. Concrete placed in ground containing deleterious substances shall be kept free from contact with such ground or with water draining from such ground during placing of concrete for a period of at least three days or as otherwise instructed by the Engineer-in-Charge. The ground water around newly poured concrete shall be kept to an approved level by pumping or other approved means of drainage. Adequate steps shall be taken to protect immature concrete from drainage by debris, excessive loading, vibration etc., which may impair the strength and durability of the concrete.

All fresh concrete shall be covered with a layer of Hessian or similar absorbent materials, and kept constantly wet for a period of fourteen days or more from the date of placing of concrete as per directions of the Engineer-in-Charge. Curing can also be done by ponding. Concrete slabs and floors shall be cured by flooding with water of minimum 25 mm depth for the period mentioned above. Steps shall also be taken to protect immature concrete from damage by debris, excessive loading, vibrations, abrasion, deleterious ground water, mixing with earth or foreign materials, floatation etc. that may impair the strength and durability of the concrete. Approved curing compounds may be used in view of moist curing with the permission of the Engineer-in-Charge. Such compounds shall be applied to all the exposed surfaces of the concrete as soon as possible after the concrete has set.

6.11 TESTING AND ACCEPTANCE CRITERIA

The contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards at his own cost, in a laboratory approved by the Engineer-in-Charge.

6.11.1 TESTING OF CONCRETE

a) Normally, only compression tests shall be performed but the Engineer-in-Charge may require other tests to be performed in accordance with IS: 516 (Latest Edition).

b) The minimum frequency of sampling for each grade of concrete shall be as follows:

<table>
<thead>
<tr>
<th>Quantity of concrete in the work cu.m</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 5</td>
<td>1</td>
</tr>
<tr>
<td>6 – 15</td>
<td>2</td>
</tr>
<tr>
<td>16 – 30</td>
<td>3</td>
</tr>
<tr>
<td>31 – 50</td>
<td>4</td>
</tr>
<tr>
<td>51 &amp; above</td>
<td>4 plus one additional sample for each additional 50 cum or part thereof.</td>
</tr>
</tbody>
</table>

However at least one sample shall be taken from each shift.
At least 6 (six) specimens per sample shall be taken and 3 (three) of these shall be tested at 7 (seven) days and the remaining at 28 days. Minimum compressive strength on 15 cm cubes of different grades of concrete at 7 days shall be as per table 5 of IS: 456-1978.

a) To control the consistency of concrete from every mixing plant, slump test and or compaction factor test in accordance with IS: 1199 shall be carried out by the contractor every two hours or as directed for the test specimens and shall be recorded for reference. The Engineer-in-Charge may, at his discretion, may waive the above tests for small and unimportant concreting.

6.11.2 ACCEPTANCE CRITERIA FOR CONCRETE

a) The acceptance criteria for concrete shall be in accordance with IS: 456 (Latest Edition). However, in exceptional circumstances, the Engineer-in-Charge may, at his discretion, accept a concrete of lower strength than specified and which is otherwise unacceptable according to IS: 456 (Latest Edition).

b) Payment for concrete which is normally unacceptable as per the criteria laid down in IS: 456, but has been accepted by the Engineer-in-Charge shall be made at a reduced rate prorate to the strength obtained.

c) Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specification by the contractor. No payment shall be made for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures, etc. wasted in the dismantled portion. If any damage is done to the embedded portion or adjacent structures, the same shall be made good free of charge by the contractor, to the satisfaction of the Engineer-in-Charge.

6.11.3 LOAD TEST OF CONCRETE

Load test on concrete, if desired by the Engineer-in-Charge, shall be carried out as soon as possible after expiry of 28 days from the time of placing of concrete as per IS: 456. Entire cost of load testing shall be borne by the contractor and if, any portion of the structure is found unacceptable under the relevant clause of IS: 456, the same shall be dismantled and replaced by a new structure as per specification at no extra cost. If the adjacent structure gets damaged, the same shall be made good free of charge by the contractor to the satisfaction of the Engineer-in-Charge.

6.11.4 CONCRETING AT SUNKEN PORTION OF WC / TOILET / KITCHEN

Modified polyester fibre of approved make of 12 mm / 6 mm cut length is to be added in the concrete of sunken portion (sunken slab and vertical wall portion) @ 0.25% by weight of cement used i.e. 125 grams per 50 kg bag of cement.
7.0 FORMWORK

If it is so desired by the Engineer-in-Charge, the contractor shall prepare before commencement of the actual work, design and drawings for formwork and centering and get them approved by the Engineer-in-Charge. The formwork shall conform to the shape, line and dimensions as shown on the drawings.

Formwork shall be of laminated shuttering plywood of minimum 12 mm thickness as per BIS for columns and beams etc. and of laminated shuttering plywood of minimum 12 mm thickness as per BIS and or welded steel plates of uniform pattern for slabs. Struts shall generally be of mild steel tubes and strong sal bolls 150 mm or above in diameter. Bamboos, small diameter bolls, etc., shall not be used unless approved by the Engineer-in-Charge in specific cases.

Supports or props should not be put on any un-propped lower suspended floor or beam unless calculations are submitted to the Engineer-in-Charge to confirm the strength of the lower floor beam and no propping shall be taken out until the Engineer-in-Charge’s approval has been obtained.

The centering shall be true and rigid and thoroughly braced both horizontally and diagonally. The forms shall be sufficiently strong to carry without undue deformation, the dead weight load. Where the concrete is vibrated the form work shall be strong enough to withstand the effects of vibration without appreciable deflection, bulging, distortion or loosening of its components. The joints in the form work shall be sufficiently tight to prevent any leakage of mortar. The form work shall be such as to ensure a smooth uniform surface free from honeycombs, air bubbles, bulges, fins and other blemishes. Any blemish or defect found on the notice of the Engineer-in-Charge immediately and rectified free of charge as directed by him. To achieve the desired rigidity tie bolts, spacer blocks, the wires clamps as approved by the Engineer-in-Charge shall be used but they must in no way impair the strength of concrete or leaves stains or marks on the finished surface. Where there are chances of these fixtures being embedded, only mild steel or concrete of adequate strength shall be used. Bolts passing completely through liquid retaining walls/slabs for the purpose of security and aligning the form work should not be used.

For exposed interior and exterior concrete surface of beams, columns and walls, plywood or other approved forms thoroughly cleaned and tied together with approved corrosion-resistant device shall be used. All floor and beam centering shall be crowned not less than 8 mm in all direction for every 5.0 meters span. Unless described on the drawing or to the contrary beveled strips 25 mm by 25 mm shall be provided, without any extra charge, to form angles and in corners of column and beam boxes for chamfering of corners. Temporary openings for cleaning, inspection and for pouring concrete shall be provided where they are necessary and as may be directed by the Engineer-in-Charge. The temporary opening shall be so formed that they can be conveniently closed when required and must not leave any mark on the concrete.
7.1 **CLEANING AND TREATMENT OF FORMS**

All forms shall be thoroughly cleaned of old concrete, wood shaving, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish loose concrete, chippings, shavings, saw dust etc., shall be scrupulously removed from the interior of the forms before the concrete is poured as directed by the Engineer-in-Charge.

Before shuttering is placed in position, the form surface in contact with concrete shall be treated with approved non-staining oil or composition. Care shall be taken that the oil or composition does not come in contact with reinforcing steel or existing concrete surfaces. It shall not be allowed to accumulate at the bottom of the shuttering.

The form work shall be so designed and so erected that the forms for slabs and the sides of beams, columns and walls may be removed first, leaving the shuttering to the soffits of beams and their supports in position. Supporting of beams shall not be done except with the approval of the Engineer-in-Charge and props can be reinstated in anticipation of abnormal conditions. If form work for column is erected for the full height of the columns, one side shall be left open and built up in section as placing of concrete proceeds. Wedges, spacer bolts, clamps or other suitable means shall be provided to allow accurate adjustments of the form work and to allow it to be removed gradually without disturbing the concrete.

7.2 **REMOVAL OF FORMS**

The contractor shall begin the removal of form work only after approval of Engineer-in-Charge. He shall place on record the date on which the concrete is placed in different parts of the work and the date of the removal of form work there from. This record shall be checked and countersigned by the Engineer-in-Charge. The contractor shall be responsible for the safe removal of form work but the Engineer-in-Charge may delay the time of removal if he considers it necessary. Any work showing signs of damage through premature removal of form work or loading shall be entirely removal of form work or loading shall be entirely reconstructed without any extra cost to owner.

Forms for various types of structural components shall not be removed before the minimum periods specified in IS: 456 (latest edition) which shall also be subject to the approval of the Engineer-in-Charge.

However, in any case, form work shall not be struck until the concrete has reached a strength at least twice the stress to which the concrete may be subjected at the time of removal of forms.

The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab, beam or arch as the case may be together with any live load likely to accrue during or further construction.

Where the shape of the element is such that the form work has re-entrant angles, the form work shall be removed as soon as possible after the concrete has set to avoid shrinkage cracks occurring due to the restraint imposed.

The form work shall be so made as to produce a finished concrete, true to shape, lines, levels, plumb and dimensions as shown in drawings.
7.3 **RE – USE OF FORMS**

Before re-use all forms shall be thoroughly scrapped, cleaned, joints etc., examined and when necessary repaired and inside surface treated as specified herein before. Formwork shall not be used/re-used if declared unfit or unserviceable by the Engineer-in-Charge.

8.0 **FABRICATION AND PLACEMENT OF REINFORCEMENT STEEL**

The contractor shall prepare and furnish to EPIL bar-bending schedule with working drawings for all R.C.C. works for review and approval by the Engineer-in-Charge. No work shall be commenced without the approval of the bar-bending schedule by the Engineer-in-Charge.

The contractor shall supply, fabricate and place the reinforcement steel to shapes and dimensions as per drawings and specifications.

Any adjustment of reinforcement to suit field conditions, construction joints other than those shown on drawings shall be subject to approval of the Engineer-in-Charge.

8.1 **CLEANING**

Before placing the concrete all steel for reinforcement shall be made free from loose scale, rust, oil, grease, paint or any other harmful matter which may affect its bond with concrete.

8.2 **BENDING**

Unless otherwise specified, reinforcing steel shall be bent in accordance with procedure specified in IS: 2520 and or as approved by the Engineer-in-Charge. Bends and shapes shall comply strictly with the dimensions given in the approved Bar Bending schedule. Bending schedule shall be rechecked by the contractor before bending and he shall be entirely responsible for its correctness.

No reinforcement steel shall be bent when in position in the work without approval of Engineer-in-Charge, whether or not it is partially embedded in concrete. Bars shall not be straightened in manner that will injure the material. Re-bending can only be done if approved by the Engineer-in-Charge. Reinforcement bars shall be bent by machine or other approved means producing a gradual and even motion.

8.3 **PLACING IN POSITION**

All reinforcement shall be accurately fixed and maintained in position as shown on the drawings by such approved means as steel chairs and or concrete spacer blocks. Bars intended to be in contact at crossing points shall be securely bound together at all such points by two number No. 20G annealed soft iron wire.

Binders shall tightly embrace the bars with which they are intended to be in contact and shall be securely held. The vertical distance between successive layers of bars shall be maintained by provision of steel spacer bars. They should be so spaced that the main bars do not sag perceptively between adjacent spacers.
The placing of reinforcement steel shall be completed well in advance of concrete pouring. Immediately before pouring, the reinforcement steel shall be checked by the Engineer-in-Charge for accuracy of placement and cleanliness and necessary corrections as directed by him shall be carried out. The concrete cover over the reinforcement shall be as shown on the approved drawings unless otherwise directed by the Engineer-in-Charge. Care should be taken to ensure that projecting ends of ties and other embedded metal do not encroach into the concrete cover. Where concrete blocks are used for ensuring the cover and positioning reinforcement, they shall be made of mortar 1:2 (one part cement: two parts sand) by volume and cured for at least 7 days. The sizes and locations of the concrete blocks shall be approved by the Engineer-in-Charge. Laps and anchorage lengths of reinforcing bars shall be in accordance with IS:456, unless otherwise specified. If the bars in a lap are not of the same diameter, the smaller will guide the lap length. The laps shall be staggered as far as practicable and as directed by the Engineer-in-Charge, and not more than 50% of bars shall be lapped at particular section.

9.0 BRICK WORK

9.1 SCOPE

This specification covers furnishing, installation, repairing, finishing, curing, protection, maintenance and handing over of masonry works for use in structures and at locations covered under the scope of the contract.

9.2 GENERAL

All masonry work shall be true to lines and levels as shown on drawings. All masonry shall be tightly built against structural members and mounded with dowels, inserts etc., as shown on drawings.

9.3 MORTAR

Mortar for brick work except for half brick or lower thickness walls shall generally be in 1 part cement and 5 parts sand by volume unless otherwise stated. Mortar for half brick and lower thickness brick walls shall be 1 part cement and 4 parts sand by volume unless stated otherwise.

The unit of measurement for cement shall be a bag of cement weighing 50 Kg. and this shall be taken as 0.035 cu.m. Other ingredients in specified proportions shall be measured in boxes of suitable size. Sand shall be measured on the basis of its dry volume. In case of damp sand, its quantity shall be increased suitably to allow for bulkage.

Cement and sand shall be mixed dry thoroughly on clean approved platform and water shall then be added to obtain a mortar of the consistency of a stiff paste, care being taken to add just sufficient water for the purpose. Mortar shall be used as early as possible after mixing and before it has begun to set and in any case within 30 minutes after water is added to dry mixture. Mortar unused for more than 30 minutes shall be rejected and removed from site of work.
9.4 LAYING

Brick shall be soaked by submergence in clean water for at least 6 hours in approved vats before use. The contractor shall provide tanks of sufficient capacity to allow the specified immersion. Bricks shall be laid in water by hand and not thrown. The bricks shall not be too wet at the time of use, as they are likely to slip on the mortar bed and there will be difficulty in ensuring plumbness of the wall. Bricks shall be laid in English bond unless specified otherwise. Broken bricks shall not be used. Cut bricks shall be used if necessary to complete bond or as closers. Bricks shall be laid with frogs upwards over full mortar beds. Bricks shall be pressed into mortar and tapped into final positions so as to be embed fully in mortar. Inside faces shall be buttered with mortar before the next brick is placed and pressed against it. Thus all joints between bricks shall be fully filled with mortar. Mortar joints shall be kept uniformly 10 mm thick. All joints on face shall be raked to minimum 10 mm depth using raking tool while the mortar is still green to provide bond for plaster or pointing. Where plaster or pointing is not provided, the joints shall be struck flush and finished immediately. Brickwork of two bricks thick or more shall have both faces in true plane. All brickwork shall be built tightly against columns, floor slabs or structural parts, around window and door frames with proper distance to permit caulked joint.

In half brick work 02 Nos. 6 mm dia MS bar to be provided in every 4th course.

9.5 CURING OF MASONRY WORK

Masonry shall be cured by keeping it wet for seven days from the date of laying. In dry weather at the end of days work top surface of masonry shall be kept wet by ponding.

10.0 STONE WORK

10.1 STONE

The stone shall be of granite, trap, limestone, sandstone, quartzite etc. and shall be obtained from quarries approved by Engineer-in-Charge. Stone shall be hard, sound, durable and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and others similar defects that may adversely affect the strength and appearance. As far as possible stone shall be of uniform colour and texture. Generally stones shall not contain crypt crystalline silica or chart, mica and other deleterious materials like iron–oxide, organic impurities etc.

10.2 SIZE OF STONE

Normally stone used should be small enough to be lifted and placed by hand. Unless otherwise indicated the length of stone shall not exceed 3 times the height and the breadth or base shall not be greater than three-fourth of the thickness of the wall or not less than 15 cm. The height of stone may be upto 30 cm.

10.3 LAYING

All stone shall be wetted before use. Each stone shall be placed closed to the stone already laid so that the thickness of the mortar joints at the face is not more than 20 mm. Face stone shall be arranged suitably to stagger the vertical joints and long vertical joints shall be avoided.
10.4 **BOND STONE**
At least one bone stone or a set of bond stones shall be provided for every 0.5 sqm of area of wall surface. All the bond stones should be marked suitably with paint as directed by Engineer-in-Charge.

11.0 **PLASTER WORK**

11.1 **SCOPE**
This specification covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over, of plastering to masonry and concrete. Before commencing work on the finishing items the contractor shall obtain the approval of the Engineer-in-Charge regarding the scheduling of work to minimize damage by other contractors. He shall also undertake normal precautions to prevent damage or disfiguration to work of other contractors and other installations.

11.2 **PREPARATION OF SURFACE**
All joints in masonry walls be raked out to a depth of at least 10 mm with a hooked tool made for the purpose while the mortar is still green. Walls shall be brushed down with stiff wire brush, to remove all loose dust from the joints and thoroughly washed with water.

For all types of work the base cement concrete slab or masonry surface shall be roughened by chipping and cleaned of all dirt, grease or loose particles by hard brush and water. The surface shall be thoroughly moist to prevent absorption of water from the base course. Any excess of water shall be mopped up.

Prior to commencement of actual work, the approval of the Engineer-in-Charge shall be taken as to the acceptability of the base.

11.3 **MORTAR**
Mortar for plastering shall be as specified in the drawings and in the schedule of finishes. For sand cement plaster, sand and cement in the specified proportion shall be mixed dry on a water tight platform and minimum water added to achieve working consistency.

No mortar which has stood for more than half an hour shall be used, mortar that shows tendency to become dry before this time shall have water added to it.

11.4 **INTERNAL WALL PLASTER**
This plaster shall be laid in a single coat of 12 mm thickness with cement mortar 1:6 (1 cement : 6 fine sand). The mortar shall be dashed on the prepared surface with a trowel and finished smooth by trowel on the surface. Internal wall plaster shall be carried out on jambs, lintel and sill faces, top and undersides etc., as shown in the drawing or as directed by the Engineer-in-Charge.
11.5 INTERNAL CEILING PLASTER

Ceiling plaster shall be laid in a single coat of 6 mm thickness with cement mortar 1:3 (1 cement : 3 fine sand) applied before wall plaster.

11.6 EXTERNAL PLASTER

Exterior plaster shall be carried out in 2 layers, the first layer being 12 mm thick and the second layer being 6 mm thick. The first layer shall be dashed against the prepared surface with trowel to obtain an even surface. The second layer shall then be applied and finished leaving an even and uniform surface, trowel finished unless otherwise directed by the Engineer-in-Charge.

Modified polyester fibre of approved make of 6mm / 4.8 mm cut length is to be added with the cement mortar mix of the external plaster work @ 0.25% by weight of cement used i.e. 125 grams per 50 kg bag of cement.

11.7 APPLICATION OF PLASTER

Plaster when more than 12 mm thick, shall be applied in two coats, i.e., a base coat followed by the finishing coat. Thickness of the base coat, however, shall not exceed 12 mm in thickness. The lower coat shall be thicker than the upper coat. The overall thickness of the coat shall not be less than the minimum thickness shown on the drawings. The under coat shall be allowed to dry and shrink before applying the second coat of plaster. The under coat shall be scratched or roughened before it has fully hardened to form a mechanical key. The method of application shall be ‘thrown on’ rather than ‘applied to trowel’.

To ensure even thickness and true surface, patches of plaster about 100 mm to 150 mm square or wooden screed 75 mm wide and of the thickness of the plaster shall be fixed vertically about 2000 mm to 3000 mm apart to act as gauges. The finished wall surface shall be true to plumb, and the contractor shall, without any extra cost to the owner, make up irregularity in the brick work with plaster. All verticals edges of brick pillars, door jambs etc., shall be chamfered or rounded off as directed by the Engineer-in-Charge. All drips, grooves, moldings and cornices as shown on the drawing or instructed by the Engineer-in-Charge shall be done with special care to maintain true lines, levels and profiles. After the plastering work is complete, all debris shall be removed and the area left clean. Any plastering that is damaged shall be repaired and left in good condition at the completion of the job.

12.0 FINISH

Where ever any special treatment to the plastered surface is indicated, the work shall be done exactly as shown on the drawings, to the entire satisfaction of the Engineer-in-Charge regarding the texture, colour and finish.
12.1 **STANDARD FINISH**
Wherever punning is indicated, the interior plaster shall be finished rough. Otherwise the interior plaster shall generally be finished to a smooth surface. The exterior surface shall generally be finished with a wooden float.

12.2 **NEAT CEMENT FINISH**
Immediately after achieving a true plastered surface with the help of a wooden straight edge, the entire area shall be uniformly treated with a paste of neat cement at the rate of one Kg per sq.m. and rubbed smooth with a trowel.

12.3 **CURING**
Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to get damaged. The Engineer-in-Charge will give the decision as to when the plaster has hardened in. Curing shall be done by continuously applying water in a fine spray and shall be carried out at least 7 days. Each individual coat of plaster shall be kept damp continuously for a minimum two days.

12.4 **WATER PROOFING ADMIXTURES**
The contractor shall use approved water proofing admixtures made of approved manufacturer in the mortar for external plaster work. The quantity to be used etc., shall be in accordance with the manufacturer's instructions, however, subject to approval of the Engineer-in-Charge. These admixtures shall not contain calcium chloride unless specifically allowed by the Engineer-in-Charge and shall conform to IS : 2645.

12.5 **ACCEPTANCE CRITERIA**
Finish to masonry and concrete shall fully comply with the drawings, specifications, approved samples and instructions of the Engineer-in-Charge with respect to lines, levels, thickness, colour, texture, pattern and any other special criteria as mentioned in the specification or as shown on the drawing.

13.0 **FLOORING**
13.1 40 mm thick marble chips flooring rubbed and polished to granolithic finish, under layer 25 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm nominal size) and top layer 15 mm thick with white, black, chocolate, grey, yellow or green marble chips of sizes from 1 mm to 4 mm nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble powder) by weight in proportion of 4:7 (4 cement marble power mix : 7 marble chips) by volume including cement slurry etc complete with medium shade pigment with ordinary cement.

13.2 **KOTA STONE FLOORING / SKIRTING**
a) **Material**: All the kota stone slab shall be of selected quality, hard, sound, dense and homogenous in texture free from cracks, decay, weathering and flaws. They shall be hand or machine cut to be requisite thickness. They shall be of the colour indicate in the drawing or as instructed by the Engineer-in-Charge.
The slab shall have the top (exposed) face polished before being brought to site, unless otherwise specified. The slab shall be conform to the size required. Before starting the work the successful bidder shall get the sample of slabs approved by Engineer-in-Charge.

b) **Laying:**

Mortar of specified mix shall be spread under the area of each slab, roughly to the average thickness specified in the items. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped with wooden mallet and brought to the level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the mortar then shall be corrected by adding fresh mortar at hollows. The mortar is allowed to harden a bit and cement slurry of honey like consistency shall be spread over the same at the rate of 4.4Kg of cement per sqm. The edges of the slab already paved shall be buttered with grey cement, with admixture of pigment to match the shade of the slab including polishing and finishing complete.

### 13.3 NON-SKID CERAMIC TILES

Tiles shall be of 1st quality conforming to IS: 15622, of minimum size 300 mm x 300mm minimum 7 mm thick unless otherwise indicated in the schedule of finishes and drawing. The tile shall be laid over 20 mm thick cement mortar 1:4 over neat cement slurry @ 3kg per sqm over RCC slab including filling joints with neat white cement slurry mixed with pigment to match the color of tiles. The color and shade of the tiles shall be as directed by Engineer-in-Charge. The tile shall be of approved make.

### 13.4 GLAZED TILES IN SKIRTING / DADO

The tiles shall be 1st quality conforming to IS: 15622 of minimum thickness of 5 mm and of size as mentioned in the drawing / finishing schedule. The colour shall be got approved by Engineer-in-Charge of EPI. The tile shall be sound, true to shape, flat and free from flaws and other manufacturing defects affecting their utility. The tiles shall be laid over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and joining with grey cement slurry @ 3.3 kg / sqm including pointing in white cement mixed with pigment of matching shade.

### 14.0 PROPERTIES, STORAGE AND HANDLING OF COMMON BUILDING MATERIALS

#### 14.1 SCOPE

The scope of this section is to specify the properties, storage and handling of common building materials unless otherwise mentioned in the drawings or schedule of items.
14.2 GENERAL

The whole of the materials to be mobilized in connection with the permanent work of the contact must be new and of good quality and description of their respective kinds and shall be approved by the Engineer-in-Charge.

Except where otherwise specified or permitted by the EPIL, all materials shall conform to the latest edition of the Bureau of Indian Standards. The initials ‘I.S./BIS’ followed by a number in any of the contract document shall refer to the relevant Indian Standards and current at the date of tendering including all amendments published before that date.

Before ordering materials of any description, the bidders shall submit to the Engineer-in-Charge the names or suppliers proposed and shall obtain approval in writing from the Engineer-in-Charge of the supplier from whom he proposes to obtain such materials. Should the Engineer-in-Charge at any time be not satisfied with the methods of operations carried on at any supplier’s works or place of business, he shall have the power to cancel his previously given consent to obtaining any material from such suppliers.

15.0 WATER PROOFING TREATMENT ON ROOF SLAB

1. The water proofing treatment of roof slabs shall be as given below:

a) For flat roof prior to water proof treatment grading of slope 1:80 is to be provided with screed concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 12 mm nominal size) with minimum thickness of 25 mm near rain water drainage pipe.

b) **Inaccessible Roof**: Providing and laying APP (Atactic Polypropylene Polymer) modified pre fabricated five layer, 3-4 mm thick water proofing membrane black finished reinforced with polyester / glass fibre matt. The membrane to be laid over a coat of bitumen primer by using butane torch and finally painted with two coat of aluminum paint of approved make. The laying of the membrane to be done as per the specifications provided by the manufacturer.

   **Approved Manufacturers**: Bitumat Co. Ltd., Pidilite, General Membrane, Tamko, STP Ltd., Tixsa India Ltd.

c) **Accessible Roof**: Providing and laying APP (Atactic Polypropylene Polymer) five layer, 3-4 mm thick water proofing membrane black finished reinforced with polyester / glass fibre matt. The membrane to be laid over a coat of bitumen primer by using butane torch and finally overlaid with 40 mm thick concrete screed 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 12 mm nominal size). The laying of the membrane to be done as per the specifications provided by the manufacturer.

   **Approved Manufacturers**: Bitumat Co. Ltd., Pidilite, General Membrane, Tamko, STP Ltd., Tixsa India Ltd.

d) Water proofing treatment for roof slab shall be carried out by an approved specialized firm. Ten years guarantee shall be given by the specialized firm and the contractor on non-judicial stamp paper of Rs. 50.00 (Rupees fifty only) for the effectiveness of water proofing treatment.
16.0 WATER PROOFING TREATMENT ON SUNKEN PORTION

Providing and laying water proofing treatment to vertical and horizontal surfaces of depressed portions of W.C., kitchen and the like consisting of:

i) 1st course of applying cement slurry @ 4.4 Kg/sqm mixed with water proofing compound ‘Imperno’ of Snowcem or equivalent conforming to IS : 2645 in recommended portions.

ii) 2nd course of 20 mm cement plaster 1:3 (1 cement : 3 coarse sand) mixed with water proofing compound in recommended proportion.

iii) 3rd course of applying blown or residual bitumen applied hot at 1.7 Kg. per sqm of area.

iv) 4th course of 400 micron thick PVC sheet. (Overlaps at joint of PVC sheet should be 100 mm wide and pasted to each other with bitumen @ 1.7 Kg/sqm.).

Water proofing treatment for sunken portion shall be carried out by an approved specialized firm. Ten years guarantee shall be given by the specialized firm and the contractor on non-judicial stamp paper of Rs. 50.00 (Rupees fifty only)

17.0 EXPANSION / ISOLATION / SEPARATION JOINTS

17.1 GENERAL

Expansion / Isolation / separation joints in concrete and masonry structure shall be provided at specified places, as per detail indicated in the drawings. The material and types of joints shall be as specified herein after. In case of liquid retaining structures, additional precautions shall be taken to prevent leakage of liquids as may be specified in the drawings or as directed by the Engineer-in-Charge. All materials are to be procured from reliable manufacturers and must have the approval of the Engineer-in-Charge. The Engineer-in-Charge may demand test certificates for the materials and or instruct the contractor to get them tested in an approved laboratory at no extra cost to the owner. Joints shall be formed true to line, level, shape, dimension and quality as per drawings and specifications. Prior approval of the method of forming the joints shall be obtained from the Engineer-in-Charge before starting the work.

17.2 BITUMEN BOARD / EXPANDED POLYSTRENE

17.2.1 BITUMEN BOARD

Bitumen impregnated fibre board of approved manufacturer as per IS : 1838 may be used as filler for expansion joints. It must be durable and waterproof. It shall be compressible and possess a high degree of rebound. The dimensions of the board shall be equal to that of the joints being formed. It shall, preferably be manufactured in one piece, matching the dimensions of the joints and not prepared by cutting to size smaller pieces from larger boards at site.
If required, commercial quality of expanded polystyrene products commonly used for commercial insulations may also be used as filler materials in expansion joints. The thickness may vary from 12 mm to 50 mm. The material shall have to be procured from reliable manufacturers as approved by the Engineer-in-Charge. The method of installation shall be similar to that recommended by the manufacturers. A coat of Bitumen paint may have to be applied on the board against which concrete will be placed.

17.2.2 JOINT SEALING STRIPS

Joint sealing strips may be provided at the construction, expansion and isolation joints as a continuous diaphragm to contain the filler material and or to exclude passage of water or any other material into or out of structure. The sealing strips shall be either metallic like G.I. aluminum or copper, or non-metallic like rubber or PVC.

Sealing strips shall not have any longitudinal joint and shall be procured and installed in largest practicable lengths having a minimum number of transverse joints.

The material is to be procured from reputed manufacturers having proven record of satisfactory supply of joints strips of similar make and shape for other jobs. The jointing procedure shall be as per the manufacturer’s recommendations, revised if necessary by the Engineer-in-Charge. The contractor is to supply all labour and material for testing, protection etc.

17.2.3 METAL SEALING STRIPS

Metal sealing strips shall be either G.I., Aluminum or Copper and formed straight, U shaped, Z shaped or any other shape and of thickness as indicated in the drawings and schedule of finishes and or as instructed by the Engineer-in-Charge.

The transverse joints shall be welded using brass rods and approved fix and shall be tested by method approved by the Engineer-in-Charge to establish that it is leak proof. In case it is found that the joints can not be made leak proof, longer lap lengths and different method of brazing which will render it leak proof, shall be adopted by the contractor without any additional cost to the owner. The edges shall be neatly crimped and bent to ensure proper bond with the concrete.

17.2.4 G.I. STRIPS

G.I. Strips shall be minimum 18 gauge thick and 200 mm in width unless specified otherwise. The standards of galvanizing shall be as per relevant Indian Standard for heavy duty work.

The strips shall be strong, durable, without any rust or grease. At the joints the over – lapping shall be for a minimum length of 50 mm.
17.2.5 **ALUMINUM STRIPS**

Aluminum strips shall be minimum 18 swg thick 300 mm width unless specified otherwise and shall conform to IS: 737 of 19000 grade or 31000 grade (Designation as per IS: 6051). A minimum lap of 50 mm length, if required shall be provided at the joints.

17.2.6 **COPPER STRIPS**

The copper strips shall be minimum 18 swg in thickness and 300 wide unless specified otherwise and shall conform to relevant Indian Standards.

It shall be cleaned thoroughly before use to expose fresh surface, without any reduction in gauge. A minimum lap of 50 mm in length, if required, shall be provided at the joints.

18.0 **DAMP PROOF COURSE (DPC)**

It shall consists of a layer of cement concrete of proportions 1:2:4 (1 cement : 2 course sand : 4 grades stone aggregate of 12 mm nominal size) and of thickness 40 mm.

Cement concrete shall be, admixed with integral water proofing compound in specified proportion as per manufactures instructions. The proportions of water proofing compound shall not exceed 3% by weight of cement. Cement concrete laying shall be thoroughly compacted to dense impervious mass, be cured at least 7 days.

19.0 **PLINTH PROTECTION AND DRAIN**

It shall be provided around the building as per drawing.

20.0 **SYNTETIC ENAMEL PAINT**

Shall be made from synthetic designs and drying oil with rutile titanium dioxide and other selected pigments to give a smooth, hard, durable and glossy finish to all exterior and interior surfaces. The paint shall conform to IS : 2932 and IS : 2933.

21.0 **WATER PROOF CEMENT PAINT**

Shall be made from good quality white cement and lime resistant colours with accelerators, waterproofing agents and fungicides. The paint shall conform to IS : 5410.

22.0 **ACRYLIC EMULSION PAINT**

Shall be water based acrylic copolymer emulsion with rutile titanium dioxide and other selected pigments and fungicide. It shall exhibit excellent adhesion to plaster and cement surface and shall resist deterioration by alkali salts. The paint film shall allow the moisture in wall to escape without peeling or blistering. The paint, after it is dried, should be able to withstand washing with mild soap and water without any deterioration in colour or without showing flaking, blistering or peeling.
23.0 OIL BOUND DISTEMPER

Oil bound distemper (IS: 428 -1969) of approved brand and manufacturer shall be used. The primer where used be cement primer or distemper primer. These shall be of same manufacturers as that of distemper. The distemper shall be diluted with prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day’s work shall be prepared.

24.0 WHITE WASHING

Shall be done from pure shell lime or fat lime, or a mixture of both as instructed by the Engineer-in-Charge, and shall conform to IS: 712 latest edition. Samples of lime shall be submitted to the Engineer-in-Charge for approval and lime as per approved sample shall be brought to site in unslaked condition. After slaking it shall be allowed to remain in a tank of water for two days and then stirred up with a pole until it attains the consistency of thin cream. 100 grams of gum to 6 litres of white wash water and little quantity of indigo of synthetic ultramarine blue shall be added to the lime.

25.0 DOOR, WINDOW AND VENTILATOR

25.1 STEEL DOOR, WINDOW & VENTILATOR

Steel door frames shall be manufactured form commercial mild steel sheet of 1.25 mm thickness conformig to IS: 266 and IS: 435. Hot rolled steel section for fabrication of steel window and ventilator shall conforms to IS: 7452. Shapes, weight and designation of hot rolled sections shall be as per IS: 7452. The workshop for fabrication shall be got approved by Engineer-in-Charge. Fabrication drawings shall be submitted by the contractor which shall also include the weights of materials used and got approved from the Engineer-in-Charge.

25.2 GLAZED ALUMINUM DOOR, WINDOWS, FRAMES

Work to be executed as per IS – 1948. All sections shall be approved by Engineer-in-Charge before fabrication is taken up. Doors, Windows, Frames, Mullions, Transoms etc. shall be anodized in bath of sulfuric acid to provide a clear coating of minimum 15 micron (IS: 1968). The anodized materials shall then be sealed by immersing in boiling water for 15 minutes. A protective transparent coating shall be applied to the sections before dispatch from the factory. Fabrication drawings shall be submitted by the contractor which shall be include the weights of materials used and got approved from the Engineer-in-Charge.

26.0 GLASS AND GLAZING

SCOPE

The work in general shall consists of supplying and fixing all glass and glazing including all chips, putty, mastic cement etc. wherever required as shown on drawings.
INSTALLATION

The contractor shall supply and install all glass and glazing as required for various doors, windows, sashes, ventilators and fixed louvers, miscellaneous glazing having uniform refractive index and free from flaws, specks and bubbles. The glass be brought to site in the original packing from the manufacturer and cut to size at site. The cut edges shall be straight free from chips, spalls or any other damages. Clear glass shall be flat drawn sheet glass and shall be at least 4 mm thick. Sheet glass for doors shall be minimum 6.3 mm thick.

Wired glass shall be thick rolled glass with centrally embedded 24 g. wire mesh of Georgian type. This may be of clear or coloured glass, as shown in drawings.

Quick setting putty shall be used for windows and sashes except when glare reducing glass is used where it shall be of non-setting type of approved make conforming to IS: 419.

Neoprene gaskets with snap-fit glazing shall be fixed as per manufacture's instructions and shall fit firmly against the glass to give a leak-proof installation.

27.0 CARPENTRY AND JOINERY

27.1 SCOPE

This shall include supply and fixing of door and window shutters, paneled and flush doors, partitions, wall paneling, shelves, furniture, cabinets, pelmets etc., as shown in drawings including a prime coat of approved paint, varnish/synthetic enamel paint or fixing of plastic laminate where called for in the schedule. This shall also include supply and fixing of all hardware and fittings shown in the drawings.

27.2 TIMBER

Unless otherwise specified all timber shall be best quality well seasoned second class hard wood free from larger loose knots, cracks, and other defects. Where specified timber shall be treated with approved wood preservative. Before starting the carpentry work, the contractor shall have the wood approved by the Engineer-in-Charge.

27.3 PLYWOOD

Plywood shall be commercial quality or with decorative surface veneer. Unless otherwise stated, the adhesive used in plywood shall be phenol formaldehyde resin of B.W.R. grade conforming to IS: 848.

27.4 FLUSH DOORS

Flush doors shall be block or solid core doors with commercial or decorative faces and hardwood edges. The core for solid core doors shall be of block board or wood particle board. The thickness shall be as specified in the ‘Schedule finishes’.
Flush doors and board shall be of the required size and thickness. Flush doors shall be ordered to a size little more in which to that after trimming, it fits the opening between rebates perfectly. Where shown in the drawings and the schedule, flush doors shall be surfaced with decorative laminates of required type and design. The laminate shall be glued to the panel with liquid synthetic phenol formaldehyde resin glue and kept in suitably pressed for at least 12 hours as per best trade practice.

27.5 PANELED AND GLAZED DOORS AND WINDOW SHUTTERS

The wood shall be accurately cut, planed and smoothened to hold full dimensions as shown in the drawings after finishing. The thickness of stiles and rails shall be as required for the shutters.

Stiles and rails shall be properly and accurately mortised and tongued. While assembling a leaf, stiles shall be left projecting as a horn. The stiles and rails shall have 12 mm groove or as specified in the drawings for the panel or glass to fit in.

27.6 FLY PROOF SHUTTER

The wood shall be accurately cut, planed and smoothened to hold full dimensions as shown in the drawings after finishing. The thickness of stiles and rails shall be as required for the shutters. Patching or plugging of any kind shall not be permitted except as provided. The stiles and rails shall be given a rebate to receive the wire gauge which shall from the panels.

24 gauge MS, wire Gauze conforming to IS: 1568 shall be used for fly proof shutter.

27.7 CABINET WORK

All cabinet work shall be a prime cost item. Cabinets shall be prepared at site as per best practices and techniques, machines, tools and craftsmen available in the furniture making industry. Sample of the work shall be approved by the Engineer-in-Charge.

Details shall be incorporated as shown in the drawings. Bottom shall be framed in to the drawer front, sides and back. Accurately aligned guides and proper clearance smoothly without bending. All joints and all work shall be glued together with phenol formaldehyde synthetic glue resin, the parts being clamped and pressed at least for 12 hours.

28.0 FITTINGS AND FIXTURES

Fixtures and fittings for doors, windows etc., shall be as shown on drawing and finishing schedule. These shall be heavy type, good quality and from approved manufacturer.

28.1 WORKMANSHIP

28.1.1 GENERAL

The work shall be done by skilled carpenters as per details shown on drawing or instructed by the Engineer-in-Charge.
Farming timber and other work shall be close fitting with proper wood joinery, accurately set to required lines or levels and rigidly secured in place.

The surface of frames etc., which will come in contact with masonry after fixing, shall be given two coats of approved paint before fixing. Mastic caulking shall be done after fixing external door and window frames. Special care shall be taken to match the grain of timber or plywood which will be subsequently polished. Screwing or nailing will not be permitted to the edge of plywood or chip board sheets. All exposed plywood edges shall be finished with teakwood lipping unless otherwise shown on drawings.

28.1.2 **FINISH**

All carpentry work after finishing shall be sand papered smooth. A prime coat of paint shall be given after inspection by the Engineer-in-Charge to all surfaces other than those which shall be subsequently polished or covered with laminated plastic sheet.

29.0 The successful bidder shall establish a field testing laboratory at site, equipped with the minimum following equipments.

1. One no. compression testing machine of 100 tonne capacity suitable for testing concrete cube of 150 mm x 150 mm x 150 mm size.

2. One no. electronic weighing machine with maximum weight of 10 kg.

3. 24 nos. MS cube moulds of size 150 mm x 150 mm x 150 mm.

4. One no. slump cone.

5. One set of sieves for fine aggregate. (includes sieves of designation 4.75 mm, 2.36 mm, 1.18 mm, 600 microns, 300 microns, 150 microns).

6. One set of sieves for coarse aggregate. (includes sieves of designation 37.5 mm, 19 mm, 9.5 mm, 4.75 mm).

7. One no. silt testing jar.

8. One no. electric oven.

9. One no. vernier calliper.

10. One no. screw gauge.
# 30.0 LIST OF APPROVED MAKES

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Material</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Synthetic Enamel Paint</td>
<td>Berger, Asian, ICI, Dulux, Nerolac, Shalimar, J&amp;N</td>
</tr>
<tr>
<td>2.</td>
<td>Plastic Emulsion Paint</td>
<td>ICI, Asian, Berger, Nerolac</td>
</tr>
<tr>
<td>3.</td>
<td>Other Paints / Primer</td>
<td>ICI, Asian, Berger, Nerolac</td>
</tr>
<tr>
<td>4.</td>
<td>Ceramic Tile</td>
<td>Johnson / Somany / Kajaria / Regency</td>
</tr>
<tr>
<td>5.</td>
<td>Glazed Tile</td>
<td>Johnson / Somany / Kajaria / Regency</td>
</tr>
<tr>
<td>6.</td>
<td>Lift</td>
<td>OTIS, Kone Elevator</td>
</tr>
<tr>
<td>7.</td>
<td>Ordinary Portland Cement</td>
<td>ACC, Ultratech, Star, Lafarge, Dalmia, Ambuja, Amrit conforming to IS for 43 / 53 grade as applicable of design and drawing.</td>
</tr>
<tr>
<td>8.</td>
<td>Pre-laminated (phenol bonded) Particle Board</td>
<td>Novapan, Bhutanboard, Kitply, Greenlam</td>
</tr>
<tr>
<td>9.</td>
<td>Water Proofing Compound</td>
<td>Accoproof, Impermo, CICO, Pidilite, Choskey, Scot</td>
</tr>
<tr>
<td>10.</td>
<td>APP (atactic Polypropylene Polymer) Membrane</td>
<td>Pidilite Industries Ltd. Texsa India Ltd., STP Ltd., Bitumat Co. Ltd. Soprema, General Membrane</td>
</tr>
<tr>
<td>11.</td>
<td>Door Closer / Floor Spring</td>
<td>Door King, Everite, Hardwyn</td>
</tr>
<tr>
<td>12.</td>
<td>Aluminium Section</td>
<td>Indal, Hindalco, Bhoruka</td>
</tr>
<tr>
<td>13.</td>
<td>Clear Glass / Clear Float Glass / Toughened Glass</td>
<td>Modi, Atul, Saint Gobain</td>
</tr>
<tr>
<td>14.</td>
<td>Sunken Portion Treatment</td>
<td>Choskey, Rofee, CICO, SIKA</td>
</tr>
<tr>
<td>15.</td>
<td>White Cement</td>
<td>JK, Birla White</td>
</tr>
<tr>
<td>16.</td>
<td>Texture Paint</td>
<td>Berger, Spectrum or equivalent</td>
</tr>
<tr>
<td>17.</td>
<td>White Glazed Fireclay Sinks</td>
<td>EID, Parry</td>
</tr>
<tr>
<td>18.</td>
<td>Reinforcement Steel MS &amp; TMT</td>
<td>M.S. bar shall conform to IS: 2062. TMT bar shall be as per IS: 1786 of grade Fe-415 / 500. Approved manufacturer for MS/TMT bar are SAIL/ TATA TISCON/ RINL/ SHYAM STEEL other reputed manufacturer with prior approval of the competent authority.</td>
</tr>
</tbody>
</table>
19. Block Boards / Particle board / Ply Board
   : Century / Green Ply / Kitply

20. Precast Mosaic & Precfast Chequered Tiles
    : Modern / Nitco

21. OBD / Dry Distemper
    : Shalimar / Asian / Dulux / Nerolac / Berger

22. Waterproof Cement Paint
    : Super Snowcem / Duracem / Aquacem / Acrocem

**Note:** The materials other than approved list shall also bear IS mark and/or to be approved by the Engineer-in-charge before the use. Required tests are to be conducted by the contractor before use at works.

### 31.0 **I.S. CODE**

Some of the important relevant applicable IS codes are mentioned below:

- **IS: 1200** (Pertaining to respective work): Method of measurement of building and Civil Engineering works.
- **IS: 456** Code of practice for plain and reinforced concrete.
- **IS: 1199** Method of sampling and analysis of concrete.
- **IS: 1838** Preformed fillers for expansion joints in concrete non extruding and resilient type (Bitumen impregnate filler)
- **IS: 2386** (Part I to IV) Methods of tests for aggregates for concrete.
- **IS: 2505** General requirements for concrete vibrators, immersion type.
- **IS: 2506** Screed board concrete vibrators.
- **IS: 2514** Concrete vibrating tables.
- **IS: 3025** Code of practice for concrete structure for the storage of liquids.
- **IS: 3350** Methods of tests for routine control for water used in industry.
- **IS: 4565** From vibrators for concrete.
- **IS: 9130** Admixture for concrete.
- **IS: 516** Method of tests for strength of concrete.
- **IS: 1786** High strength deformed bars for concrete reinforcement.
IS: 1081  Code of practice for fixing and glazing of metal doors, windows and ventilators.

IS: 2502  Code of practice of bending and fixing bars for concrete reinforcement.

IS: 2571  Code of practice for welding and mild steel bars used for reinforced concrete construction.

IS: 2202  Specification for wooden flush door shutter.

IS: 1661  Code of practice for cement and cement lime plaster finish on walls and ceilings.

IS: 4101  Code of practice for external facing and veneers.

IS: 6248  Metal rolling shutter and rolling grills.


IS: 1081  Code of practice for fixing and glazing metal doors, windows and ventilators.

IS: 1038  Specifications for steel doors, windows and ventilators.
SPECIFICATION FOR SANITARY, WATER SUPPLY & PLUMBING (REVISED)

1.0 GENERAL

1.1 The scope of work comprises supply, installation, testing and commissioning of the facilities for water supply, sewerage and drainage, sanitary fixtures & fittings etc. The scope of work includes supply of all materials as per specifications and drawings, laying, fitting, fixing, installation, commissioning and testing of the same.

1.2 For all items of works the rates shall be comprehensive and all inclusive. The rate shall include for all matters and things necessary for satisfactory completion and maintenance of the work in proper working order and to the satisfaction of the Engineer, including testing, making samples etc. and all that have been indicated in the specifications or other tender documents either directly, or indirectly, and cover all obligations of the contractor under the contract. No claim for additional payment shall be allowed for any error or misunderstanding by the contractor of the work involved.

1.3 Unless otherwise mentioned in the description of the item, this BOQ shall be applicable for work in any height, position or condition.

1.4 Unless otherwise stated, method of measurement as described in the latest editions of IS: 1200 with its parts corresponding to different sections of work shall be followed. In case of any dispute in this matter, the decision of Engineer shall be final, binding and conclusive.

1.5 All the water supply, drainage and sanitary works shall be carried out strictly as per Central PWD specifications, 1996 Vol. (Two), 2002 Edition with upto date corrections slips for sanitary installation, water supply, drainage and miscellaneous works.

1.6 All the water supply and sanitary works shall be carried out by the licensed plumbers approved by the local authorities and skilled workmen, experienced in the trade.

1.7 All works shall be completely concealed within shafts or chases or in fills and dropped ceilings unless specifically shown in the drawings or required otherwise.

1.8 All works shall be adequately protected, to the satisfaction of the Engineer, so that the whole work is free from damage throughout the period of construction upto the time of handing over.

1.9 No work shall be covered without approval of the Engineer.

1.10 The contractor shall be responsible for coordinating the work with works of other trades sufficiently ahead of time to avoid unnecessary hold-ups. Hangers, sleeves, recesses, etc. shall be left in time as the work proceeds whether or not these are shown in drawings.

1.11 All clamps, screws, brackets, hangers and all miscellaneous steel work needed in the work shall be fully galvanized.

1.12 Only specified brand of materials will be used subject to approval of the sample.
1.13 Before the work is handed over, the contractor shall clean all fixtures, removing all plasters, stickers, rust stains and other foreign matter of discoloration of fixtures leaving every part in acceptable condition and ready for use to the satisfaction of the Engineer.

1.14 All sanitary-ware and fittings shall conform to respective BIS standards. The contractor shall submit samples of all fittings and fixtures proposed to be used to the Engineer for his approval.

1.15 The approved samples shall remain with the Engineer till the completion of the work.

2.0 SCOPE OF WORK

The contractor shall carry out and complete the work under this contract in every respect in conformity with the rules and regulations of the local authority. The contractor shall furnish all labour, supply and install all materials, appliances, equipment necessary for complete installation and testing of the whole plumbing services as specified and as per the relevant BIS codes and as shown on the drawings. This also includes all materials, appliances, equipment etc. not specifically mentioned herein or noted on the drawings but which are necessary and customary to make a complete installation as per the drawings or described herein, properly connected and in working order.

In general, the work to be performed under this contract shall comprise of the following:

1. All incidental jobs connected with plumbing services installation, such as excavation in trenches and back filling, cutting chases in concrete and brick work and making good, cutting / drilling holes through walls, floors and grounding for fixing of fixtures equipment etc.

2. Furnish and install a complete working, plumbing services installations shown on the drawings and described in this specification and as per the latest BIS specification.

3. Complete installation of internal and external water supply system.

4. Complete installation of the sewerage and sewerage appurtenances internally as well as around the buildings.

5. Complete installation of all sanitary and plumbing fixtures.

6. Repair of all damages done to the premises as result of this installations and removal of all debris left by those engaged in these installations.

7. Clean all plumbing fixtures, and ensure a satisfactory performance of all the fixtures at the time of testing and commissioning.

8. It is the responsibility of the contractor to take care of all the fixtures fitted until the time of handing over to the owner in working condition.

9. Painting of all the concealed and expose pipes, as specified.
3.0 Fee, Permits and Tests

The contractor shall pay all fees and obtain permits required for the installations of this work.

On completion of the work, the contractor shall obtain and deliver to the owner, certificates of final inspection and approval by the local authority. The EIC shall have full power to demand the materials or work to be tested by an independent agency at the contractor’s expenses in order to prove their soundness and adequacy.

4.0 Drawings and Specifications

The drawings and specifications shall be considered as part of this contract and any work or materials shown on the drawings and not called for in the specifications and vice versa, shall be executed as if specifically called for in both. The drawing indicate the extend and general arrangement of the fixtures, drainage system, etc. and are essentially diagrammatic. The drawings indicate the points of supply and termination of pipelines and broadly suggest the routes to be followed.

The work shall be installed as indicated on the drawings. However, any minor changes found essential to co-ordinate this work with other trades shall be made without any additional cost. The data given herein and on the drawings is as exact as could be secured, but its complete accuracy is not guaranteed. The drawings and specifications are for the assistance and guidance of the contractor and exact locations, distances and levels will be governed by the building drawings and approval of the Engineer-in-charge herein after referred to as EIC shall be obtained before commencement of work.

At the completion of the work, contractor shall furnish necessary information like invert levels and layout of pipeline, for the preparation of final completion drawings, to the EIC.

5.0 Manufacturer’s Instructions

Where manufacturers have furnished specific instructions, relating to the materials used in this job, covering points not specifically mentioned in the documents, these instructions shall be followed in all cases.

6.0 Changes in Dimensions

If the size of the fixtures mentioned is not available, then the nearest available size shall be fixed with due consent of the EIC.

7.0 Materials

1. Unless otherwise specified all the materials shall conform to the respective Bureau of Indian Standards.

2. All the materials shall be as per the list of approved brand of manufacturers and sample for the same shall be got approved before placing order. The approved samples shall be deposited with the EIC.
8.0 Sewerage Line

Providing and laying sewerage line Non presence NP2 class (light duty) RCC pipe of 150 mm to 300 mm dia as required from the outlet of the building to the inlet of the septic tank or sewerage treatment plant with necessary manhole chambers etc. as per CPWD specifications.

9.0 Sewer Appurtenances

9.1 Inspection Chambers & Manholes

9.1.1 Size of chambers/manholes

The size given in bill of quantities and drawings shall be internal size of chamber. The work shall be done strictly as per standard drawing and following specifications.

9.1.2 Benching

Chanelling and benching shall be done in 1:3:6 cement concrete, rendering smooth with neat cement. The following size of chanells for the bench shall be adopted.

<table>
<thead>
<tr>
<th>Size of drain</th>
<th>Depth at Centre i.e. at walls</th>
<th>Depth at Sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 cm</td>
<td>15 cm</td>
<td>25 cm</td>
</tr>
<tr>
<td>15 cm</td>
<td>20 cm</td>
<td>30 cm</td>
</tr>
</tbody>
</table>

9.1.3 Chamber / Manhole

Covers shall be of tough homogenous cast iron conforming to IS : 1726 with lifting hooks, as per the details given in the drawing and fixed on the MS frame embedded in the concrete.

C.I. steps duly painted shall be provided whenever the depth of the manhole/chamber is more than 1.2 mtr., as per instructions of EPI.

10.0 Water Supply

All water supply installation work shall be carried out through licensed plumber.

10.1 Pipes and Fittings

The pipes shall be of the medium quality galvanized iron, conforming to IS: 1239 and of approved make. It shall be of screwed or socket type. All fittings shall be malleable galvanized iron fittings of approved make. A sample of each kind shall be got approved from Engineer-in-Charge and all the materials should be according to the approve sample.
10.2 Laying and Fixing

The pipes shall be checked for any visible damage and shall be sorted out for reclamation. Any pipe which shows any damage shall not be used.

For internal work, all pipes and fittings shall be fixed truly vertical or horizontal, either by means of standard pattern holder-bat clamps keeping the pipes clear of the walls by 12mm everywhere or by concealing, as directed by EIC.

For external work, G.I pipes and fittings shall be laid in trenches. The width of the trench shall be the minimum width required for working. The pipes laid underground shall not be less than 50 cms from the finished ground level. The work of excavation and refilling shall be done as specified elsewhere, or instead concealed as directed.

10.3 Jointing

The pipes shall be cleaned and cleared from all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipe. The end shall then be screwed in the socket, Tee etc. with the pipe wrench. Care shall be taken that all the pipe fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Burr from the joints shall be removed after screwing. After lying, the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter.

10.4 Painting

All buried G.I pipes shall be painted with two coats of anti-corrosive bituminastic paint of approved make.

10.5 Testing

Before any pipes are painted or covered, they shall be tested to a hydrostatic pressure of 7 Kg/sq.cm. Pressure shall be maintained for at least eight hours without appreciable drop in pressure. In addition to the sectional testing of water supply pipes, the contractor shall test the entire installation to the complete satisfaction of the EIC. He shall rectify any leakages, failure of fittings or valves.

10.6 Water Fittings (Taps, Stop Cock etc.)

All water fittings shall be of approved make and shall generally comply to the latest BIS specifications. The fittings and joints shall be tested as specified & for pipe line; to ensure that the joint are leak proof, defective fittings and the joints shall be repaired or redone/replaced as directed. A sample of each kind shall be for approved from Engineer-in-Charge and all the materials should be according to the approve sample.
10.7 **Valves**

a) Fullway and check valve above 65 mm dia shall be CI double flanged conforming to IS-780 and as per approved make.

b) Fullway and check valve upto 65 mm dia shall be gun metal tested in 20 kg/cm² pressure and conforming to IS-778.

c) Foot valve shall be of gun metal.

11.0 **Sanitary Fixtures and Fittings**

11.1 **Workmanship**

All sanitary-ware shall be fixed in a neat workman like manner, true to level and plumb. Manufacturers instructions shall be followed closely regarding installation and commissioning.

11.2 **Sanitary Ware**

All sanitary ware shall be of first quality, free from warps, cracks and glazing defects. All sanitary ware, fittings and fixtures shall be as shown in drawings.

11.3 **Testing**

When the installation has been completed the satisfaction of the Engineer it shall be tested in the following manner.

(a) The entire system shall be slowly filled with water, allowing any trapped air to escape.

(b) When all outlets are closed the system shall be checked for water tightness.

(c) Each outlets shall then be checked for rate of flow and correct operation.

12.0 **Sanitary Installation and Fixtures**

All fixtures shall be fixed in a neat workman-like manner, true to line and as recommended by the manufacturers or as shown on the drawings. Care shall be taken to fix all fixtures, bolts and nuts and each fixture will warrant the correct size of screws or nuts and bolts.

Care shall be taken in fixing all chromium plated fixtures and accessories so as not to leave any tool marks or damages on the finish. All such fixtures shall be tightened with fixed spanner. Use of ‘Stiltson’ type pipe wrenches with toothed jaws shall not be allowed.

All fixtures shall be thoroughly tested after connecting with the drainage water supply system. All fixtures shall be thoroughly flashed and any leakage in piping, valves and fittings corrected to the complete satisfaction of EIC.

Upon completion of the works remove all levels, stickers, plasters etc. from the fixtures and clean all fixtures with soap and water so as to present neat and clean toilets.

All vitreous sanitary appliances (Vitreous China) shall conform to IS: 2556 (Part – I).
12.1 **Indian Water Closet**

Indian water closet with ‘P’ or ‘S’ trap shall be of Orissa type with 32 mm PVC flush pipes, lower level PVC cistern, CP stop cock. Indian water closet and trap shall be set in 1:4 lime surkhi concrete and flush with floor. Low level cistern shall be fixed at a height as per drawings or as directed by the EIC.

12.2 **Wash Basins**

This shall be of white vitreous china clay of good quality, of approved make and size as specified in the drawing. These shall be supported on a pair of CI brackets of approved design.

12.3 **Sinks**

Sinks shall be of stainless steel and of approved make and size as specified in the drawing.

12.4 **Mirror**

The mirror shall be of 5.5 mm thickness. The size shall be as specified in the approved drawing and made with commercial plywood fixed to the back of the mirror. Mirror shall be fixed to the wall with CP side clips and screws. The mirror shall be as per relevant BIS specification.

12.5 **Towel Rail**

Towel rail shall be of chromium plated steel with brackets, bends and circular flanges. The size of the rail shall be as specified in the drawing. The brackets shall be fixed by means of CP brass screws to wooden cleats, firmly embedded in the wall.

12.6 **Floor Traps**

The traps shall be of CI and self cleaning and deep water seal type with a 50 mm water seal. It shall have a 150 mm dia grating. These shall be fixed in concrete to the required level and position.

12.7 **Shower**

These shall be of CP finish swivel type and of size as mentioned in the drawing.

12.8 **Towel Ring, Soap Tray, Cloth Stand etc.**

These shall be of CP finish. These shall be fixed by means of CP brass screw to wooden clips firmly embedded in the wall.

13.0 Location of septic tank, if constructed shall be at a maximum distance of 30.00 (thirty) metre from the edge of the building if not otherwise mentioned in the drawing.
14.0 Feed point for water supply pipe line to buildings shall be at a maximum distance of 30.00 (thirty) metre from the edge of the buildings.

15.0 If sewerage treatment plant is provided instead of septic tank sewer line including inspection chamber upto a distance of 30.00 m from the edge of the building shall be considered included in the lump-sum price of the building.

16.0 **LIST OF APPROVED MAKE OF MATERIAL**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Make</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Vitreous China Sanitary Ware</td>
<td>Hindustan Sanitary Ware / Cera / Neycer / Parryware</td>
</tr>
<tr>
<td>3.</td>
<td>Stainless Steel Tank</td>
<td>Orient / Suhag / Nirali / Anjali / Swastik / Diamond</td>
</tr>
<tr>
<td>5.</td>
<td>Valves</td>
<td>Kirloskar / Kilburn / IVC / L&amp;T</td>
</tr>
<tr>
<td>7.</td>
<td>Submersible Pumps</td>
<td>Kirloskar / KSB / Grudfoxx</td>
</tr>
<tr>
<td>8.</td>
<td>CP Fittings</td>
<td>Sona / Gem / Jaguar / Esses / Essco</td>
</tr>
<tr>
<td>9.</td>
<td>White Glazed Fire Clay Sinks</td>
<td>EID / Parry</td>
</tr>
<tr>
<td>10.</td>
<td>Hot Water Heaters</td>
<td>Racold / Bajaj / Volta / Venus</td>
</tr>
<tr>
<td>11.</td>
<td>Ball Valve with Float</td>
<td>Leader / Kilburn / Prayag</td>
</tr>
<tr>
<td>12.</td>
<td>Manhole Cover</td>
<td>BC / TDS or equivalent</td>
</tr>
<tr>
<td>13.</td>
<td>CI Sluice Valve</td>
<td>Kirloskar / IVC / Leader</td>
</tr>
<tr>
<td>14.</td>
<td>Overhead Water Tank</td>
<td>Sintex / Polycon / Roma / Patton</td>
</tr>
<tr>
<td>15.</td>
<td>PVC Pipes Fittings</td>
<td>Parag / Jindal / Supreme / KiTEC / Prince</td>
</tr>
<tr>
<td>16.</td>
<td>GI Pipes Fittings</td>
<td>Jindal / Tata / Kalinga / ITC / BST / Zenith</td>
</tr>
</tbody>
</table>
### 17.0 IS CODE

<table>
<thead>
<tr>
<th>IS Code</th>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 1172</td>
<td>1971</td>
<td>Code of basic requirements for water supply, drainage and sanitation (Revised).</td>
</tr>
<tr>
<td>IS 4111</td>
<td>1967</td>
<td>Code of practice for ancillary structures in sewerage system.</td>
</tr>
<tr>
<td>IS 1626</td>
<td>1960</td>
<td>A.C. building pipes gutters and fittings (spigot and socket type).</td>
</tr>
<tr>
<td>IS 3989</td>
<td>1970</td>
<td>Centrifugally span cast iron spigot and socket soil, and ventilating pipes, fittings and accessories.</td>
</tr>
<tr>
<td>IS 1239</td>
<td>1968</td>
<td>Specifications for mild steel tube, tubulars and other steel pipes and fittings.</td>
</tr>
<tr>
<td>IS 6295</td>
<td>1971</td>
<td>Code of practice for water supply and drainage in high altitude and or sub-zero temperature regions.</td>
</tr>
<tr>
<td>IS 6511</td>
<td>1965</td>
<td>Specifications for salt glazed stoneware pipes and fittings (first version).</td>
</tr>
<tr>
<td>IS 2556</td>
<td></td>
<td>Specifications for vitreous sanitary appliances (vitreous china).</td>
</tr>
</tbody>
</table>

**Note:** The material other than approved list shall also bear ISI Mark and / or to be approved by the Engineer-in-Charge before use. Required tests are to be conducted by the contractor before use at works.
SPECIFICATIONS OF ELECTRICAL WORKS (REVISED)

1.0 GENERAL

1.1 The Electrical installation work shall be carried out in accordance with Indian Standard code of practice for Electrical Wiring Installation IS: 732 – 1963 and IS: 2274 – 1963. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Electric Supply Authority and fire insurance regulations in so far as these become applicable to the installation. Electrical work in general shall be carried out as per following specifications.

General Specifications of Electrical Works

(Part I – Internal) – 1994

General Specifications of Electrical Works

(Part II – External) – 1994

Whenever these specifications calls for a higher standard of materials and on workmanship than those required by any of the above mentioned regulation and specifications, then the specification mentioned here under shall take precedence over the said regulations and standards.

2.0 MATERIALS

All materials to be used in this work shall be new and shall be approved by Engineer-in-Charge.

List of approved makes and manufacture of electrical materials is attached herewith. Only such materials as are on the list shall be allowed to be used.

3.0 RECEPTACLES

All 250V receptacles shall be 2 wire three pole 5 amp. flush mounted or flush type of approved make. For power loads, the flush type switches and socket shall of 15 amp. rating and be also of approved make.

4.0 SWITCHES

All flush type switches shall be totally enclosed type of 5 amp. rating for upto four light outlets and 15 amp rating for more than four light outlets, being controlled by one switch. These shall be of approved make for light loads. For power loads, the flush type switches shall be of 15 amp rating and be of approved make.

5.0 COVER PLATE

These shall be the integral part of the switch and socket and of a colour approved by the Engineers as required.
6.0 POSITION OF LIGHTING & DISTRIBUTION BOARDS AND SWITCH GEARS

The recommended position of the lighting control switches, distribution boards and switch gears, as shown on the layout drawings, will be adhered as far as practicable.

Should there be any discrepancy or incomplete description, ambiguity or omission in the drawings and other documents, whether original or supplementary, forming the contract, the contractor shall immediately on discovering the same, draw attention of the Engineer.

Prior to the installation of lighting, fan and plug points and the distribution boards switches etc. final position shall be ascertained by the contractors with the Engineer-in-Charge’s representative.

7.0 PAINTING AND MARKING

All exposed steel work not actually embedded in building construction (viz. junction-boxed, switch boards etc) will be painted to match the existing shades of walls as instructed.

8.0 SUPPLY

The 415 KV supply mains will be brought in at place/s pointed out by the Engineer and will be three phase 4 wire, 50 cycles system 415V between phases. All necessary arrangements, to obtain the required supply connections shall be made by the contractors.

9.0 CONCEALED WIRING INSTALLATIONS

9.1 CONDUITS

These shall be of 16 SWG upto 32 mm dia and 14 SWG for 38 mm and above dia, PVC having perfectly circular tubing and capable of being cleaned and tight fitting joints.

9.2 ERECTION

Conduits shall be laid before casting in the upper portion of a slab or otherwise, as may be instructed or in accordance with approved drawing so as to conceal the entire run of conduits and ceiling outlet boxes. Vertical drops shall be buried on columns or walls. Wherever necessary, chases will be cut by the contractor with the prior written orders of the site Engineer-in-Charge to sufficient depth to allow fill thickness of plaster over conduits. Width of the chases will be made to accommodate the required no. of conduits. The chases will be filled with cement, coarse sand mortar (1:3) and properly cured by watering. If a chase is cut in an already finished surface the contractor shall fill the chase and finish is to match the existing finish. Contractor should not cut any iron bars to fix conduits. When the conduit is to be embedded in a concrete member, it shall be adequately tied to reinforcement to prevent displacement during casting.

Suitable expansion joint fittings of approved make shall be provided at all points where the conduit crosses any expansion joint in the building.
9.3 **USE OF BENDS**

This shall be of 14 SWG. As far as possible, the conduit system shall be so laid out that it will obviate the use of tees, elbows and sharp bends. No length of conduit shall have more than the equivalent of two quarter bends from inlet to outlet.

9.4 **CROSS SECTION**

The conduits shall be of ample sectional area to facilitate the drawing of cables. In no case shall the total cross section of cables measured over all, be more than half the area of the conduit.

9.5 **CEILING OUTLET BOXES**

Outlet boxes for ceiling fan shall be fabricated for a minimum 3 mm thick, 200 mm depth and 60 mm sides with 12 mm dia rod welded to the box. These shall be so protected at the time of laying that no material finds its way inside during concrete casting or plastering.

9.6 **DRAW BOXES**

MS draw boxes of ample dimension shall be provided at convenient points on walls to facilitate pulling of long run of cables. They will be completely concealed with asbestos cement covers flush with plaster wall. These boxes will be as few as possible and located where found suitably by the Engineer-in-charge. All the MS boxes used for house switches, plugs, drawing of wires etc., shall be five sided and of minimum 20 SWG.

9.7 **SWITCH BOXES**

MS boxes of required sizes shall be provided to house speed regulators, switches and plug sockets. This shall be attached to conduits by means of check nuts on either side of their walls. These shall be completely concealed leaving edges flush with wall surfaces. MS box shall be fitted with a brush earth terminal.

9.8 **CLEANING OF CONDUIT RUNS**

The entire conduit system including outlets and boxes shall be thoroughly cleaned after completion of erection and before drawing in cables.

9.9 **PROTECTION**

To safe guard against filling up with the plaster etc., all the outlets boxes and switch boxes will have to be provided with temporary covers and plugs within the tendered cost which shall be replaced by sheet covers as required.

9.10 **PAINTING**

Before erection, the conduit shall be painted at such places where the pipe had been damaged due to vice and wrange grip.
9.11 **FAN REGULATOR**

These shall be flush type, located in the same box as light switches wherever possible. The regulators shall be tested before installation to ensure proper graduation of fan speed.

9.12 **LAYING OF CONDUIT ONLY FOR TELEPHONE OR OTHER DUMMY CONDUITS**

The conduit for telephone system shall be the same as conduits for other work and as specified before. The minimum size shall be 20 mm dia. Junction boxes shall be provided at distance not exceeding 10 M. The whole work shall be done in cooperation with the Telephone Authority and the contractor must make such modifications as the company desires in consultation with Telephone Department. The same will apply to any other dummy conduit.

9.13 **WALL SOCKETS AND PLUGS**

Wall sockets will be of the following type:

a) For lighting plug point - 5 / 6 Amps. Capacity, 3 / 5 pin type.
b) For power plug point - 15 / 16 Amps. Capacity, 5 / 6 pin type.

The quoted rates shall also include earthing the third pin with 16 SWG GI wire.

9.14 ** WIRES AND CABLES **

a) All wires shall have been manufactured in accordance with latest IS specification amended upto date. Wire shall be carried out with PVC insulated 660 / 1100 volt grade unsheathed single core with electrolytic studded copper conductor.

b) Twin flexible cables used for pendants shall have cross sectional area of 0.001 sq. inch (equivalent to 23/0.0076 inch) or large and be insulated in accordance with relevant IS specification amended upto date.

9.15 **POINT WIRING**

a) The point wiring shall be carried out in the under mentioned manner each of which will conform to the given specification:

1. In concealed conduit system including providing supply and fixing of conduit, bends, junction boxes, brass bushes, check nuts etc.

2. Looping system will be followed throughout including supply and drawing of required sizes of wire without damaging the same.

3. All flush type accessories will be used.

4. The point will commence from the distribution board including circuits each having independent neutral wire and will end upto the outlet box and switch box.
5. The point will be complete with conduit including accessories and wire, necessary junction outlet and switch boxes, connections and ceiling roses, switch boxes and flush plates, necessary earthing connection etc., as required.

6. The installation will generally be carried out in conformity with the ISI code, electrical rules and the Electrical Rules and Institution of Engineers (London) briefly called IEE Rules, where the specification differs these specifications will prevail.

For the purpose of determining the load per circuit, the following rating of points shall be assumed:

- Light point 80 watts.
- Convenience plug points 100 watts.
- Fan points 80 watts.
- Exhaust fan point 12" 80 watts.
- Exhaust fan point 15" 90 watts.
- Exhaust fan point 18" 120 watts.
- Power plug points 1000 watts.

The convenience plug point shall be complete with 3 / 5 pin 5 / 6 Amps. Plug and socket enclosed in MS box with the controlling switch as required and the third pin shall be earthed with no. 16 SWG bare copper wire.

The ceiling fan point shall be complete with ceiling outlet box with recessed fan hook and a provision in the switch box for mounting the regulators. The ceiling fan/exhaust fan and its regulator shall be earthed. The point shall be complete as above.

Each circuit shall have not more than one power plug and the plugs shall be earthed with no. 14 SWG bare GI wire. The point shall be completed with a 5 / 6 pin 15 / 16 Amps plug socket switch combined mounted on a MS box.

9.16 MAINS AND SUB-MAINS

Mains and sub-mains shall consists of wires, cables and conduits bends junction boxes, PVC bushes, check nuts etc., as specified herein before. The sizes and capacities of conduits and wires shall be required as per load and shall commence from main switches to various distribution boards. Wires shall be drawn in the concealed without being damaged. For this purpose, draw boxes shall be located at convenient place. Every main and sub-main will run in an independent conduit with an independent earth wire of suitable capacity running along the entire run of conduit. For single phase, one earth wire shall run and for 3 phase, 2 earth wire shall run. Necessary provision of wire lengths entering and emerging out of conduit must be made for connections.

9.17 COMPLETION TEST

The installation with fittings complete shall satisfactorily pass the following tests before current is switched on:
a) All lamps and appliances having been connected and with all switches ‘ON’ a pressure not less than twice the working pressure (subject to a limit for 500V) shall be applied and the insulation resistance must not be less than 50 meg. Ohms divided by the number of points.

b) With all lamps and appliances removed from the circuit and all switches ‘ON’ a similar test between poles shall satisfy the above requirement.

c) As soon as the conduit in slab/screed is fixed, the contractor shall arrange to give it earth continuity test to ensure that the conduit or lead sheathing is electrically continuous throughout and connected to earth.

d) To ensure that all single pole switches are on the live side of the apparatus they control.

The contractor shall notify in writing to the Engineer about the completion of the work. The contractor will fix up the date of testing in consultation with the Engineer-in-Charge for such tests.

Should the above tests not comply with the limits as laid down in IEE Rules, the contractor shall rectify the faults at his own cost until the required results are obtained.

9.18 DISTRIBUTION BOARDS / SUB DISTRIBUTION BOARDS

All the distribution boards shall be factory manufactured of approved brands only. These shall be complete with necessary supporting structures, copper bus bars, neutral link and removable cover. The miniature circuit breaker shall be with notified operating curves and be capable of clearing a fault of 5 KA. The miniature circuit breaker to be used to control lighting circuits shall have tripping characteristics of 5.0 sec. At 150% full load current and those for power point circuits of 0.01 seconds at 700% full load current. The miniature circuit breakers shall be rated for the ambient temperature prevailing at site and shall have the trip devices correctly calibrated. All these MCB’s shall be factory tested and supported by suitable test certificates.

10.0 UNDER GROUND CABLE

10.1 MEDIUM AND LOW VOLTAGE

Cables should be doubled steel tape armoured PVC insulated conforming to quality as specified in the schedule of work. All joints of cables should be in joint boxes and filling in of the compound shall be done as per IS specification using the best quality materials. All cables, accessories and other materials should conform to IS specification. The jointing work should be carried out by a competent authorized cable jointer.

10.2 H.T. CABLES

All cables used for 11/33 KV system shall be XLPE cables. These cables shall have individually screened course and be manufactured and tested according to IS:7098 (Part – II) – 1973 amended upto date. The conductor for these cables shall be from electrical purity aluminum ¾ H or H temper. All conductors shall be compacted circular in shape. The insulation shall be high quality cross linked polyethylene – obtained by chemical cross linking of polythene molecules. The armouring applied over the common covering shall be of flat steel wires.
Electrical - 7

Each and every delivery length of the cable shall be subjected to routine test as per IS:7098 (Part – II) – 1973 amended upto date. The operating characteristics of these cables shall be as under:

i) Permissible maximum continuous operating temperature - 90°C
ii) Permissible short circuit temperature - 250°C
iii) Dielectric constant (Er) st 50⁰ Hz 30⁰C to 90⁰C - 2.4
iv) Loss factor at 50 Hz, 30⁰C to 90⁰C - 0.05×100×-314
v) Special voltage resistivity at 20⁰C - >10ohm cm

10.3 TRENCH

Trenches shall not be less than 35 cm wide and 75 cm below ground level for cables upto 1.1 KV and 35 cm wide and 120 cm deep for cables above 1.1 KV grade. Wherever necessary, suitable propping and shoring made on to avoid caving of the adjoining trench walls. Where the cables cross other service lines adequate protection should be taken to prevent accidental exposure and or damage to the cables.

10.4 SPACING BETWEEN CABLES

Before the cables are laid, a layer of 8 cm sand is provided for purpose cushioning. The cables after being uncoiled and laid into the trench from the rollers should be drawn in straight lengths. After the cable is laid, it is to be covered with another layer of sand of about 15 cm in depth, and the top surface to be suitably leveled to receive the cable covers. These covers shall be of concrete blocks of 20 cm × 20 cm × 5 cm and laid in a manner to overlap the cables of either side by at least 5 cm. Cable markers of aluminum or GI shall be provided at ground level after being suitably embedded in concrete blocks of 20 cm × 20 cm × 20 cm and spaced at distance of about 30 m from center to center at every change in direction.

Cables may also be laid in tire formation in the same trench. In this case also after the first 8 cm sand cushion, the first tire of cable is laid and sand filled in the trench to form a bed of 23 cm. above this tier. After this the second cable is laid and process repeated the top most tier being at least 45 cm. below the ground level. The cable shall be suitably covered with breaks or tiles.

When laying the cables care should be taken to see that the PVC insulated cables are bend or straightened slowly and sharp radii. The minimum safe bending radius for single – core cables is 20 dia and for multi-core cables 15 diameters and for armoured cables 12 diameters, the diameter being the overall diameter of the cable. Where the cables are required to cross roads this should be normally taken through hume pipe at least 15 cm in diameter.

Cables laid inside the building should be properly protected and be carried either through ducts with suitable covers with slab or chequered plates or fixed to walls by clamps, brackets or cables trays.

Cable entering or leaving the buildings should be taken through GI pipes. These pipes/sleeves shall be properly sealed after pulling the cables for preventing the water from entering inside the building as per directions of Engineer-in-Charge.
10.5 LAYING OF CABLE TRAY / SURFACE

Cable shall be laid in perforated MS cable tray / ladder. Cable shall be properly dressed before cable ties / clamps are fixed.

10.6 CABLE TAGS

Cable tags shall be made out of 2 mm aluminum sheets, each tag (1 – ½) inch dia with one hole of 2.5 mm dia, 6 mm below the periphery. Cable designations are to be punched with letter / number and the tags are to be tied inside the panels beyond the glands as well as below the glands at cable entries. Tray tags are to be tied at all bends. One straight length, tags shall be provided at every 5 meters.

10.7 TESTING THE CABLES

High voltage test should be undertaken to ensure that no damage has occurred during the laying operation and that the joints are in order. Cables of 1.1 KV suitable for low and medium voltage should withstand for 15 minutes, 3000 D.C. volts applied between the conductors and between each conductor and sheath. In absence of pressure testing arrangement it is sufficient to test for 1 minute with 2000 volts. If the test results are found to be not satisfactory the contractor shall arrange for having this set right at their cost, including removal of rejected materials, re-laying, etc.

10.8 EARTHING

Plate Electrode: shall be made of as plats of 6 mm thick and (600 x 600) mm size GI electrode. The plate shall be buried vertically in ground at depth of not less than 3.5 meters to the top of plate, the plate being en-cashed in charcoal and salt to a thickness of 15 cm all round. It is preferable to bury the electrode to a depth where the sub-soil water is present. Earth leads to electrode shall be laid in a GI pipe and connected to the plate electrode with GI bolts, nuts and washers. A GI pipe of not less than 19 mm dia shall be placed vertically over the plate and terminated in a funnel at 5 cm above ground. The tunnel shall be provided with a wire-mesh. The funnel shall be enclosed in a masonry chamber (100 x 50) cm. The chamber shall be provided with CI frame cover of (100 x 50) cm size. The earth station shall also be provided with a suitable permanent identification level tag.

Pipe Electrode: shall comprise of a 2.5 meter long 40 mm dia GI pipe buried in a plot of (35 x 35) cm size and filled with alternate layer of charcoal, salt and river sand and connected at the top to a GI pipe of 19 mm, 1 meter long with a funnel at the other end, 5 cm above the ground. The earth lead shall be properly fixed to the pipe electrode with brass bolt, nuts and washers. The funnel and earth lead connection shall be enclosed in a masonry chamber (30 x 30 x 30) cm dimension. The chamber shall be provided with a CI frame with cover. Proper permanent identification tag / level shall be provided for each electrode.

Normally each electrode shall not be situated less than 1.5 m from any building.
**Testing:** on completion of the entire installation, the following test shall be conducted and no earth electrode shall have ohmic resistance of more than 2 ohm and in rocky soil not more than 3 ohm.

**11.0** The work shall basically consist the following:

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>POINT WIRING</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Wiring for light point/fan point/exhaust fan point/call bell point with 1.5 sq.mm PVC insulated copper conductor cable in recessed PVC conduit as required including 5/6 amp piano type switch, C.I. cover plate etc. complete.</td>
</tr>
<tr>
<td>2.</td>
<td>Wiring for twin control light 1.5 sq.mm PVC insulated, copper conductor, cable in recessed PVC conduit with 2 way, 5/6 amp piano type switch etc. as required.</td>
</tr>
<tr>
<td>3.</td>
<td>Wiring for 3 pin 5/6 amps light plug point on same switch board including providing and fixing 3 pin 5/6 amp socket outlet and 5/6 amp piano type switch connection etc. as required.</td>
</tr>
<tr>
<td>4.</td>
<td>Wiring for light plug 2 × 1.5 sq.mm PVC insulated copper conductor single core cable in recessed PVC conduit along with 1 no. 2.24 mm dia bare copper wire for loop earthing as required.</td>
</tr>
<tr>
<td>5.</td>
<td>Wiring for power plug with 2 × 4 sq.mm PVC insulated copper conductor, single core cables in recessed PVC conduit along 1 no. 2.24 mm dia bare copper wire for loop earthing as required.</td>
</tr>
<tr>
<td>6.</td>
<td>Wiring for Ckt. Wiring with 2 × 2.5 sq.mm PVC insulated, copper conductors, single core cables in recessed PVC conduit complete as required.</td>
</tr>
<tr>
<td>7.</td>
<td>Wiring for sub main with 4 × 6 sq.mm PVC insulated copper conductor single core cables in recessed PVC conduit complete as required.</td>
</tr>
<tr>
<td>8.</td>
<td>Supplying and fixing metal box of 100 mm × 100 mm × 60 mm deep (nominal size) in recess with suitable size phenolic laminated sheet cover in the front including providing and fixing 3 pin 5/6 amps socket outlet and 5/6 amps tumbler/piano type switch, connections, painting etc. as required (for light plugs).</td>
</tr>
<tr>
<td>9.</td>
<td>Supplying and fixing metal box of 180 mm × 100 mm × 60 mm deep (nominal size) on surface or in recess with suitable size phenolithic laminated sheet cover in the front including providing and fixing 3 pin 15/16 amps tumbler/piano type switch, connections, painting etc. as required (for power points).</td>
</tr>
<tr>
<td>10.</td>
<td>Supplying and fixing 20 amps, 240 volts, SPN industrial type, socket outlet, with 2 pole and earth, metal enclosed plug top along with 20 amps G-series, SP, MCB, in sheet steel enclosure in recess with chained metal cover for the socket outlet and complete with connections, testing and commissioning etc. as required.</td>
</tr>
<tr>
<td><strong>SWITCH BOARDS, DBS &amp; CABLES</strong></td>
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<tr>
<td>11.</td>
<td>Supplying and fixing MCB type TPNDB 4 way prewired in recess complete as required with copper busbars, N link etc. and following.</td>
</tr>
<tr>
<td>12.</td>
<td>Supplying and fixing MCB TPNDB 4 way prewired in recess complete as required with copper busbars, N link etc.</td>
</tr>
<tr>
<td>13.</td>
<td>Providing and fixing of 63 A (Category A) TPNSFU with HRC fuses complete as required including supplying and fixing of suitable angle iron frame.</td>
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<td></td>
<td>Description</td>
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<tr>
<td>14.</td>
<td>Supplying, installation, testing and commissioning of cubical type wall/floor TPN distribution board with aluminium bus bars, wiring, connections, painting etc. complete as required with following switch gear and accessories as per approved drawing and design. I/c 125 A TPNFSU – with HRC fuses o/g 40 A TPN-MCB-125 A4P change over switch.</td>
</tr>
<tr>
<td>15.</td>
<td>Supplying, installation, testing and commissioning of cubical type wall/floor mounted TPN distribution board with aluminum bus bars, wiring, connections painting etc. complete as required with following switch gear and accessories as per approved drawing and design. I/c 400 A TPNSFU with HRC fuses. O/g 125 A TPNSFU.</td>
</tr>
<tr>
<td>16.</td>
<td>CABLES</td>
</tr>
<tr>
<td>17.</td>
<td>Supplying and installation of 1.1 KV grade PVC insulated sheathed and armoured Al. Conductor cable of following size as per IS : 1554 (Part – I)</td>
</tr>
<tr>
<td>18.</td>
<td>Laying and fixing of 1.1 KV grade PVC insulated sheathed and armoured Al. Conductor cable in ground or on wall/ceiling complete as required.</td>
</tr>
<tr>
<td>19.</td>
<td>Supplying and laying cable and termination with brass compression gland and crimped cable and sockets.</td>
</tr>
<tr>
<td>20.</td>
<td>Providing earthing station with G.I. Plate 600 x 600 x 6 mm watering pipe, masonry enclosure, C.I. cover plate etc. complete as required including salt and charcoal.</td>
</tr>
<tr>
<td>21.</td>
<td>Providing and fixing G.I earth strip 50 x 5 mm in 65 mm dia G.I. pipes in ground.</td>
</tr>
<tr>
<td>22.</td>
<td>Supplying and laying 2 x 55 mm G.I. strip in 40 mm dia G.I. pipe from earth electrode as required.</td>
</tr>
<tr>
<td>23.</td>
<td>Providing and fixing 6 SWG dia, G.I. wire in recess for loop earthing along with the existing/recessed conduits/sub main wiring/cable as required.</td>
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<tr>
<td>24.</td>
<td>Supplying and laying of 20 x 3 mm GI strip in parapet wall and vertical dropping ground.</td>
</tr>
<tr>
<td>25.</td>
<td>Supplying and fixing of 300 mm long GI tube having single prong at top with 85 mm dia, 6 mm thick GI base plate including making holes as required.</td>
</tr>
<tr>
<td>26.</td>
<td>INSTALLATION OF LIGHT FITTINGS, FAN AND FIXTURES</td>
</tr>
<tr>
<td>27.</td>
<td>Supply, installation, testing and commissioning of prewired, fluorescent fittings of all types complete with all accessories and tubes etc. directly on ceiling/wall, including connections with 1.5 sq.mm PVC insulated, copper conductor, single core cable as required.</td>
</tr>
<tr>
<td>28.</td>
<td>Supply, installation, testing and commissioning of ceiling fan and regulator, including wiring the down rod of standard length (upto 30 cm) with 1.5 sq.mm PVC insulated, copper conductor, single core cable including cartage etc.</td>
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<tr>
<td><strong>29.</strong></td>
<td>Supply, installation, testing and commissioning of exhaust fan upto 450 mm sweep in the existing opening, including making the hole to suit the sizes of the above fan, making good the damage etc. complete.</td>
</tr>
<tr>
<td><strong>30.</strong></td>
<td>Supply, installation, testing and commissioning call bell/buzzer and piano type bell push, suitable for D.C./A.C. single phase 230 volts complete as required.</td>
</tr>
<tr>
<td><strong>31.</strong></td>
<td>Supply, installation, testing and commissioning, erection of wall bracket/ceiling fittings of all sizes and shapes containing upto two GLS lamps per fitting, complete with all accessories including connections etc. required.</td>
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</table>

### 12.0 LIST OF APPROVED MAKE OF MATERIAL FOR ELECTRICAL

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<td>Larsen &amp; Toubro</td>
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<tr>
<td>3.</td>
<td>Siemens</td>
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<tr>
<td>3.</td>
<td>HPL</td>
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<tr>
<td>2.</td>
<td>MCCB</td>
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<tr>
<td>2.</td>
<td>Larsen &amp; Toubro</td>
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<tr>
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<td>Siemens</td>
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<tr>
<td>3.</td>
<td>HPL</td>
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<tr>
<td>3.</td>
<td>Aluminum Conductor PVC Insulated Wires</td>
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<td>1.</td>
<td>Plaza</td>
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<td>2.</td>
<td>Paragon</td>
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<td>3.</td>
<td>Finolex</td>
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<td>4.</td>
<td>Universal</td>
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<td>5.</td>
<td>Payal</td>
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<td>4.</td>
<td>Copper Conductor PVC</td>
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<tr>
<td>1.</td>
<td>Plaza Insulated Wires</td>
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<td>5.</td>
<td>Payal</td>
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<td>6.</td>
<td>Harsh</td>
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<td>5.</td>
<td>Metal Clad Socket Outlet</td>
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<tr>
<td>1.</td>
<td>Crompton</td>
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<tr>
<td>2.</td>
<td>HPL</td>
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<tr>
<td>6.</td>
<td>L.T. Panels</td>
</tr>
<tr>
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<td>Larsen &amp; Toubro</td>
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<tr>
<td>2.</td>
<td>Crompton Greaves</td>
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<td>3.</td>
<td>HPL</td>
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<td>7.</td>
<td>Bus Duct</td>
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<td>1.</td>
<td>Zeta</td>
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<tr>
<td>2.</td>
<td>Best &amp; Crompton</td>
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<tr>
<td>3.</td>
<td>ECS</td>
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<td>9.</td>
<td>Frequency Meter</td>
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| 10. | Meter / CTS | 1. SG  
|   |   | 2. Automatic Electric |
| 11. | Selector Switches | 1. KayCee  
|   |   | 2. Larsen & Toubro |
| 12. | Contactors | 1. Siemens  
|   |   | 2. Larsen & Toubro  
|   |   | 3. HPL |
| 13. | HRC Fuse | 1. HPL  
|   |   | 2. Siemens |
|   |   | 2. Siemens |
| 15. | Battery Charger | 1. Automatic Electric  
|   |   | 2. Usha Rectifier |
| 16. | Batteries | 1. Exide  
|   |   | 2. Standard |
| 17. | Relays | 1. HPL. |
| 18. | Timers | 1. Larsen & Toubro |
| 19. | Motors | 1. Siemens  
|   |   | 2. Kirloskar  
|   |   | 3. NGEF  
|   |   | 4. Crompton |
| 20. | Starters | 1. Larsen & toubro  
|   |   | 2. HPL |
| 21. | Rising Mains | 1. Zeta  
|   |   | 2. ECS |
| 22. | Volt / Amp. Meters | 1. Automatic Electric  
|   |   | 2. HPL  
|   |   | 3. Havells |
| 23. | Single Phase Preventor | 1. Larsen & Toubro |
| 24. | Indicating Lights | 1. Siemens  
|   |   | 2. SG |
| 25. | Pumps | 1. Beacon  
<p>|   |   | 2. Kirloskar |</p>
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<td>Khaitan</td>
<td>Polar</td>
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<td>Orient –Summer Cool</td>
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<td>Siemens</td>
<td>G.E.C.</td>
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<td>4. Havells</td>
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<td>41. Metal Box</td>
<td>MS sheet 10 gauge, painted with black paint.</td>
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<td>42. Switch Gear / Isolator</td>
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<td>45. Fluorescent &amp; Other Fittings</td>
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<td>3. Crompton Greaves</td>
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<td>4. HPL</td>
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<td>46. Conduit</td>
<td>1. MS:- BEC, AKG, WAVIN, EMCO</td>
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<td>47. Cable</td>
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<td>5. Finolex</td>
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</table>
48. MCB Isolator & its DB
   1. MDS
   2. Havels
   3. Standard Koop
   4. Crompton Greaves
   5. HPL
   6. GECO

49. Fuse Carrier Bakelite / Rewirable
   1. Havells
   2. HPL
   4. Siemens

50. Other electrical fixtures
    Shall be of standard make and of BIS approved.

Note: The materials other than approved list shall bear IS mark and/or to be approved by the Engineer-in-charge before the use. Required tests are to be conducted by the contractor before use at works.

13.0 Electrical power supply feed point for connection to building shall be at a maximum distance of 30.00 (thirty) metres from the edge of the buildings.
14.0 GENERAL NOTES ON ELECTRICAL WORKS

(1) For switch boards – recessed 18 SWG sheet steel metal boxes of necessary size fitted with suitable size phenolic laminated sheet covers in front, including painting as required.

(2) Wiring shall be concealed with copper wire.

(3) Cable – PVC insulated with copper conductor for light points 1.50 sqmm ISI marked.

(4) Cable – PVC insulated with copper conductor for circuit wiring 2.50 sqmm ISI marked.

(5) Cable – PVC insulated with copper conductor for power points 4.00 sqmm ISI marked.

(6) All fittings & fixtures including switch / socket on existing board should be ISI marked of approved quality.

(7) All electrical fittings will be ISI marked and approved make.

(8) A sample of each kind shall be approved from engineer-in-charge and all the materials should be according to the approved sample.

(9) Two way switch shall be provided for staircase.

(10) Conduit for cable TV shall be provided.

(11) The location of light fitting shown in the drawing are indicative and actual position shall be approved by Engineer-in-Charge.

(12) Sub main wiring with cable PVC insulated sheathed copper conductor size 10 to 16 sqmm 32 mm dia PVC conduit.

(13) Electric power supply feed point for connection to the building will be at a maximum distance of 30 m from the edge of the building.

(14) Lighting conductor final, made of 25 mm dia, 300 mm long GI tube having single prong at top with 85 mm dia, 6 mm thick GI base plate including making holes etc. complete including GI tape 20 mm x 3 mm, testing joint made of 20 mm x 3 mm thick GI tape from earth electrode directly in ground all complete as per the instruction of Engineer-in-Charge.

(15) The location of main switch and distribution board shall be at ground floor below staircase.

(16) One no. earthing pit shall be provided for each block as per following details earthing with GI earth 600 mm x 600 mm x 6 mm thick including accessories and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. with charcoal or coke salt, b-class 50 mm dia GI pipe (normal) complete with GI fittings, including trenching, refilling etc. all complete as per the instruction of Engineer-in-Charge.
List of Drawings

NIT No. & Date: NERO/CON/ASR/Silchar/273  
Dated: 10.11.2017

Tender for: Construction Of 06 Nos. Type-II (G+II) Quarter In 01 Block Including Infrastructural Development Works For Assam Rifles At Silchar, Assam.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Title of Drawing</th>
<th>Drawing No.</th>
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<tr>
<td>1</td>
<td>Ground Floor Plan</td>
<td>AR-QTR-II-01</td>
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<tr>
<td>2</td>
<td>Typical Upper Floor Plan (1&lt;sup&gt;st&lt;/sup&gt; &amp; 2&lt;sup&gt;nd&lt;/sup&gt;)</td>
<td>AR-QTR-II-02</td>
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<tr>
<td>3</td>
<td>Terrace Floor Plan</td>
<td>AR-QTR-II-03</td>
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<td>4</td>
<td>Front Elevation-A</td>
<td>AR-QTR-II-04</td>
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<td>5</td>
<td>Side Elevation-B</td>
<td>AR-QTR-II-05</td>
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<td>6</td>
<td>Section A-A</td>
<td>AR-QTR-II-06</td>
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<td>7</td>
<td>Section B-B</td>
<td>AR-QTR-II-07</td>
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<tr>
<td>8</td>
<td>Ground Floor Plan (Garage)</td>
<td>AR-GARAGE-01</td>
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Note: The enclosed drawings are for tender purpose and for general guidance only. The works shall be executed as per the construction drawings to be issued during course of work and as per instructions of the Engineer-in-charge.

(Signature and seal of the Tenderer)
NOTE: ALL WINDOWS SHALL BE PROVIDED WITH MS GRILL.
NOTE: ALL WINDOWS SHALL BE PROVIDED WITH MS GRILL.
SECTION --- B - - B
CONSTRUCTION OF 06 NOS. TYPE-II QUARTER (G+II) FOR ASSAM RIFLES AT SILCHAR, ASSAM

SCALE:

DRG TITLE:

PROJECT EXECUTING AGENCY:

PROJECT:

G ROUND FLOOR PLAN

CONSTRUCTION OF 06 NOS. TYPE-II QUARTER (G+II) FOR ASSAM RIFLES AT SILCHAR, ASSAM

DATE: 07.08.2017

DRAWING NO:

CLIENT:

DIRECTORATE GENERAL ASSAM RIFLES

SHILLONG

DRAWN BY:

CHECKED BY:

ENGINEERING PROJECTS INDIA LTD.

BLOCK-A, 4TH FLOOR, HINDUSTAN TOWER,

JWAHAR NAGAR, BELTOILA, GUWAHATI

SCALE:

DATE: 07.08.2017

DRAWN BY:

CHECKED BY:

ENGINEERING PROJECTS INDIA LTD.

BLOCK-A, 4TH FLOOR, HINDUSTAN TOWER,

JWAHAR NAGAR, BELTOILA, GUWAHATI

GL ±00

PLINTH LVL 450

CYCLE SHED 1700x1100

CYCLE SHED 1700x1100

CYCLE SHED 1700x1100

CYCLE SHED 1700x1100

Y1

1155

1220

1215

1160

4975

X1

X2

1865

2095

1000

Y5

Y4

Y3

Y2

GL ±00