

MILITARY ENGINEER SERVICES**CONTENTS****NAME OF THE WORK: PROVISION OF HANGAR AND ANNEXE BUILDING
ATVISAKHAPATNAM**

Sl. No.	Description	Pages	
		From	To
1.	Contents		
2.	Tender Forwarding Letter and Instructions for filling and submission of Tender		
3.	Notice Inviting Tender (IAFW-2162) (Revised-1960) including Appendix 'A' to Notice Inviting Tender along with Integrity Pact& Joint Venture and amendments there to		
4.	Tender and Lump Sum Contract for Works IAFW-2159 (Revised 1947)		
5.	General Conditions of Contracts IAFW-2249 (1989 Print) including Amendments and Errata thereto		
6.	Schedule of Minimum Fair Wages including Amendments and Errata thereto		
7.	Special Conditions		
8.	Particular Specifications including List of Drawings, Appendices & Annexure		
9.	Errata/Amendments to Tender Documents		
10.	Relevant Correspondence		
11.	Acceptance Letter		
12.	Total Pages		

Drawings : _____ Sheets

Signature of Contractor
Date:AA Dir (Contracts)
For Accepting Officer

Telephone : 0891-25 77 405/27 46 003
Fax : 0891- 27 47 002
E-mail : dircontceznv2-mes@nic.in

Chief Engineer (Navy)
Military Engineer Services
Station Road
Visakhapatnam-530 004

85414/ /E8**Jun 2026**

M/s _____

PROVISION OF HANGAR AND ANNEXE BUILDING AT VISAKHAPATNAM

Dear Sir(s),

1. Tender documents in respect of above work are uploaded on the site www.defproc.gov.in. The tender is on Single Stage Two Cover e-Tendering system. The contents of Cover-1 & Cover-2 are specified in Notice Inviting Tender.
2. Bids will be received online by Accepting Officer up to the date and time mentioned in the Notice Inviting Tender (NIT). No tender/bid will be received in physical form and any tender/bid received in such manner will be treated as non bonafide tender/bid.
3. Bids will be opened on due date and time fixed for opening in the presence of tenderers/bidders or their authorised representatives, who have uploaded their quotation/bid and who wish to be present at the time of opening the bids.
4. Your attention is also drawn to 'Instruction on Filling and Submission of Tender' attached herewith. You may forward your points on tender documents and/or depute your technical representative for discussion on tender/drawings and to clarify doubts. You are requested not to write piece meal points and forward your points duly consolidated.
5. Un-enlisted contractor are required to submit the scanned copies (in pdf file) of documents required as per eligibility criteria mentioned in 'Instruction on Filling and Submission of Tender' and Appendix 'A' to NIT along with Earnest Money Deposit (EMD) and tender fee on e-procurement portal and submit the physical documents in the office of Chief Engineer (Navy), Station Road, Visakhapatnam-530 004 within time limit specified in NIT. Inadequacy/deficiency of documents shall make the bid liable for rejection resulting in disqualification for opening of finance bid.
6. Contractor having not executed Standing Security Bond and Standing Security Deposit in any MES formation shall upload scanned copy of Earnest Money Deposit (EMD) mentioned in Notice Inviting Tender and shall ensure receipt of hard copy of EMD in the office of tender issuing authority before date & time fixed for this purpose. In case of failure to abide by any of these two requirements, the finance bid will not be opened.
7. Enlisted contractors of MES shall submit the scanned copies (pdf file) of enlistment letter, tender fee and such other documents as mentioned in Appendix 'A' to NIT on e-procurement portal and submit physical documents in the office of Chief Engineer (Navy), Station Road, Visakhapatnam-530 004 before date & time fixed for this purpose.
8. The contractor must ensure that the tender/bid on the proper form is uploaded in time as the Accepting Officer will take no cognizance of any quotations/offer received in any other electronic or physical form like e-mail/fax/by hand/through post from tenderer/bidder even if they are received in time.

9. In view of delays due to system failure or other communication related failures, it is suggested that the tender/bid be uploaded, if necessary, sufficiently in advance of the last due date and time fixed.
10. General Conditions of Contracts (IAFW-2249) (1989 Print) and errata and amendments thereto, Schedule of Minimum Fair Wages, MES Standard Schedule of Rates, Part-I (2009) (Specifications) and MES Standard Schedule of Rates, Part-II (2020) (Rates) are not enclosed with these documents. These are available for perusal in the Office of Garrison Engineer concerned and this Office.

Note: Tenderers are deemed to be in possession of the above documents. The documents mentioned above are available in booklet form in any of the MES Offices, which can be seen during working hours on any working day, with prior notice. The tenderers are deemed to have made themselves acquainted with the contents of the above mentioned documents before submission of the tender/bid and no claim whatsoever on this account shall be entertained.

11. ANY TENDER, WHICH PROPOSES ALTERATIONS TO ANY OF THE CONDITION, SPECIFICATIONS LAID DOWN IN THE TENDER DOCUMENTS OR ANY NEW CONDITION, WHATSOEVER, IS LIABLE TO BE REJECTED.
12. Contractor shall get themselves registered with the Employees Provident Fund Organisation and deposit the necessary contributions with the EPFO. Further, it is a mandatory requirement that all construction workers should be provided Universal Account Number (UAN) by the contractor by appropriately registering them on the EPFO portal. All the workers deployed by contractor are enrolled as members of Provident Fund and should be given the Universal Account Number (UAN). Certificate to the effect that all the workers employed directly or indirectly are registered for EPF and the due consideration have been credited into their account shall be rendered by the contractor along with each and every RAR/Final Bill.

Note: For the purpose of above, contractor shall have Provident Fund Code Number obtained from concerned authorities (Employees Provident Fund Organization). In case tender/bid is accepted, the Provident Fund Code Number shall be submitted to GE before placing the Work Order.

13. GST REGISTRATION NUMBER: The contractor shall be in possession of GST Registration Number. It is mandatory for the contractors to upload their GST Registration Number along-with the T Bid. This will be one of the criteria for qualifying in T Bid. Contractor, who does not upload GST Registration Number, shall be disqualified in the T Bid evaluation and his Finance Bid shall not be opened.
14. APPLICABLE TO DGNP ENLISTED CONTRACTORS ONLY: The tenderers who are enlisted with DGNP Visakhapatnam/Mumbai shall submit Earnest Money Deposit (EMD) for the amount as indicated in Appendix 'A' to Notice Inviting Tender. Scanned copy of EMD shall be uploaded along with 'T' Bid. Hard copy of EMD however be sent by Speed Post/Registered Post along with other documents within the time specified in Appendix 'A' to Notice Inviting Tenders..
15. Court of the place from where tender has been issued shall alone have jurisdiction to decide any dispute out of or in respect of this tender. After acceptance of tender, Condition 72-Jurisdiction of Courts of IAFW-2249 shall be applicable.
16. In case the BOQ is revised through Corrigendum to tender documents, bidders shall be required to quote their rates in the Revised BOQ only. Tenderer is supposed to check if any revised BOQ has been uploaded by MES, before uploading their BOQ. In case any bidder

uploads pre-revised BOQ, it shall be considered as willful negligence by them and their bid shall be considered as non-bonafide.

17. PERFORMANCE SECURITY (REFER CONDITION 19 OF IAFW 2249 GENERAL CONDITIONS OF CONTRACT):

- 17.1 The tenderers shall note that the successful bidder shall lodge performance security of an amount equivalent to **5% of contract sum** within 28 days from the date of receipt of letter of Acceptance in the form of FDR or he may choose to submit BGB or Govt. securities or Insurance surety bonds from IRDAI approved insurance companies or scheduled banks
- 17.2 The performance security shall be in favour of Accepting Officer. The WO No.1 shall be placed only after submission of performance security of adequate value by the contractor. In case a fixed deposit receipt of any Bank is furnished by the contractor to the Government as part of the performance Guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the Government to make good the deficit. The Performance Security shall be initially valid up to the stipulated date of expiry of defects liability period plus minimum 60 days beyond that. In case final bill is not paid during this period, the contractor shall get the validity of Performance Guarantee extended to cover such enlarged time required for payment of final bill. The performance security will be released to contractor on expiry of defects liability period provided always that the contractor has been paid the final bill and contractor has rendered the NO Demand Certificate (IAFW-451).
- 17.3 In case the tenderer fails to deposit the Performance Security within the stipulated period the award of work shall be liable to be cancelled and the amount of Earnest Money shall be forfeited. In this situation, MES enlisted contractor shall deposit the Earnest Money as stipulated in the Notice Inviting Tender through MRO. Further bids submitted by ibid bidder will not be opened till the amount equal to Earnest Money is deposited in the Govt. treasury.

Yours faithfully,

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

INSTRUCTIONS ON FILLING AND SUBMISSION OF TENDER**1. EARNEST MONEY:**

- 1.1. If you are not enlisted as an approved contractor with any MES formation or if you are enlisted but have not deposited the standing security, you are required to submit your tender with sum of rupees (See Appendix 'A') as earnest money in the form of call deposit receipt from a scheduled bank in favour of the GE (See Appendix 'A' to Notice of tender). The scanned copy of the same in the pdf file is to be uploaded at the time of applying for the bid. Any tender/bid not accompanied by earnest money in the prescribed form will be treated as non-bonafide and will not be considered for acceptance.
2. The printed form of General Conditions of Contracts, IAFW-2249 (1989 print) and errata/ amendments thereto forming part of the tender documents can be seen by tenderer in any of the MES offices during office hours. Tenderers will be deemed to have full knowledge of IAFW-2249 with up to date errata and amendments whether they study the same or not.
3. It shall be noted that any tender who proposes any alteration to any of the conditions and/or specifications and/or other provisions laid down in these documents and/or which proposes other conditions of any description what so ever is liable to be rejected.
4. Tenderers are required to quote their tender carefully so as to submit an accurate and bonafide tender. No subsequent offer for reduction in the rates as a pretext of error/mistake in estimate or in quoting the tender will be entertained after opening of tender from any of the tenderers other than the lowest tenderer. Please note that any offer or reduction from contractor other than the lowest tenderer after opening of the tender will be viewed seriously and will call for severe disciplinary action against such contractor by the Department for a minimum period of one year and in addition any other action as deemed necessary by the department against such contractor.

5. INCOME TAX DEDUCTION AT SOURCE:

- 5.1. Please note that under Section 194-C of the Income Tax Act 1961, the tax at 2% or at other percent where exemption is granted will be deducted at source from the gross amounts of the payments claimed for the value of work done and materials lying at site under this contract without making any adjustments on account of materials issued under Schedule ' B ' and for supply of water, tools and plants etc.

6. GUIDELINES/ PROCEDURE TO BE FOLLOWED IN THE PROCESS OF E-TENDERING:

- 6.1. It is mandatory for all the bidders to have class-II or class-III digital signature certificate (in the name of person who will sign the Application) from any of the licensed certifying agency (Bidders can see the list of licensed CAs from the link www.cca.gov.in) to participate in e-tendering process.
- 6.2. There is no physical supply of tender documents. The bidders, can view/download the tender documents from the web site www.defproc.gov.in. The bidder shall submit their offer online in electronic formats, however DD/bankers cheque for Tender Fees is required to be submitted manually in the office HQ CE (Navy) Complex, Station Road, Visakhapatnam-530 004, before date & time of opening of bid (first stage) and scanned copy of DD/ bankers cheque for Tender Fees, and EMD etc. must also be uploaded at www.defproc.gov.in.
- 6.3. The tender to be submitted online at www.defproc.gov.in by due date and time as mentioned in NIT, which shall form the part of the contract document. The bidders who are

desirous of participating in 'e' Tender shall submit their price bids in the standard formats prescribed in the Tender documents, displayed at www.defproc.gov.in. The bidder should upload the scanned copies of all the relevant certificates, documents etc., in the www.defproc.gov.in in support of their technical bid & price bids. The bidder shall sign on all the statements, documents, certificates, uploaded by him, owning responsibility for their correctness/authenticity.

- 6.4. The Price Bids will be opened online by the opening officers at the specified date & time and the result will be displayed on the www.defproc.gov.in, which can be seen by all the bidders who participated in the tenders. If the office happens to be closed on the date and time of bid opening as specified OR due to some unforeseen reason (s), the bid could not be opened on the date and time of bid opening as specified, the bid will be opened on the next or subsequent working day and on the time as decided by the Accepting Officer without assigning any reason. No claim will be entertained on this account.
- 6.5. The bidders can visualize the opening process online.
- 6.6. The concerned officer will evaluate and process the tenders as done in the conventional tenders and will communicate the decision to the bidder online/by registered post. After the award of the contract, an agreement shall be signed as done in offline Tenders.
- 6.7. No physical form of tender will be accepted and the same will be summarily rejected. The department does not take any responsibilities for non-availability of internet connection or network traffic jam etc. for online bid at any stage. The department will not be responsible for any error like missing of schedule data while downloading by the Bidder. No claim will be entertained on this account.
- 6.8. One bidder can submit only one bid for one work/project. If a bidder will submit more than one bid, his bids will be summarily rejected.
- 6.9. If any lowest tenderer revoking his offer/tender or revising his rates upward (which will be treated as revocation of offer) or makes any modifications in the terms and conditions of the tender, then the Government shall, without prejudice to any other right or remedy, be at liberty to recover the said earnest money as aforesaid. In case of MES enlisted contractors, the amount equal to the Earnest Money stipulated in the Notice of Tender, shall be notified to the tenderer for depositing the amount through MRO, failing which the amount shall be recovered from payment due to such Contractor or shall be adjusted from his Standing Security Deposit. Participation for further tender to such tenderer (s) shall also remain suspended till the aforesaid Earnest money is deposited in the Govt. Treasury. Further the tenderer shall not be allowed to participate in the retendering process of the work.
- 6.10. In case any tampering/alteration is noticed between the documents as uploaded at the time of submission of the bid online and the original one as uploaded by the office of CE(Navy) Visakhapatnam, then the bid submitted shall become invalid and the Government shall, without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money as aforesaid. In case of MES enlisted contractors, the amount equal to the Earnest Money stipulated in the Notice of Tender, shall be notified to the tenderer for depositing the amount through MRO, failing which the amount shall be recovered from payment due to such Contractor or shall be adjusted from his Standing Security Deposit. Participation for further tender to such tenderer (s) shall also remain suspended till the aforesaid Earnest money is deposited in the Govt Treasury. Further the tenderer shall not be allowed to participate in the re-tendering process of the work.
- 6.11. The bidder shall regularly visit the website www.defproc.gov.in for any Errata/Amendments to tender documents/price bid till the date and time of online submission of price bid and bidder must incorporate them in their bid documents.

- 6.12. Before deadline for submission of bids, the department can modify the bid document(s) by issuing addenda/corrigenda. Any addendum/corrigendum thus issued shall be part of the bidding documents and shall be uploaded on the website as a corrigendum. To give prospective bidders reasonable time to take an addendum/corrigendum into account in preparing their bids, the department may, at discretion, extend as necessary the deadline for submission of bids. However, no claim will be entertained on this account.
7. Bidder(s)/Tenderer(s) attention is drawn to the official secret Act, particularly section 5 thereof for compliance.
8. The Accepting Officer reserves right to accept a tender submitted by a Public Sector Undertaking/ Enterprise undertaking giving a price preference over other tender(s) which may be lower, as are admissible under the Government policy. No claim for any compensation or otherwise shall be admissible from such tenderer (s) whose tender may be rejected on account of the said policy.
9. These instructions shall form part of the contract documents and shall be signed along with the tender documents during signing of contract agreement.
10. These instructions shall form part of the contract documents and shall be signed and returned along with the tender documents on acceptance of the bid.
11. DEDUCTION AT SOURCE OF GST ON WORKS CONTRACT.
- 11.1. Deduction at source towards GST on works contracts will be made by GE from RAR/Final bill at the applicable rate as per existing rules/law.
12. BANK GUARANTEES
- 12.1. On acceptance of tender, facilities for execution of Bank guarantee as applicable for certain purposes are available to the contractors as detailed below:
(a) Performance Security Deposit for individual works.
(b) Retention Money for payment of Running Account Receipts.
- 12.2. The Bank Guarantee Bonds shall be from 'State Bank of India or any scheduled Bank.
- 12.3. Bank Guarantee shall be executed for a period and on a form as directed by the Accepting Officer.
13. **CPM**
- 13.1. The tender is based on CPM.
- 13.2. The tenderer is expected to be fully conversant with the CPM technique and employ technical staff who can use the technique in sufficient details.
- 13.3. The tenderer's attention is drawn to special conditions of the tender regarding preparation of the detailed network and time schedules for the work and his liability for employing sufficient resources to adhere to this schedule. Any inability on the part of the tenderer in using the technique will be taken as his technical insufficiency and will affect his class of enlistment and future prospects of receiving tenders for work.
14. **EXECUTIVE AGENCY**

- 14.1. The executive agency of the above work is **Garrison Engineer Project Navy No. 2 Visakhapatnam** who will be called hereinafter as Garrison Engineer or concerned Garrison Engineer.
15. The tenderer/bidder shall use the DSC issued on behalf of the applicant firm/proprietor for uploading the bid.
16. **ERRATA/AMENDMENTS TO TENDER DOCUMENTS**
- 16.1. The department may issue amendments/errata to the tender documents before due date or extended closing date & time of bid submission. The contractor is required to read the tender documents in conjunction with the amendments if any issued by the department.

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

(In lieu of IAFW-2162)(Revised-1960)

MILITARY ENGINEER SERVICES
NOTICE INVITING TENDER

1. An e-Tender is invited for the work as mentioned in Appendix 'A' to this Notice Inviting Tender (NIT).
2. The work is estimated to cost as indicated in aforesaid Appendix 'A'. The estimate, however, is not a guarantee and is merely given as rough guide. If the work cost more or less, the tenderer/bidder will have no claim on this account. The tender shall be based on as mentioned in aforesaid Appendix 'A'.
3. The work is to be completed within the period as indicated in aforesaid Appendix 'A' in accordance with the phasing if any, indicated in the tender from the date of handing over of site, as stipulated in Work Order No.1 to be issued by GE after acceptance of contract and submission & acceptance of performance security.
4. Normally contractors whose names are on the MES approved list for the area in which the work lies and within whose financial powers the estimated amount would fall may tender/bid. Within 28 days of the receipt of the Acceptance Letter, the contractor shall lodge the Performance Security Deposit @ 5% of the Contract Sum in the form of (a) A Bank Guarantee in the prescribed form from any of the Nationalised/ Scheduled Indian bank to be mandatorily confirmed from the Head Office of the Bank (or) (b) Govt. Securities, FDR or any other Govt. Instruments as stipulated by the Accepting Officer, failing which, the Acceptance of the Tender will be cancelled and the EMD submitted by the contractor will be forfeited. In case of MES enlisted contractors, the amount equal to the Earnest Money stipulated in the Notice of Tender, shall be notified to the contractor for depositing the amount through MRO, failing which the amount shall be recovered from payment due to such contractor or shall be adjusted from his Standing Security Deposit. Participation for further tenders by the contractor shall also remain suspended till the aforesaid earnest money is deposited in the Govt. treasury. Further, the contractor shall not be allowed to participate in the retendering process of the work. Not more than one tender/bid shall be submitted/uploaded by one contractor or one firm of contractors. Under no circumstances, will a father and his son (s) or other close relations who have business dealing with one another be allowed to tender/bid for the same contract as separate competitors. A breach of this condition will render tenders/bids of both parties liable to rejection.
5. Chief Engineer (Navy), Station Road, Visakhapatnam-530 004 will be the Accepting Officer hereinafter referred to as such, for the purpose of the contract.
6. The Technical bid and Financial bid (Cover-1 & Cover-2) shall be uploaded by the tenderer/bidder on or before the date and time mentioned in aforesaid Appendix 'A'. Scanned copy of DD/BC with Enlistment details/documents shall be uploaded as Packet-1/Cover-1 (T-Bid) of the Tender/Bid on e-Tendering Portal. DD is refundable in case T-Bid is not accepted resulting in non-opening of Q-Bid. The applicant contractor shall bear the cost of bank charges for procuring and encashing the DDs and shall not have any claim from Government whatsoever on this account.
 - 6.1. Tender form and conditions of contract and other necessary documents shall be available on www.defproc.gov.in/www.eprocure.gov.in site for download and shall form part of contract agreement in case the tender/bid is accepted.
 - 6.2. In case a contractor, who has not executed the Standing Security Bond, the Cover-1 shall be accompanied with by Earnest Money of an amount as mentioned in Appendix 'A' in the form of Deposit at Call Receipt issued in favour of concerned Garrison Engineer (see Appendix 'A') by a Nationalised/ Scheduled bank or in the form of Receipted Treasury

Challan, the amount being credited to the Revenue Deposit of the concerned Garrison Engineer (See Appendix 'A').

- 6.3. A Contractor who is not enlisted for the command/area in which the work lies, but whose names are on the MES approved list of any MES formation and who have deposited Standing Security Deposit and have executed Standing Security Bond may also tender/bid without depositing Earnest Money along with the tender.
- 6.4. The Garrison Engineer will return the Earnest Money wherever applicable to all unsuccessful tenderers/bidders by endorsing an authority on the Deposit at Call Receipt for its refund on production by the tenderer/bidder a certificate of the Accepting Officer that a bonafide tender was received and all documents were returned.
- 6.5. Copies of the drawings and other documents pertaining to the work signed for the purpose of identification by the Accepting Officer or his accredited representative, sample of the materials and stores to be supplied by the contractor will also be available for inspection by the tenderer/bidder at the office of Accepting Officer and concerned Garrison Engineer during working hours.
7. The tenderers/bidders are advised to visit the site of work by making prior appointment with the Garrison Engineer who is also the executing agency of the work (See Appendix 'A'). The tenderers/bidders are deemed to have full knowledge of all relevant documents, samples, site etc. whether they have inspected them or not.
8. Any tender/bid which proposes any alteration to any of the conditions laid down or which proposes any other condition of any prescription whatsoever is liable to be rejected.
9. The uploading of a tender/bid implies that tenderer/bidder has read this notice and the conditions of contract and has made himself aware of the scope and specifications of work to be done and of the conditions and the rates at which stores, tools and plants etc. will be issued to him and local conditions and other factors having bearing on the execution of the work.
10. The tenderer/bidder must be in possession of MES Standard Schedule of Rates, Part-I (2009) (Specifications) and MES Standard Schedule of Rates, Part-II (2020) (Rates) including amendments and errata thereto.
11. Invitation for e-Tender does not constitute any guarantee for validation of T-Bid and subsequent opening of Finance Bid of any applicant/bidder, even of enlisted contractors of appropriate class merely by virtue of enclosing DD. The Accepting officer shall reserve the right to reject the T-Bid and not open the Finance Bid of any applicant/bidder. T-Bid validation shall be decided by the Accepting Officer based on, inter alia, capability of firm as per criteria given in aforesaid Appendix 'A' to this NIT. The applicant contractor/bidder will be informed regarding non validation of his T-Bid assigning reasons thereof through the www.defproc.gov.in website. The applicant contractor/bidder, if he so desires, may appeal to the Next Higher Engineer Authority i.e. HQ, Chief Engineer, Eastern Command, Kolkata-700 001 on e-mail id dircontceengrkl-mes@nic.in with a copy to Accepting Officer on e-mail before the scheduled date of opening of finance bid. The decision of the Next Higher Engineer Authority shall be final and binding. The contractor/bidder shall not be entitled for any compensation whatsoever for rejection of his bid.
12. The Accepting Officer reserves the right to accept a tender submitted by a Public Undertaking, giving a price preference over other tender (s)/bid (s) which may be lower, as are admissible under the Government policy. No claim for any compensation or otherwise shall be admissible from such tenderer/bidder whose tender/bid is rejected.

13. The Accepting Officer does not bind himself to accept the lowest or any tender/bid or to give any reason for not doing so.
14. This Notice Inviting Tender (NIT) including Appendix 'A' shall form part of the contract.
15. Irrespective of whatever mentioned in Condition 19.3 of IAFW 2249 with regard to suspension of tender on account of non-submission of performance security, issue of tenders to such tenderer shall remain suspended for a period of six months from the date cancellation of contract under the Condition 19.3 of IAFW 2249 in case of un-enlisted contractors. In case of MES enlisted contractors, issue of tenders shall remain suspended till deposit of EMD or six months from the date cancellation of contract whichever is later.

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

APPENDIX 'A' TO NOTICE INVITING TENDER

1.	Name of Work	:	PROVISION OF HANGAR AND ANNEXE BUILDING AT VISAKHAPATNAM
2.	Estimated Cost of Work	:	4000.00Lakhs(AtparMarket)
3.	Period of Completion	:	25 [Twenty five] Months
4.	Cost of Tender Documents	:	Rs 3,000.00 in the form of DD / Bankers Cheque from any Scheduled Bank in favour of Garrison Engineer Project Navy No. 2 Visakhapatnam and payable at Visakhapatnam (Note : In case of retendering, the contractor who had quoted in the previous call is not required to submit the cost of tender.)
5.	Website/Portal Address	:	www.defproc.gov.in
6.	Type of Contract	:	The tender shall be based on Pre-Priced Schedules (IAFW-2159) (Revised1947) and General Conditions of Contracts (IAFW-2249) with Schedule 'A' (List of Items of work)/ BoQ to be priced by tenderer.The tenderers are required to quote their LumpSum amounts for Pre-Priced parts of Schedule'A'and quote rates against Items of other parts of Schedule 'A'.
7.	Information & Details:		
	(a) Bid submission start date	:	Refer critical dates on the web site.
	(b) Bid submission end date	:	
	(c) Date of bid opening	:	
8.	Eligibility Criteria:		
	(a) For MES Enlisted Contractors	:	(i) Contractor/Joint venture shall be enlisted with MES in Class SS and Category ' a (i) Building Works ' subject to satisfactory remarks wrt performance in respect of works in hand as reflected in Work Load Return (WLR) or any other report circulated by competent engineer authority.
	(b) For contractor not enlisted with MES	:	(i) Contractor/Joint venture shall meet the enlistment criteria of ' SS ' Class and Category 'a (i) Building Works ', i.e. with regard to having satisfactorily completed requisite value of works with Central/ State Government/ Central/ State PSUs/ AWHO/ AFNHB/ CGEWHO/ DGMAP, annual turnover, bank solvency, working capital and other requirements given in para 1.4 and 1.5 of Section-1 of MES Manual on Contracts-2020 as available in all MES formations as well as MES website (www.mesgov.in).

APPENDIX 'A' TO NOTICE INVITING TENDER (Contd...)

8.	Eligibility Criteria: (Contd)					
(b)	For contractor not enlisted with MES (Contd)	:	(ii) Not carrying adverse remarks in Work Load Report (WLR) or any other similar report circulated by any competent authority. (ii) Not suspended/ debarred/ blacklisted (either permanently or temporarily) from participating in any bid or for business dealings by any Central/State Government Department or any Central/State Government PSU or any Autonomous Body under Central/State Government or any Local Body as on the bid submission end date. (iii) Details of works completed and under Progress in MES be submitted in the following format:- * table			
* Table						
S.No	CA No. & Name of work	Value of CA	Date of commencement	Date of Completion	Extended Date of Completion	
1	2	3	4	5	6	
8(b) Contd...			(iv) Un-enlisted contractor who have secured two works in MES should get themselves registered in the appropriate designated class with any registering Authority, else the firm will not be eligible for participation in the tender unless until the firm is enlisted with the MES.			
9.	Tender issuing and Accepting Officer	:	<u>Accepting Officer:</u> Chief Engineer (Navy), Visakhapatnam -530004 <u>Tender Issuing Concerned Officer:</u> T Srinivasa Rao, AADirector (Contracts) Mobile No : 7799141516 Email id : dircontceznv2-mes@nic.in			
10.	Executing Agency	:	Garrison Engineer Project Navy No. 2 Visakhapatnam			
11.	Earnest Money for DGNP enlisted and other Contractors	:	Rs.15,00,000.00 in favour of Garrison Engineer Project Navy No. 2 Visakhapatnam			
12.	Integrity Agreement	:	The subject Notice Inviting Tender (NIT) is an invitation to offer made on the condition that the Bidder will sign the Integrity Agreement, which is an integral part of tender/bid documents. Bidders who do not upload scanned copy of INTEGRITY PACT (IP) duly signed will be informed through option of 'Short Fall Documents' (in e-tendering portal). Any bidder who fails to forward the copy of IP duly signed even after this communication shall be disqualified in the Technical Bid (Cover-1) evaluation and his financial bid will not be opened.			

Notes:

1. After opening of Cover-1, if the number of MES enlisted contractor of 'SS' class as well as eligible un-enlisted contractors, if any, fulfilling the other eligibility criteria given in NIT is less than 7 (Seven), applications in respect of MES contractors One class below the eligible class shall also be considered subject to fulfillment of other eligibility criteria given in the NIT. Therefore MES contractors upto One class below may also bid for this tender. However, contractors of one/two classes below the eligible class shall not be considered in case their present residual work in hand is more than five times their present tendering limit. Such bidders shall upload in their Cover-1 bid details of works in hand showing names of work, names of Accepting Officers, contract amounts, dates of commencement and completion (stipulated) and progress as on bid submission date. These details shall be verified by the Tender Issuing Authority from concerned formations in case bids of such contractor are considered for evaluation.
2. In case after opening of Cover 1, the number of MES enlisted contractor of eligible Class as well as un-enlisted contractors, if any, fulfilling the other eligibility criteria given in NIT, are 7 (Seven) or more, applications of only those one class below the eligible class bidders shall be considered who have previously completed similar works satisfactorily and are meeting the criteria of upgradation in respect of past experience of completed works (individual work experience and average annual turnover as applicable) and financial soundness (solvency/financial soundness and working capital) as per details given in Manual on Contracts. Therefore such contractors shall upload the requisite information/documents in the Cover-1.
3. Un-enlisted contractor shall be considered provided he meets the criteria. However foreign firms shall not be eligible for this tender. However Indian Firms having foreign national/Indian national staying abroad/Indian national having taken foreign citizenship, as director(s) shall be considered subject to security clearance from the concerned authorities.
4. Contractors enlisted with MES will upload following documents in Cover-1 for checking eligibility:
 - (a) Application for tender on Firm's letterhead.
 - (b) Enlistment letter issued by the Registering Authority duly renewed for the cycle period in vogue.
 - (c) Scanned copy of DD/Bankers Cheque toward cost of tender and EMD instrument in case SSD bond is not signed at the time of registration.
 - (d) Any other document required as described in this Appendix.
5. Contractor not enlisted with MES will be required to upload following documents in Cover-1 for checking eligibility:
 - (a) Application for tender on Firm's letterhead.
 - (b) Scanned copy of DD/Bankers cheque toward cost of tender and EMD instrument.
 - (c) Copy of Police Verification Report/Police Clearance Certificate/ Character Certificate from the Police Authority of the area where the registered office of the firm is located/ notarized copy of valid passport of Proprietor/each Partner/each Director.
 - (d) All documents required for enlistment in MES for the class mentioned in Para 8 (b) above as per Para 1.5 of Section 1 of MES Manual on Contracts 2020.
 - (e) Details of works being executed in MES, if any.
 - (f) Any other document required as described in this Appendix.

6. Tenders not accompanied by scanned copies of requisite DD/Bankers Cheque towards cost of tender and earnest money (as applicable) in Cover-1 shall not be considered for validation of 'T' bid and their Financial bids will not be opened.
7. Contractors should ensure that their original physical DDs and Earnest Money Deposit (EMD) instruments (as applicable) reach the office of Accepting Officer with 07 (Seven) days of bid submission end date, failing which following action shall be taken:
 - (a) In case of tenders from an enlisted contractor of MES, where scanned copies of requisite DD/ Bankers Cheque towards cost of tender have been uploaded in Cover 1 but physical copies are not received within the stipulated period, their financial bids (Cover 2) will be opened. However non-submission of physical copies of cost of tender shall be considered as willful negligence of the tenderer with ulterior motives and such tenderer shall be banned from bidding for a period of six months commencing from the date of opening of Financial Bid (Cover 2).
 - (b) In case of tenders from un-enlisted contractor, where scanned copies of requisite DD/Bankers Cheque towards cost of tender have been uploaded in Cover-1 but physical copies are not received within the stipulated period, their financial bids (Cover-2) will not be opened. Name of such contractors along with complete address shall be circulated for not opening of their bids for a period of six months commencing from the date of opening of Financial bid (Cover-2).
 - (c) In case of tenders from enlisted and un-enlisted contractors, where scanned copies of instruments for Earnest Money Deposit (as applicable) have been uploaded in Cover 1 but the same are not received in physical form within stipulated period, such tenders shall not qualify for opening of financial bid (Cover-2).
8. Contractor will not be allowed to execute the work by subletting or through power of attorney to a third party/another firm on his behalf. However a contractor can execute the work through power of attorney to sons/daughters/spouse of Proprietor/Partner/Director and firm's own employees, director, project manager provided they are not having a separate enlisted firm in MES in their name as Proprietor/Partner/Director.
9. After opening of Cover 1 and during its technical evaluation, in case any deficiency is noticed in the documents required to be uploaded by the tenderers as per NIT, a communication in the form of e-mail/SMS/Speed Post etc. shall be sent to the contractor to rectify the deficiency within a period of seven days from date of communication failing which their financial bid (Cover 2) shall not be opened and contractor shall not have any claim on the same.
10. Invitation for e-tender does not constitute any guarantee for validation of Technical bid and subsequent opening of financial bid of any applicant/bidder merely by virtue of enclosing DD. Accepting Officer reserves the right to reject the Technical bid and not to open the financial bid of any applicant/ bidder. Technical bid validation shall be decided by the Accepting Officer based on eligibility of the firm as per criteria given in this Appendix. Tenderer/bidder will be informed regarding non-validation of his Technical bid assigning reasons therefore through tender evaluation report which shall be uploaded on the website. Such tenderer, if desires, may appeal to the next higher Engineer Authority (NHEA) i.e. HQ, Chief Engineer, Eastern Command, Kolkata-700001 on email id dircontceengrklmes@nic.in with copy to the Accepting Officer on email before the scheduled date of opening of Cover 2. NHEA shall decide the matter within a period of seven working days from the date of receipt of appeal. The decision of the NHEA shall be final and binding. The tenderer/bidder shall not be entitled for any compensation whatsoever for rejection of his bid.

11. In case the BOQ is revised through the corrigendum and the bidder has failed to quote on revised BOQ (i.e. he has quoted on pre revised BOQ), such bid shall be treated as willful negligence by the bidder and his quotation shall be considered non- bonafide. In such cases the lowest tender shall be determined from amongst the valid/bonafide bids only. Accepting Officer may decide whether to re-tender or consider the lowest bonafide tender for acceptance.
12. Revoking the offer of revising the rates upward or offering voluntary reduction by the lowest tenderer after opening of Cover-2 shall be considered as a willful default. For this default a penalty of an amount equal to Earnest Money shall be levied. In case of an un- enlisted tenderer, Earnest Money deposit by him shall be forfeited. In case of MES enlisted tenderer having deposited the Standing Security Bond, an amount equal to the earnest money stipulated in the NIT, shall be notified to the tenderer for depositing through MRO and consideration of such tenderer in tender evaluation for future works shall remain suspended till the aforementioned amount is deposited in the Government Treasury. No other disciplinary/ administrative action shall be taken against such tenderers. In such a situation, the next lowest offer shall not be considered for acceptance. Instead, retendering shall be resorted to in a transparent and fair manner and the defaulting tenderer and his related firm if any, shall not be eligible for this tender in second call or subsequent calls.
13. Tender of related firms shall not be considered simultaneously. Firms shall be termed as related if Proprietor/one or more Partners/Directors are common. Decision of Accepting Officer in this regard shall be final and binding.
14. **INTEGRITY PACT:** Integrity pact is an integral part of tender/bid documents. Scanned copy of Integrity pact duly signed on each page by the bidder shall be uploaded as a part of technical bid (Cover -1) and original IP duly on all pages shall be forwarded by post along with demand draft to Accepting Officer. Bidders who do not upload scanned copy of IP duly signed will be informed through option of 'Short Fall Documents' (in e-tendering portal). Any bidder who fails to forward the copy of IP duly signed even after this communication shall be disqualified in the Technical Bid (Cover-1) evaluation and his financial bid will not be opened. (Refer Annexure III of NIT).

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

ANNEXURE-III**INTEGRITY PACT****1. GENERAL:**

1.1. Whereas THE PRESIDENT OF INDIA, represented by Chief Engineer (Navy) Visakhapatnam here-in-after referred to as Principal/Owner and the first part, has floated the Tender and intends to award, under laid down organizational procedure, contract for **PROVISION OF HANGAR AND ANNEXE BUILDING AT VISAKHAPATNAM** here- in-after referred to as works/services and M/s_____represents by_____ (which term unless expressly indicated by the contract, shall be deemed to include its successors and its assignees), here-in-after referred to as the Bidder/Contractor and the second part is willing to carryout the works/services.

2. Whereas the Bidder is a Proprietorship Concern/Partnership Firm/Limited Liability Firm/Private Limited Company/Limited Company/Joint Venture constituted in accordance with the relevant law in the matter and the Principal/Owner is Chief Engineer (CE) performing its functions on behalf of the President of India.

3. OBJECTIVES:

3.1. Now, therefore, the Principal/Owner and the Bidder agree to enter into this pre- contract agreement, referred to as INTEGRITY PACT (IP), to avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the conclusion of the contract to be entered into with a view to:

3.2. Enabling the Principal/Owner to get the desired works/services at a competitive price in conformity with the defined specifications of the Services by avoiding high cost and the distortionary impact of corruption on public procurement.

3.3. Enabling Bidders to abstain from bribing or any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also refrain from bribing and other corrupt practices and the Principal/Owner will commit to prevent corruption, in any form, by their officials by following transparent procedures.

4. COMMITMENTS OF THE PRINCIPAL/ OWNER:

4.1. The Principal/Owner commits itself to the following:

4.2. The Principal/Owner undertakes that, no official of the Principal/Owner, connected directly or indirectly with the contract will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the Bidder, either for themselves or for any person, organisation or third party related to the contract; in exchange for an advantage; in the bidding process, bid evaluation, contracting or implementation process related to the Contract.

4.3. The Principal/Owner will, during the pre-contract stage, treat all Bidders alike and will provide to all Bidders the same information and will not provide any such information to any particular Bidder which could afford an advantage to that particular Bidder in comparison to other Bidders.

- 4.4. All the officials of the Principal/Owner will report to the appropriate Government office any attempted or completed breach(s) of the above commitments as well as any substantial suspicion of such a breach.
5. In case of any such preceding misconduct on the part of such official(s) is reported by the Bidder to the Principal/Owner wilful and verifiable facts and the same is prima facie found to be correct by the Principal/ Owner, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the Principal/Owner and such a person shall be debarred from further dealing related to the tender/contract process. In such a case while an Inquiry is being conducted by the Principal/Owner the tender process/proceedings under the contract would not be stalled.
6. **COMMITMENTS OF BIDDERS:**
- 6.1. The Bidder commits himself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of his bid or during any pre- contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commits himself to the following:
- 6.2. Bidder will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour any material or non-material benefit or other advantage, commission, fee, brokerage or inducement to any official of the Principal/Owner, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the Contract.
- 6.3. The Bidder further undertakes that he has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour any material or non-material benefits or other advantage, commission, fees, brokerage or inducement to any official of the Principal/Owner or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other Contract with the Government for showing or forbearing to show favour or disfavour to any person in relation to the Contract or any other Contract with the Government.
- 6.4. The Bidder will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.
- 6.5. The Bidder will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.
- 6.6. The Bidder would not enter into conditional contract with any Agent(s), broker(s) or any other intermediaries wherein payment is made or penalty is levied, directly or indirectly, on success or failure of the award of the contract.
- 6.7. The Bidder commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts. Complaint will be processed as per Guidelines for Handling of Complaints in vogue. In case the complaint is found to be vexatious, frivolous or malicious in nature, it would be construed as a violation of Integrity pact.

7. PREVIOUS TRANSGRESSION:

- 7.1. The Bidder declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact with any other company in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India.
- 7.2. If the Bidder makes incorrect statement on this subject, Bidder can be disqualified from tender process or the contract and if already awarded, same can be terminated for such reason.

8. COMPANY CODE OF CONDUCT:

- 8.1. Bidders are advised to have a company code of conduct (clearly rejecting the use of bribes and other unethical behaviour) and a compliance program for the implementation of the code of conduct throughout the country.

9. SANCTION FOR VIOLATION:

- 9.1. Any breach of the aforesaid provisions by the Bidder or any one employed by him or acting on his behalf (whether with or without the knowledge of the Bidder) or the commission of any offence by the Bidder or any one employed by him or acting on his behalf, as defined in Chapter IX of the Indian Penal Code, 1860 or the Prevention of Corruption Act 1988 or any other act enacted for the prevention of corruption shall entitle the Principal/Owner to take all or any one of the following actions, wherever required:
- (a) Technical bid of the Bidder will not be opened. Bidder will not be entitled to or given any compensation. However, the proceedings with the other Bidder(s) would continue.
 - (b) Financial bid of the Bidder will not be opened. Bidder will not be entitled to or given any compensation. However, the proceedings with the other Bidder(s) would continue.
 - (c) The Earnest Money Deposit shall stand forfeited either fully or partially, as decided by the Principal/Owner, in case contract is not awarded to the Bidder and the Principal/Owner shall not be required to assign any reason therefore. For enlisted contractors an amount less than or equal to Earnest Money Deposit as decided by the Principal/Owner shall be deducted from any amount held with the Department/any payment due.
 - (d) To immediately cancel the contract, if already concluded/awarded without any compensation to the Bidder.
 - (e) To cancel all or any other Contract(s) with the Bidder.
 - (f) To temporarily suspend or temporarily debar/permanently debar the bidder as per the extant policy.
 - (g) If adequate amount is not available in the present tender/contract, the deficient amount can be recovered from any outstanding payment due to the Bidder from the Principal/Owner in connection with any other contract for any other works/ services.

- (h) If the Bidder or any employee of the Bidder or any person acting on behalf of the Bidder, either directly or indirectly, is closely related to any of the officers of the Principal/Owner, or alternatively if any close relative of an officer of the Principal/Owner has financial interest/stake in the Bidder's firm, the same shall be disclosed by the Bidder at the time of submission of tender. Any failure to disclose the interest involved shall entitle the Principal/Owner to debar the Bidder from the bid process or rescind the contract without payment of any compensation to the Bidder. The term 'close relative' for this purpose would mean spouse whether residing with the Government servant or not, but does not include a spouse separated from the Government servant by a decree or order of a competent Court; son or daughter or step son or step daughter and wholly dependent upon Government servant, but does not include a child or step child who is no longer in any way dependent upon the Government servant or of whose custody the Government servant has been deprived of by or under any law; any other person related, whether by blood or marriage, to the Govt. servant or to the Government servant's wife or husband and wholly dependent upon Government servant.
- (i) The Bidder shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the Principal/Owner and if he does so, the Principal/Owner shall be entitled forthwith to cancel the contract and all other contracts with the Bidder.

9.2. The decision of the Principal/Owner to the effect that a breach of the provisions of this Integrity Pact has been committed by the Bidder shall be final and binding on the Bidder. However, the Bidder can approach the Independent External Monitor(s) (IEMs) appointed for the purposes of this Pact.

10. INDEPENDENT EXTERNAL MONITORS (IEMS):

10.1 MOD has appointed the following Independent External Monitors for this pact in consultation with the Central Vigilance Commission:

SI. No.	NAME OF IEM	E-MAIL ID
1	Shri Narayan Murthy Ganapathy, IFoS (Retd.)	gana_narayan@yahoo.com
2	Shri Lalatendu Mohanti, IPS (Retd.)	L.mohanti@gmail.com

10.2 Details of Nodal officer nominated by E-in-C's Branch are as follows:-

SI. No.	NAME OF THE NODAL OFFICER OF MES	EMAIL ID
(a)	Shri PKS Sengar, Director (Contracts)	Dircont1einc-mes@nic.in
	Address	Telephone Nos
	Room No.158, Dte of Contract Management Engineer-in-Chief's Branch, Kashmir House, Rajaji Marg, New Delhi-110 011	011-23019154 (Office) 9131948501 (Mobile)

10. In case of any complaint with regard to violation of Integrity Pact, either party can approach IEMs with copy to the Nodal Officer and the other party. If any such complaint from bidder is received by the Principal/Owner, the Principal/Owner shall refer the complaint to the Independent External Monitors for their recommendations/inquiry report.
- 10.1. If the IEMs need to peruse the relevant records of the Principal/Owner and/or of the Bidder/Contractor in connection with the complaint sent to them, the Principal/Owner and/or the Bidder/Contractor shall make arrangement for such perusal of records by the IEMs as demanded by them including unrestricted and unconditional access to the project documentation and minutes of meeting. If records/documents Of Sub-Contractor (s) are also required to be perused by the IEMs, the Bidder shall make arrangement for such perusal of records by the IEMs as demanded by them, IEMs are under obligation to treat the information and documents of the Principal/Owner and Bidder/Contractor/Sub-contractors with confidentiality.
- 10.2. The task of the IEMs is to review independently and objectively, any complaint received with regard to violation Integrity Pact and offer recommendations or carry out inquiry as deemed fit. The IEMs are not subject to any instructions by the representatives of the parties and shall perform their functions neutrally and independently. The report of inquiry, if any, made by the IEMs shall be submitted to either of the following for a final and appropriate decision in the matter keeping in view the provision of this Pact:
 - (a) Engineer-in-Chief in normal cases
 - (b) CVO(MES & BRO)/MoD in cases involving vigilance angle
11. **EXAMINATION OF BOOKS OF ACCOUNTS:**
 - 11.1. In case of any allegation of violation of any provisions of this Integrity Pact or payment of commission, the Principal/Owner or its agencies shall be entitled to examine the Books of Account of the Bidder and the Bidder shall provide necessary information of the relevant financial documents in English and shall extend all possible help for the purpose of such examination.
12. **LAW AND PLACE OF JURISDICTION:**
 - 12.1. This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the Principal/Owner.
13. **OTHER LEGAL ACTIONS:**
 - 13.1. The actions stipulated in this Integrity pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.
14. **SIGNING OF INTEGRITY PACT ON BEHALF OF BIDDER:**
 - 14.1. Proprietorship Concern-The Integrity Pact must be signed by the proprietor or by an authorised signatory holding power of attorney signed by the proprietor.
 - 14.2. Partnership firm-The Integrity Pact must be signed by all partners or by one or more partner holding power of attorney signed by all partners.
 - 14.3. Limited Liability firm-The Integrity Pact must be signed by all partners or by one or more partner holding power of attorney signed by all partners.

14.4. Private Limited/Limited Company-The Integrity Pact must be signed by a representative duly authorized by Board resolution.

14.5. Joint Venture-The Integrity Pact must be signed by all partners and members to Joint Venture or by one or more partner holding power of attorney signed by all partners and members to the Joint Venture.

15. VALIDITY:

15.1. The validity of this Integrity Pact shall be from date of its signing. It expires for the Contractor after the final payment under the contract has been made or till the continuation of Defect liability period, whichever is later and for all other bidders, till the Contract has been awarded.

15.2. Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

INTEGRITY PACT

To

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**NAME OF THE WORK: PROVISION OF HANGAR AND ANNEXE
BUILDING AT VISAKHAPATNAM**

Dear Sir,

It is hereby declared that MES is committed to follow the principle of transparency, equity and competitiveness in public procurement.

The subject Notice Inviting Tender (NIT) is an invitation to offer made on the condition that the Bidder will sign the Integrity Agreement, which is an integral part of tender/bid documents, failing which the tenderer/bidder will stand disqualified from the tendering process and the bid of the bidder would be summarily rejected.

This declaration shall form part and parcel of the Integrity Agreement and signing of the same shall be deemed as acceptance and signing of integrity Agreement on behalf of the MES.

Yours faithfully

Chief Engineer (Navy) Visakhapatnam

INTEGRITY PACT

To
Chief Engineer (Navy), Visakhapatnam
Station Road,
Visakhapatnam
PIN-530 004

**NAME OF THE WORK: PROVISION OF HANGAR AND ANNEXE
BUILDING AT VISAKHAPATNAM**

Dear Sir,

I/We acknowledge that MES is committed to follow the principles thereof as enumerated in the Integrity Agreement enclosed with the tender/bid documents.

I/We agree that the Notice Inviting Tender (NIT) is an invitation to offer made on the condition that I/We will sign the enclosed Integrity Agreement, which is an integral part of tender documents, failing which I/We will stand disqualified from the tendering process. I/We acknowledge that THE MAKING OF THE BID SHALL BE REGARDED AS AND UNCONDITIONAL AND ABSOLUTE ACCEPTANCE of this condition of the NIT.

I/We confirm acceptance and compliance with the Integrity Agreement in letter and spirit and further agree that execution of the said Integrity Agreement shall be separate and distinct from the main contract, which will come into existence when tender/bid is finally accepted by MES. I/We acknowledge and accept the duration of the Integrity Agreement, which shall be in the line with para 1 of the enclosed Integrity Agreement.

I/We acknowledge that in the event of my/our failure to sign and accept Integrity Agreement, while submitting the tender/bid, MES shall have unqualified, absolute and unfettered right of disqualify the tender and reject the tender/bid accordance with terms and conditions of the tender/bid.

Yours faithfully

(Duly authorized signatory of the Bidder)

In lieu of IAFW-2159 (Revised 1947)

**TO BE USED IN CONJUNCTION WITH
GENERAL CONDITIONS OF CONTRACTS (IAFW-2249)**

Telephone: 0891-25 77 405/27 46 003
Fax : 0891-27 47 002
E-mail : dircontceznv2-mes@nic.in

Chief Engineer (Navy)
Military Engineer Services
Station Road
Visakhapatnam-530 004

85414/ /E8

June 2026

**WORK REQUIRED IN THE EXECUTION OF LUMP SUM TENDER
AND CONTRACT FOR 'PROVISION OF HANGAR AND ANNEXE
BUILDING AT VISAKHAPATNAM'**

1. M/s _____ is /are hereby authorized to e-Tender for the above work.
2. The tender shall be published by this office on the MES Portal of www.defproc.gov.in. The critical dates can be referred in the web portal.
3. All correspondence must be returned to this office whether or not the tender has been submitted online.
4. Any correspondence concerning with this tender shall be addressed to the address as indicated at the top of this sheet, quoting the reference as given.
5. **THE PRESIDENT OF INDIA DOES NOT BIND HIMSELF TO ACCEPT THE LOWEST OR ANY TENDER.**

Signature of Contractor

Signature of Officer
issuing the documents
Appointment: AA Dir(Contracts)

In lieu of IAFW-2159 (Revised 1947)

SCHEDULE 'A'
(LIST OF ITEMS OF WORK)

Name of the Work: **PROVISION OF HANGAR AND ANNEXE BUILDING AT VISAKHAPATNAM**

Notes:

1. SCOPE OF WORK: This contract covers for all items of works described in BOQ (Schedule 'A' Part-I to XV). The buildings and all services described under BOQ (Schedule 'A' Part-I to XV) shall be executed at locations as shown on site plan and as directed by GE/Engineer-in-Charge. The broad scope of work included in various parts of Schedule 'A' is as under:
 - (i) Schedule 'A' Part-I : Buildings & Structures
(Pre-Priced by the Department)
 - (ii) Schedule 'A' Part-II : Site Clearance / Area Development Earthwork/
Excavation (Pre-Priced by the Department)
 - (iii) Schedule 'A' Part-III : Pile Foundation(Pre-PricedbytheDepartment)
 - (iv) Schedule 'A' Part-IV : Internal Water Supply
(Pre-Priced bytheDepartment)
 - (v) Schedule 'A' Part-V : Internal Electrification
(Pre-Priced bytheDepartment)
 - (vi) Schedule 'A' Part-VI : External Water Supply
(Pre-Priced bytheDepartment)
 - (vii) Schedule 'A' Part-VII : External Electrification
(Pre-Priced bytheDepartment)
 - (viii) Schedule 'A' Part-VIII : Area Drainage(Pre-Priced by the Department)
 - (ix) Schedule 'A' Part-IX : Sewage Disposal (Pre-Priced by the Department)
 - (x) Schedule 'A' Part-X : Lightening Protection
(Pre-Priced by the Department)
 - (xi) Schedule 'A' Part-XI : Road/ Path / Culvert
(Pre-Pricedbythe Department)
 - (xii) Schedule 'A' Part-XII : Fire Fighting System (Pre-PricedbytheDepartment)
 - (xiii) Schedule 'A' Part-XIII : Fire Alarm (Pre-Priced bythe Department)
 - (xiv) Schedule 'A' Part-XIV : Cooling appliances (Pre-Priced by the Department)
 - (xv) Schedule 'A' Part-XV : Miscellaneous Items (To be quoted by the Tenderer in
BOQ)

2. Description of buildings/structures, works and services given in BOQ (Schedule 'A' Part-I to XV) are in brief. These are deemed to be amplified and read in conjunction with Special Conditions, Particular Specifications for materials and workmanship and conditions in relevant trade section of MES Schedule Part-I & Part-II and contract drawings including notes on the drawings.
3. **PERIOD OF COMPLETION:**
 - 3.1. The entire work under this contract including connected services as mentioned in BOQ **[Schedule "A" Part-I to Part XV] shall be completed in 25 [Twenty Five] Months** from the date of handing over of site as mentioned in **work order No 1**
 - 3.2. Work Order for will be issued by Garrison Engineer Project Navy No. 2 Visakhapatnam
 - 3.3. Final bill for the work catered shall be paid to the contractor after satisfactory completion of work.
4. In case, any deviations necessitated during execution of work, against the items covered under Schedule 'A' part – I (Serial Item Nos. 1 to 4), the same shall be ordered on the contractor under condition 7 of IAFW-2249. The deviations shall be valued at par SSR 2020 [Rates] [Part-II]. The contractor shall have no claim what so ever on this account.
5. **PRE-PRICED SCHEDULE 'A' PARTS:**
 - 5.1. Works in respect of Schedule 'A' Part-I to XIV are pre-priced by MES and the total amounts as against each schedule are inserted in BOQ. The unit rates inserted in these schedules are based on unit rates given in MES Standard Schedule of Rates, Part-II 2020 including amendments/errata as indicated on tender page or at rates analogous there to. The tenderer shall work out total lump sum against each of these parts of Schedule 'A' based on his own calculations and arrive at total lump sum for each part of schedule, which shall be quoted in BOQ. The percentage above/below the pre-priced amount for that particular schedule shall be automatically worked out in BOQ. In this connection tenderers attention is invited particularly to condition 6A, Sub Para B, lump sum contracts based on pre-priced schedule 'A' of IAFW-2249 forming part of the tender documents. The contractor shall have no claim whatsoever on account of any errors in the unit rates/prices inserted by MES.
 - 5.2. The lump sum amount quoted by the tenderer shall be based on the description of items in Schedule 'A', drawings, specifications, special conditions, SSR Part-I 2009 & SSR Part-II 2020. It is an express condition of the contract that the lump sum amount quoted by the tenderer shall be deemed to include for full and entire completion of the items of work in accordance with the provision of this contract. The Government will not entertain any claim whatsoever on account of inaccuracies/misunderstanding if any, in the lump sum amount quoted by the tenderer.
6. **SCHEDULE 'A' PARTS TO BE QUOTED BY THE TENDERER:**
 - 6.1. The items of works covered under Schedule 'A' Part-I& XV are not pre-priced by MES. Therefore the tenderer is required to work out unit rate/price independently and to quote the same against each item in figures only.
7. Layout of structures/buildings and allied services indicated in the site plan are tentative. No adjustment in price shall be made on account of final approved layout within the site plan area. No claim whatsoever will be entertained on this account.

8. **ELEMENTS THAT ARE DEEMED TO BE INCLUDED IN THE LUMP SUM QUOTED BY THE TENDERER:**
- 8.1. The lumpsum quoted by the tenderer against each part of Schedule 'A' in BOQ shall be deemed to include all minor extras and constructional details, which are obviously and fairly intended and which may not have been specifically shown on drawings and/or specified in particular specifications but are essential for execution of work/services in a workman like manner and sound construction practices. In the case of difference of opinion between the contractor and Garrison Engineer as to whether or not a certain item of work constitutes minor extras and constructional details included in the lump sum amount quoted, the decision of the Accepting Officer in this regard shall be final, conclusive and binding.
- 8.2. In case any details are missing, the details indicated elsewhere in the drawings, which are similar or nearer to the missed out items of work shall be followed. In the absence of any other similar and near details, the minimum essential requirement for the completion of work from the structural and utility point of view shall be deemed to be included in the amount quoted.
- 8.3. Some of the minor details/items which shall be deemed to be essential for execution and entire completion of the works are detailed as under for guidance:
- (a) Reinforcement for any RCC member not indicated on the drawings but is structural requirement.
 - (b) Dwarf wall in situations like verandah, passage etc., not indicated in drawings.
 - (c) Lintel over doors, windows and openings not shown in drawings.
 - (d) Builders hardware for doors/windows though not indicated in drawings but essential for usage.
9. The rate quoted by the tenderer shall be inclusive of all types of taxes, levies including GST, Labour Welfare Cess etc., as prevailing on the bid submission end date stipulated in web portal.
10. The lump sum quoted by the tenderer for buildings in Schedule 'A' Part-I shall include all works as shown on drawings and/or mentioned in notes thereon and/or specified in Schedule 'A' and/or Particulars Specifications, except for the items of work catered for in Schedule 'A' Part-II to Part-XIX complete for entire completion of work, unless any items for work is specifically categorically excluded from scope of work.
11. In case details in respect of items shown on main drawings are not given in the drawings referred to in the main drawing, then the same shall be followed from any other drawings included in the list of drawings. Any drawing mentioned in the contract/contract drawings and/or required for any missing details but inadvertently not included in the list of drawings shall also be deemed to form part of contract.
12. The unit rate in Schedule 'A' Part-I shall be worked out on the basis of wall thickness with the brick size as specified in Particular Specifications including necessary adjustments in foundation width, lintel, cills, DPC/RCC bands, earth filling, flooring, plastering and pointing etc. to suit the size of bricks as specified in Particular Specifications. The contractor's quoted rate shall also be deemed to include for these contingencies.
13. **ITEMS DEEMED TO BE INCLUDED IN THE LUMPSUM:**
- 13.1. The following items of work shall also be deemed to be included in the Lump sum quoted for Schedule 'A' Part-I:
- (a) Earth work including filling/disposal of surplus and/or unsuitable soil for buildings/structures.

- (b) Surface dressing up to 3 metres from external edge of the plinth protection/steps/ramp or external wall, as applicable and disposal of soil all as specified hereinafter in Particular Specifications.
 - (c) Pile caps
 - (d) Anti termite treatment to buildings under Serial Item Nos.1 of Schedule 'A' Part-I.
 - (e) All internal sanitary appliances, fittings/fixtures/accessories and necessary connections including floor traps, gully traps, soil waste and vent pipe up to 0.9m above roof top or parapet whichever is higher, with fittings etc. and vent cowls, soil and waste pipe up to first manhole (excluding manhole) within 3 meter from the outer edge of the building. However, no price adjustment on account of any variation in distance of first manhole from outer edge of building shall be admissible.
 - (f) Further, if shaft is situated inside the building and covered from all four sides, manholes up to plinth protection shown on drawings and CI pipe fittings from shaft to plinth protection shown on drawing shall be included in Lump sum.
 - (g) Leaving/forming/cutting necessary chases, recesses, holes etc. wherever required in walls, floors, ceiling and making good in cement mortar 1:3 for filling up to 20mm and in PCC 1:2:4 type B1 for filling more than 20mm and finished to match the adjoining surfaces, for fixing chowkats for doors/windows, terminal boxes, water supply, electrification work and plumbing etc. and no deviation on this account shall be admissible for any change in layout/quantities of various items of Schedule 'A' Part-I to Part-XV.
 - (h) Fan hooks with box complete all as shown on drawings.
 - (i) Rotational moulded polythene water storage tanks (Triple layered) shall be provided over roof slab/all as shown on drawings.
 - (j) Built-in cup boards, steel cup boards, 3 tire/2 tire shelves of RCC/Cuddapah/Granite shelves etc.
 - (k) Built-in furniture as stipulated in Scales of Furniture for Defence Personnel.
14. Tentative distribution of layouts of various items of internal/external services is indicated on drawings and is included in Schedule 'A' Part-II to Part-XIV. These may be varied where necessary at the discretion of the GE. The contractor shall not be entitled for any claim on account of such varied alignments.
15. All items/quantities under Schedule 'A' Part-II to Part-XIV are 'Provisional'.
16. Unless specifically specified otherwise the unit rate of each items of work shall be deemed to be inclusive of supply of all new materials and labour for supply, fixing, installation, commissioning, designing and testing etc. complete as applicable.
17. Specifications in MES Schedule Part-I and preambles to items given in MES Schedule Part-II under respective trades shall be applicable. If any provision/items of Schedule 'A' and/or in Particular Specifications is at variance with the provisions in specification in MES Schedule Part-I and preambles to items given in MES Schedule Part-II, first the provision as per description of item of Schedule 'A' and thereafter the provision of particular specifications shall take precedence there over.

18. YARDSTICK:

- 18.1. Contractor shall submit the yardstick for Serial Item Nos. 1 to 6 of Schedule "A" Part – I in duplicate to GE within one month of acceptance of tender, indicating percentage of payment to be made for each stage of the building along with supporting details i.e. detailed estimate. Yardsticks shall be approved by the CWE.
- 18.2. There may be certain changes in yardstick percentages as submitted by the contractor while approving the yardstick by CWE due to market rates of various materials. Contractor shall not have any claim on this account and the percentage payment to be made for each stage as approved by the CWE shall be final and binding on the contractor.
- 18.3. Payment against Lumpsum buildings will be made as per approved yard stick. Payment against Lumpsum buildings without yardstick will be allowed up to and including 2nd RAR only. Further payments / RARs will be based on the yardstick as approved by CWE. Any delay in payment of 3rd RAR on account of late submission of yardstick by the contractor to the GE and further its approval by CWE shall be the contractor's responsibility and no claim whatsoever will be entertained on this account.

19. STRUCTURAL DRAWINGS/DETAILS:

- 19.1. For structural details, refer structural drawings only. If there is any discrepancy between architectural and structural drawings with regard to structural details, details shown on structural drawing shall prevail. Similarly if there is discrepancy between structural and architectural drawings with regards to architectural details, details shown in architectural drawings shall prevail. The decision of the Accepting Officer as to what constitutes structural or architectural details shall be final, conclusive and binding.
- 19.2. For missing reinforcement details of RCC works, minimum reinforcement as required as per IS shall deemed to be included in the quoted Lump sum. The decision of the Accepting Officer as regards minimum requirement as per IS shall be final and binding.
- 19.3. In case where type and size of beams, slabs and columns etc. are not indicated, these shall be provided as decided by the Accepting Officer as per details of similar beams, slabs and columns etc. and cost of same shall be deemed to be included in the quoted Lump sum. The decision of the Accepting officer as to the similar of beams, slabs, columns etc. shall be final and binding.
- 19.4. If, there is any discrepancy regarding General Notes on RCC works, TD (Typical Detail) Drawing and Structural Drawing, the detail shown in main structural drawing shall be followed. Similarly details shown in main architectural drawings shall always be followed in case of discrepancy between main architectural drawing and TD (Typical detail) drawings.
- 19.5. Nothing extra shall be admissible on account of work executed as stated above and the contractor shall be deemed to have taken into consideration the above provisions before quoting his lump sum and submitting his tender.

20. MATERIALS AND SAMPLES:

- 20.1. Refer to Condition of 10 of IAFW-2249.

- 20.2. The materials and articles, which have been specified from certain makers/manufacturers, shall be of makes/manufactures as specified. However, in case any item is being manufactured by any of the manufacturers as GRIHA certified, ISI marked and conforming to ISI, the following order of preference shall be followed without any extra claim and the contractor shall be deemed to have taken into consideration the above provisions before quoting the tender:
- i. GRIHA certified products
 - ii. ISI marked products
 - iii. conforming to IS
- 20.3. The materials and articles for the makes/manufacturers which have not been specified in tender documents the same shall be provided as under:
- i. If GRIHA certified materials are being manufactured, the the same shall be GRIHA certified. For a list of GRIHA certified manufacturers refer to the website of GRIHA ie www.grihaindia.org
 - ii. If GRIHA certified materials are not being manufactured but ISI marked materials are being manufactured, the same shall be ISI marked. For a list of ISI marked manufacturers refer to the website of BIS ie www.bis.org.in.
 - iii. If neither GRIHA certified materials nor ISI marked materials are being manufactured, the same shall be conforming to IS Specifications.
 - iv. Any minor variation in sizes of items will be approved by GE for complying with the above provisions
- 20.4. Materials of local origin shall be as specified and conforming to samples kept in GE's office. The tenderer is advised to inspect samples of materials which are displayed in the office of GE before submitting his tender. The tenderer shall be deemed to have inspected the samples and satisfy himself as to the nature and quality of materials he is required to incorporate in the work irrespective of whether he has actually inspected them or not.
- 20.5. The contractor shall not procure materials and articles unless the samples are first got approved by the GE.
21. **REINFORCEMENT:** Pricing deviations involving high strength corrosion resistant TMT bars of grade Fe-500 D/Fe-550D shall be as per rates contained in MES Standard Schedule of Rates 2020(Part-II) for TMT bars priced at par for Schedule 'A' Part-I.
22. **COMPLETION DRAWINGS & PERIODICAL SERVICES MEASUREMENT BOOKS:** The contractor shall submit Completion Drawings for all the structures and services in triplicate along with Soft copies to the Engineer-in-Charge or the Garrison Engineer. Similarly, the contractor shall also submit Periodical Services Measurement Books (PSMB) of the buildings covered in Schedule 'A' Part-I to the Engineer-in-Charge or the Garrison Engineer as directed. Lump sum quoted shall be deemed to inclusive of this aspect. The final completion shall only be issued by GE only after submission of Completion Drawings and Periodical Services Measurement Books (PSMB) as stipulated.

23. **VIEW CUTTERS AND SAFETY PRECAUTION:** The tenderer shall make all necessary arrangements to cover proposed buildings/structures with cladding sheets of 3.6m height to avoid dust/pollution/inconvenience etc. to the users. The tenderer shall also take all precautionary measures/steps to ensure safety of labour by providing suitable required Safety Jackets, Ropes, Nets, Helmets, Gumboots etc. as required. Concrete debris and other materials retrieved shall be taken to the ground level through chute or manually and shall not be thrown/dropped through openings. Any damage done to the existing structure during execution, the same shall be made good at own cost. The quoted rates shall be deemed to be included for these provisions.
24. **DEFECTS LIABILITY PERIOD:** The defects liability period for this work shall be 24 (Twenty Four) months from the certified date of completion of the work for the works under Phase-I.
25. **PROCEDURE TO DEAL WITH STAR RATE:**
- 25.1. In case of any deviation, mode of pricing shall be decided by Accepting Officer in terms of Condition 62 of IAFW-2249.
- 25.2. In the event of a deviation order involving fixation of Special (Star) Rate, Draft Rate Shall be prepared by GE (within a maximum period of 30 days) while initiating the proposal for deviation seeking approval of Accepting Officer and shall be notified to contractor. While notifying the Draft Rate, it will be clearly stipulated that the same is merely an estimated rate and firm rate shall be fixed based on actual and receipt of supporting documents from contractor such as vouchers/ literature of product/test certificates etc. (as applicable) on completion of the work involving Star Rate. Any objection to the method of fixing Star Rate will be dealt as per Condition 62 of IAFW- 2249.
- 25.3. The Draft Star Rate will be made based on market enquiry through telephonic enquiry/quotations/ email/rate lists/internet based source, material & labour constants available in various civil engg books and record available in respect of Star Rates approved in the past for similar items of works etc. Contractor may also assist GE office in preparation of draft Star Rate.
- 25.4. The Draft Star Rate shall be purely a draft rate and shall not be used for claiming final payment during execution of work. However GE shall allow part payment to the tune of 80% during execution to avoid any financial hardship to the contractor.
- 25.5. After completion of the item of work involving Star Rate, contractor shall submit the vouchers/literature of product/test certificate (as applicable, decision of GE being final in case of any disagreement) for finalisation of Star Rate. The Star Rate shall be technically checked by DCWE(C)/ Director (C) depending upon the financial effect & approved by Competent Authority within a period of one month from submission of the relevant documents by contractor as mentioned above.
- 25.6. The Star Rate as approved by Competent Authority, after technical check by DCWE (C)/Director(C) depending upon the financial effect, shall be referred as 'the rate decided by GE' under Condition 62 (G) of IAFW-2249.

Note: The Competent Authority to approve Star Rate is CWE, except those Star Rates where the financial effect of the Star Rate does not exceed Rs.5,000.00, which shall be approved by the GE. However, where a star rate has not been sanctioned before expiry of the period covered by the contract, as originally executed or as subsequently amended, the sanction of the Chief Engineer must be obtained.

26. ELECTRICAL LICENCE:

- 26.1. Prior to commencement of electrical work/ electrical component of works, copy of valid Electrical License in the name of the contractor or copy of agreement with agency having valid Electrical License shall be submitted by the contractor to the GE. In case contractor does not possess valid Electrical License and he intends to get such work executed through agency having valid Electrical License and with whom he has entered agreement, prior approval of such agency shall be got done from GE.
- 26.2. Supervisor for execution of electrical works/electrical component of works employed by the contractor shall possess Supervisor Certificate of Competency issued by concerned State Government/Union Territory and the worker/tradesmen for execution of electrical works/ electrical component of works shall hold necessary Permit issued by concerned State Government/Union Territory.

27. APPLICATION OF SURFACE FINISHES:

- 27.1. Application of finishes under the subject contract agreement shall be carried out through the manufacturer/ authorized applicators only and the tenderers are deemed to have entered in to necessary MoU with the manufacturers and their authorized applicators before quoting their bids.
- 27.2. Authorized applicator of paint manufacturers shall have valid authorization letter from the manufacturer (Minimum regional HQs) issued not earlier than 30 days from start date of the said finishing work. The authorization letter needs to also be valid for the complete period of execution.
- 27.3. The painting progress report and surface preparation report (As per the formats enclosed with the Particular Specifications) as per manufacturer's instructions shall be prepared and submitted to the Engineer-in-Charge as per the frequency stipulated by the manufacturer.

28. GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT (GRIHA):**28.1. INTRODUCTION:**

- 28.1.1. The Project has targeted for Green building certification under GRIHA v 2019.
- 28.1.2. The subject work/ project envisages to acquire a minimum of GRIHA 3- STAR or higher rating.
- 28.1.3. The contractor shall get the subject project registered with GRIHA council under version 2019. The lumpsum quoted under the subject contract agreement is deemed to include for registration, orientation workshop, site visits by GRIHA Council, documentation and other expenditures involved till submission of audit date as stipulated in GRIHA Manual.
- 28.1.4. The contractor shall appoint a GRIHA consultant to obtain GRIHA rating (minimum 3 star). The GRIHA consultant shall be enlisted / registered with MES/Railways/CPWD or any Central/State Govt. department for GRIHA certification consultancy. The rate quoted shall be deemed included with consideration of this aspect.
- 28.1.5. MES has incorporated possible GRIHA criteria in the design and specifications. The contractor shall comply with the following GRIHA Norms during execution of the work and the rates quoted under the subject work are deemed in compliance of these provisions.
- 28.1.6. The Contractor has to facilitate all measures to be taken on site to achieve green building certification under GRIHA v 2019. The Contractor is advised to refer GRIHA v 2019

reference guide in detail and take all measures on site falling under the purview of the contractor as per this reference guide in order to achieve minimum 3 Star rating, further the contractor is advised to refer NBC 2016 for all the GRIHA criteria.

28.1.7. All the activities undertaken on site with regard to Green Building Certification has to be properly documented in the form of date stamped photograph, copy of chalan, bills, cutsheet of materials brought on site, date stamped photograph of fixtures being installed or fixed etc.

28.2. PRESERVE AND PROTECT LANDSCAPE DURING CONSTRUCTION & SOIL CONVERSATION TILL POST-CONSTRUCTION:

28.2.1. All Existing trees on site has to be preserved and protected by putting barricade along the trunk. Utmost care has to be taken so that the existing trees are not damage during construction activity. The contractor shall minimize the disruption of the natural eco system.

28.2.2. The top soil till the depth of 20 cm has to be excavated and stacked separately in the layers of not more than 40 cm. This top soil has to be preserved against erosion by way of covering it with green net, mulching and through vegetation or any other means which can prevent soil erosion. This top soil is fertile soil and has to be used in Landscaping or as directed by GE. In case of unfertile top soil the contractor shall submit a soil fertility test reports of site's top soil from an ICAR (Indian Council of Agricultural Research)-accredited laboratory. The contractor has to cover entire excavated soil with green net to prevent soil erosion through wind.

28.2.3. The entire site has to be barricaded with 3 m high non porous sheets to prevent soil erosion and pollution to surrounding area. Strategies like soil erosion channels, sedimentation control etc. to be adopted to prevent/ reduce movement of soil outside the construction site.

28.3. CONSTRUCTION MANAGEMENT PRACTICES:

28.3.1. The measures are such as implementing Construction management plan, segregating & stacking of all construction waste, empty tins, cardboards, cement bags, Steel waste, cartoon, packaging material etc. construction waste on site and document the same by way of dated photographs of the above actions being taken on site.

28.3.2. The contractor has to strictly implement construction management plan as approved by Green Building Advisor.

28.3.3. The construction waste has to be measured and stage separately on site. This construction waste has to be reuse during construction if possible. The construction waste reuse in construction has also to be measured. The leftover construction waste has to be sent to recyclable industry and document the same by way of dated photographs and receipts. The leftover construction waste cannot be thrown in the open or sent to landfill sites. The contractor shall make all efforts for achieving zero waste generation by adopting appropriate resource recovery measures.

28.3.4. The contractor has to document all the activities in form of dated photographs, produce copy of challans of building material brought on site, building waste material reused on site and all such activities directed by Engineer-in-Charge. This is mandatory and has to be done meticulously.

28.3.5. Contaminated material and hazardous wastes like pesticides, paints, cleaners, and petroleum products should be separated and contain safely in the constructed area.

28.3.6. Staging should be done to separate undisturbed land from land disturbed by construction activity and material storage. The staging areas/construction areas should be barricaded to prevent spillage of contaminated areas.

28.4. REDUCE AIR & WATER POLLUTION DURING CONSTRUCTION:

28.4.1. The site roads should be regularly sprayed with water and wheels of all vehicles should be washed at the entrance by creating wheel washing facility to prevent air pollution.

28.4.2. Vegetation to be cleared only from the areas where work will start right away. The fine aggregate and excavated earth on site shall be covered with plastic/geotextile sheets and regularly sprinkled with water to avoid air pollution.

28.4.3. Vehicular speed on-site shall be limited to 10 km/h when construction is in progress.

28.4.4. All diesel generators on site to have a proper chimney with their outlet facing away from the site.

28.4.5. The contractor shall undertake the responsibility to prevent air pollution (dust & smoke), ensure availability of adequate water supply for dust suppression, devise methodology to minimize impact of dust on the surrounding environment and ensure that these methods are implemented.

28.4.6. The contract shall develop and implement a spill prevention plan (to control effects of spill from hazardous materials like bitumen, diesel etc. on site).

28.5. EFFICIENT WATER USE DURING CONSTRUCTION:

28.5.1. The contractor shall prevent wastage of water during curing. The contractor shall also make efforts to minimize use of potable water during construction by proper & efficient construction water management practices as follows:

- (a) Using gunny bags for curing and using pounding for curing.
- (b) Monitoring to avoid leaks and water wastage.
- (c) Use of additives to reduce water requirements during curing.
- (d) Use of treated waste water/captured storm water.

28.5.2. The contractor shall construct Sedimentation tank for collecting of excess curing water. This sedimentation tank will also collect storm water through storm water channel as shown in construction management plan.

28.6. PROVIDE MINIMUM LEVEL OF SANITATION/SAFETY FACILITIES FOR CONSTRUCTION WORKERS:

28.6.1. The contractor shall strictly follow the provisions contained in general conditions of contract for providing basic amenities to the workers. The contractor shall ensure cleanliness of workplace with regard to the disposal of waste and efficiently provide clean drinking water and latrines and urinals as per applicable standard.

28.6.2. The contractor shall install a safety demonstration facility on site (in consultation with Green Building Advisor) and arrange training programmes for construction workers to use safety gears and safety procedures.

28.6.3. The contractor shall comply with the National Building Code 2016 norms on construction safety for ensuring safety during construction. The National Building Code 2016 has provisions for clean and hygienic accommodation, toilet facilities, purified drinking water,

crèche facility, general store, a subsidized canteen, medical facilities and on site safety equipments, etc.

28.7. WATER QUALITY:

28.7.1. The contractor shall get the water (Drinking water for workers and water used for construction) tested with regard to its suitability of use in the works and get written approval from the Engineer-in-charge before he proceeds with the use of same or execution of works. If the water is not suitable, the contractor shall arrange Municipal water or from any other sources at his own cost and nothing extra shall be paid to the contractor on this account. The water shall be got tested at frequency specified in latest BIS code.

28.8. AVOID NOISE POLLUTIONS:

28.8.1. The contractor shall ensure that the noise levels during construction shall not exceed CPCB norms and key noise source on site (like DG sets etc.) should have sufficient acoustic insulation as per NBC 2016 norms.

28.9. WATER: USE OF LOW FLOW FIXTURES AND SYSTEMS:

28.9.1. The plumbing fixtures with the following flow rates and flush rates shall be installed in bathrooms and kitchens:

Fixture Type	Maximum Flow Rate/ Consumption
Water Closets (Full Flush)	2.7 LPF
Lavatory Faucets/Taps	3 LPM
Showerhead/Handheld Spray	3 LPM
Urinals	1.2 LPF
Kitchen Faucets	3 LPM

28.10. USE OF LOW-VOC PAINTS & OTHER COMPOUNDS IN BUILDING INTERIORS:

28.10.1. The contractor shall use zero/low-VOC paints duly approved by Engineer-in-Charge. The contractor shall use water-based acrylic paints duly approved by Engineer-in-Charge and shall not use solvent based oil paints. The contractor shall also submit certificates & vouchers from suppliers/manufacturers that the paint used are zero/low-VOC paints. The prescribed VOC limits for paints to be used are given in the table below:

THE PRESCRIBED VOC LIMITS FOR PAINTS:

Paint applications	VOC Content limit (grams of VOC per litre)	
Interior coatings	Flat	<50
	Non-Flat	<150
Exterior coatings	Flat	<150
	Non-Flat	<200
Anti-corrosive	Glass/Semi-gloss/flat	<250

LIMITS FOR LOW-VOC CONTENT IN ADHESIVES IN INTERIOR APPLICATIONS:

Architectural Adhesive application	VOC Content limit (grams of VOC per litre)
Ceramic tile	65
Structural glazing	100
Multi-purpose construction	70
Sub-floor	50
Wall boards/panel	50
PVC welding	285
Adhesive Primer for plastic	250

Sub-specific use metal to metal	30
Wood	30
Fibre glass	80
Plastic foams/porous materials (except wood)	50

LIMITS FOR LOW-VOC CONTENT IN INTERIOR SEALANTS:

Sealant Application	VOC Content limit (grams of VOC per litre)
Architectural/ Roadways	250
Single-ply roof material installation/repair	450
Others	420
Sealant Primer applications architectural nonporous	250
Sealant Primer applications architectural porous	775
Other sealant primer applications architectural	750

Notes:

1. The contractor shall use water based low-VOC sealants (acrylics, silicones and siliconized acrylics) & adhesives (acrylics or phenolic resins) duly approved by Engineer-in-charge. The solvent oil based/low in oil solvent content sealants (urethanes and butyls) & adhesives shall not be used in the construction. The contractor shall also submit certificates & vouchers from suppliers/manufacturers that the sealants/ adhesives used are low-VOC sealants/adhesives.
2. The composite wood products (particle board, blackboard, plywood) shall be free from urea-formaldehyde resins. The contractor shall also submit certificates & vouchers from suppliers/manufacturers that the composite wood products are free from urea-formaldehyde resins.

28.11. USE OF LOW-ENVIRONMENTAL IMPACT MATERIALS IN BUILDING INTERIORS:

28.11.1. The following materials to be used for building interiors (false ceiling, internal partitions, panelling, in-built furnitures, flooring, internal doors & windows and their frames etc) will be accepted as low-environmental impact materials:

- (a) Stones from India
- (b) Composite wood based products
- (c) FSC Chain of Custody certified products
- (d) Manufactured products with at least 5% recycled content
- (e) Products with EPD (cradle to gate) analyzed and published as per ISO 14025/ISO 21930
- (f) Products with water footprint (cradle to gate) analyzed and published as per ISO 14046.

28.12. INCREASE IN ENVIRONMENTAL AWARENESS:

28.12.1. The contractor shall adopt measures to create environmental awareness among workers, visitors such as vigorous campaign to bring awareness; awareness programme with the co-ordination of Self Help Groups, Welfare Associations, NGO; erection of hoardings displaying the importance and benefits of the Environment Awareness etc.

28.13. LOW OZONE DEPLETING POTENTIAL (ODP) MATERIALS:

28.13.1. The contractor shall employ 100% zero ODP (ozone depletion Potential) HCFC (hydro chloro fluorocarbon) free and CFC (chloro-fluorocarbon) free insulation such as HCFC free rigid from insulation mineral fiber cellulose insulation glass fiber, wood fiber

board corkwood expanded (bead)polystyrene , recycled newspaper and jute & cotton duly approved by Engineer-in-charge. The contractor shall not use materials which are not inherently zero-ODP such as polyurethane foams and polyisocyanurates. The contractor shall also submit certificates & vouchers from suppliers/manufactures that the insulation used are ODP/CFC/HCFC free.

28.13.2. The fire suppression system and fire extinguishers shall be free of halogen.

28.14. **SOLID WASTE MANAGEMENT:**

28.14.1. Multi-coloured dustbins to be provided in the residential campus to ensure segregation of waste at source. At site level, common storage facility of different wastes shall be provided before treatment/ recycling/ collection by concerned authority.

28.14.2. Contractual tie-ups shall be done by the contractor with waste recyclers for safe recycling of recyclable wastes such as metal, paper, plastic, glass etc.

28.14.3. Composting pits shall be constructed in site to treat organic waste.

28.14.4. The contractor shall mandatorily follow the above guidelines so that the GRIHA 3 star rating is not suffered on account of acts and action, omission, negligence of the contractor or his team or otherwise. The contractor shall immediately draw attention of MES officials and GBA if any of the tender items or specifications or conditions of contract is violating any of the GRIHA v 2019 norms which may affect 3 star rating.

28.14.5. The contractor shall submit all documentation (Dated Photographs, Test Reports, Challans or Bills and Material Vendor Certificates etc) as and when required / instructed by Green Building Advisor or Engineer In Charge.

28.14.6. The contractor shall arrange a site visit with Green Building Advisor and submit 3 monthly report comprising photographic, documentary evidences to demonstrate compliance with these additional conditions. This report shall be verified by Green building advisor.

28.15. **CHECKLIST FOR CONTRACTOR TO FOLLOW ON SITE:**

- (i) Complied with the safety procedures norms and guidelines as outlined in NBC 2016 (BIS 2005c) Part 7
- (ii) Personal Protective Equipment Provided like safety helmets, harness & safety nets etc.
- (iii) First-Aid box provided
- (iv) All parts of dangerous machinery shall be guarded
- (v) Precautions for working on machinery
- (vi) Hoists and lifts, lifting machines, chains, ropes and other lifting tackles in good condition.
- (vii) Walking surface or boards at high are of sound construction and provided with safety rails or belts.
- (viii) Providing measures to prevent fires
- (ix) Fire extinguishers and buckets of sand to be provided in a fire-prone area and elsewhere.
- (x) Providing sufficient and suitable light in case of working during the night
- (xi) Safety policies of the construction firm/division/company.
- (xii) Labour camp and Canteen for workers
- (xiii) Creche
- (xiv) Washrooms for male and female labours
- (xv) Drinking water
- (xvi) Signages, safety signages and guards

28.16. **CHECKLIST FOR WASTE SEGREGATION & DISPOSAL DURING CONSTRUCTION:**

The contractor shall have adequate measure to segregate & recycle at least 75% of following possible construction waste. Recycling includes donation or reuse at some other location.

- (i) Asbestos products-insulation, tiles and so on.
- (ii) Fuels and heating oil and other volatile/flammable liquids, such as coolants grease.
- (iii) Centring oil and formwork oil.
- (iv) Wood dust.
- (v) Lead.
- (vi) Plastics, acrylics and PVC.
- (vii) Hazardous gases released on burning of waste.
- (viii) Chemical admixtures, sealants, adhesives solvents, among other (should never be burnt)
- (ix) Paints, pigments, dyes and primers
- (x) Carbon black
- (xi) Pesticides
- (xii) Tarpaulin
- (xiii) Explosives and related products and equipment used in excavation
- (xiv) Products packing (such as cement bags, cartons, containers and plastic covers)
- (xv) Compressed gases/cylinders
- (xvi) H₂S emission
- (xvii) Mercury containing lamps and tubes-fluorescent lamps intact and crushed, halogen lamps, are lamps UV lamps, high-pressure sodium lamps, mercury vapour lamps, neon lamps, and incandescent lamps.
- (xviii) All types of batteries
- (xix) Electronic ballasts, PCBs, transformers, capacitors, switchgear, lead cable, and oil filled/gel filled cables.
- (xx) Electronic waste-computer products, circuit boards, CTRs, electronic parts, solder dross, and weld waste.

28.17. **PENALTY CLAUSE-** The contractor has to remove all objection/ measures raised by GRIHA council from time to time after audit, or submit necessary documents, as required by GRIHA consultant on time as decided by GE/GRIHA consultant. If the contractor fails to do so, then a penalty equal to Rs 10,000/per day subject to maximum of 5% of Shedule 'A' Part-I value shall be deducted from total contract value.

29. **DESIGN MIX/JOB MIX FORMULA**

29.1. Irrespective of whatever stipulated elsewhere in these tender documents, design mixes/job mix formulae for SDAC (Road Work) and Design mix of RCC shall be got done from any one of the following institutes only:

- (a) IIT Mumbai
- (b) IIT Bhubaneswar
- (c) IIT Chennai
- (d) IIT Hyderabad
- (e) IIT Kharagpur
- (f) NIT Trichy
- (g) NIT Warangal
- (h) NIT Surathkal
- (j) NIT Rourkela
- (k) Andhra University

30. **TESTING:**

30.1. Irrespective of whatever stipulated elsewhere in these tender documents, design mixes/job mix formulae for SDAC (Road work) and design mix shall be got done from any one of the following institutes only:

- (a) IIT Mumbai
- (b) IIT Bhuvaneshwar
- (c) IIT Chennai
- (d) IIT Hyderabad
- (e) IIT Kharagpur
- (f) NIT Trichy
- (g) NIT Warangal
- (h) NIT Surathkal
- (j) NIT Rourkela
- (k) Andhra University
- (l) Any Govt approved institute/ labs

31. **PROCUREMENT OF E&M MACHINERY ETC.:**

31.1. E&M Machines/Equipment's such as DG set, LT panel boards, AC etc., shall be brought at site by the contractor after 80% progress of building work to avail manufacturer guarantee/warranty in full. However, necessary approval of design, drawing, Make and technical details be submitted the contractor to GE well in advance.

32. **SOIL STABILIZATION AROUND PILE CAPS, EXTERNAL PLINTH BEAMS AND FLOORINGS :-**

32.1. The soil stabilization as stipulated below and as shown in the drawings shall be carried out by the contractor. The lumpsum rate quoted by the contractor against respective buildings/structures/items are deemed inclusive of soil stabilization as stipulated and as shown in drawings.

32.2. **SOIL STABILIZATION AROUND PILE CAPS:**

- (a) 200 mm crusher dust (area covered by pile cap plus 500mm offset all along periphery of pile caps).
- (b) Non woven Geo textile (area covered by Pile cap plus 500mm offset all along periphery of pile caps).
- (c) Compacted moorum 900mm thick below PCC of pile cap (area covered by Pile cap plus 500mm offset all along periphery of pile cap).
- (d) Compacted moorum of thickness equal to pile cap plus PCC thickness & 500mm all round pile cap.

32.3. **FILLING UNDER & SIDES OF EXTERNAL PLINTH BEAM:**

- (a) 100 mm crusher dust (area covered from internal face of plinth beam upto 500mm away from outer edge of plinth protection).
- (b) Non woven Geo textile (area covered from internal face of plinth beam upto 500mm away from outer edge of plinth protection).
- (c) Compacted moorum 900mm thick below PCC of Plinth beam (area covered from internal face of plinth beam upto 500mm away from outer edge of plinth protection).
- (d) Compacted moorum above NGL upto MGL 500mm from the outer edge of plinth protection.
- (e) Compacted moorum between NGL and specified layers of plinth protection.

32.4. **SOIL STABILIZATION BELOW FLOORING IN HANGAR, ANNEXE, HARDSTANDING (FRONT & REAR), AC PLANT ROOM, CAR PARKING & SCOOTER PARKING :**

- (a) Compacted backfill
- (b) Compacted crusher dust 300mm thick

- (c) Non woven geo textile
 - (d) Compacted moorum 300mm thick
 - (e) Compacted moorum 300mm thick
 - (f) Compacted crusher dust 300mm thick
 - (g) Compacted moorum 300mm thick below PCC
- 32.5. For compaction of back fill, crusher dust, moorum filling under flooring and upto 1m from outer edge of pile foundation, no power driven heavy roller should be used after casting of piles. For achieving specified compaction, other mechanical vibrators and hand roller shall be used. The thickness of layers may be reduced to achieve compaction of minimum 95 % MDD using these means.
33. **CONVEYOR ROLLERS:** The contractor shall provide conveyor rollers alongwith supporting structure(s) in the building all as stipulated and as shown in the drawings. The quoted lumpsum is deemed included for provision of conveyor rollers.
34. **SITE LAB :** Contractor shall provide 01 No. site lab along with toilet facility of prefabricated/ preengineered structure/ PCC block masonry structure with plaster, tiled flooring and false ceiling. The size shall be minimum 225 Sq.m or more and as approved by CWE.
35. **SITE OFFICE :** Contractor shall construct site office for MES executives of PCC block masonry structure with toilet facility, plaster, tiled flooring and false ceiling. The size of office shall be minimum 25 Sq.m and as approved by GE.
36. **THIRD PARTY TECHNICAL INSPECTION(TPTI):**
- 36.1 Third Party Technical Inspection (TPTI) comprising of a group of professors of IITs, NITs, Central Building Research Institute (CBRI), CRRI, Govt accredited laboratories and CVC approved institutions will be engaged by the Department to check the work during execution in respect of the subject contract agreement for the following purposes:-
- (a) To check and certify the quality of the work.
 - (b) To monitor the compliance of removal of defects pointed out during Inspection before completion of the work.
- 36.2 The Contractor shall provide all assistance and full access to site to TPTI agency to carry out inspection of the work and perform testing at the site as per the standard codes of practice, provisions of the contract and specifications. TPTI agency will also review all the reports and records of the regular field testing, testing carried from outside laboratories. TPTI agency will also check test registers and site records. Findings of TPTI inspection will be noted to the contractor and contractor shall be bound to take remedial measures to the satisfaction of Engineer-in-Charge / GE.
- 36.3 Frequency of visits of TPTI will be atleast once in a three months. However, depending on the exigency and importance of a particular stage the GE may call TPTI team at any time.
- 36.4 TPTI agency will submit inspection report(s) for each inspection covering the following aspects and the contractor shall take all necessary actions/ measures to comply with the observations rasied in the inspection reports to the satisfaction of Engineer-in-charge/ GE:-
- (a) The details of defective work to be dismantled by the executing agency.
 - (b) The details of defective materials brought at site which are to be removed from the site immediately.
 - (c) The quality control test results and suggestions regarding remedial measures, if any, to be taken.

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

SCHEDULE 'B'
ISSUE OF MATERIAL TO THE CONTRACTOR
(See Condition-10 of IAFW-2249)

Ser No	Particulars	Rates at which stores will be issued to the contractor		Place of issue (by name for all items)	Remarks
		Unit	Rate		
1	2	3	4	5	6
Nil					

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

SCHEDULE 'C'
LIST OF TOOLS AND PLANTS (OTHER THAN TRANSPORT) WHICH WILL BE HIRED TO THE CONTRACTOR
(See Condition-15, 34 and 35 of IAFW-2249)

Ser No	Quantity	Particulars	Details of MES crew supplied	Hire charges per unit per working day	Standby charges per unit per off day	Place of issue (by name)	Remarks
1	2	3	4	5	6	7	8
Nil							

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

SCHEDULE 'D'
TRANSPORT TO BE HIRED TO THE CONTRACTOR
(See Condition-16 & 35 of IAFW-2249)

Ser No.	Quantity	Particulars	Rate per unit per working day	Place of issue (by Name)	Remarks
1	2	3	4	5	6
Nil					

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

(In lieu of IAFW-2159 (Revised 1947))

TENDER

To

The President of India

Having examined and perused the following documents:

1. Specifications signed by the Jt Dir(Contracts).
2. Drawings detailed in Particular Specifications.
3. Schedule 'A', 'B', 'C' & 'D' attached hereto
4. MES Standard Schedule of Rates 2009 (Part-I) 'Specifications' together with Amendment Nos. 1 to 3 and MES Standard Schedule of Rates 2020 (Part-II) 'Rates' Amendment Nos. 1 to 122 including section 30 Runway and pavement (30001 to 30053) here-in-after referred as the MES Schedule.
5. General Conditions of Contracts IAFW-2249 (1989 Print) together with Amendments Nos. 1 to 49 and Errata 1 to 20
6. **Refer Condition-31 of IAFW-2249 General Conditions of Contracts: Water will be supplied by the MES and shall be paid by the contractor at Rs. 123.49 per every One Thousand Litres of water consumed. Refer Special Condition No. 8 here-in-after..**
7. Should this tender be accepted I/We agree:
 - *(a) That the sum of **Rs.15,00,000.00 (Rupees Fifteen Lakh Only)** forwarded as Earnest Money shall be refunded by the Govt. on receipt of the appropriate amount of Performance Security Deposit as per Condition 19 of IAFW-2249 in conjunction with the amendment Nos. 41 to 48 issued thereto.
 - (b) To execute all the works referred to in the said documents upon the terms and conditions contained or referred to therein and as detailed in General Summary here-in-after and to carry out such deviations as may be ordered vide **Condition 7 of IAFW-2249** upto a maximum of **10 % (ten percent)** and further agree to refer all disputes (in case of disagreement with the decision of competent engineer authority) to **Dispute Resolution Board (DRB)** as per Condition 71 of General Conditions of Contracts (IAFW 2249) and further in case of non-acceptance of the decision of DRB, in part/full, to the arbitration by an Arbitral Tribunal as required by Condition 70 to be appointed by the **ENGINEER-IN-CHIEF** or in his absence the Officer Officiating as **ENGINEER-IN-CHIEF or DIRECTOR GENERAL OF WORKS** if specifically delegated in writing by the **ENGINEER-IN-CHIEF ARMY HEADQUARTERS NEW DELHI** whose decision shall be final, conclusive and binding.

*To be deleted where not applicable

TENDER (Contd...)

Brought forward from BOQ Rs. _____

(Rupees _____

_____ only)

Signature _____ Name _____ in the
capacity of _____ duly authorised to sign the
tender for and on behalf of _____ (IN BLOCK CAPITAL).

Witness: _____

Postal Address:

Date: _____

Address:

Telephone No _____

ACCEPTANCE

_____ Alterations have been made in these documents and as evidence that
these alterations were made before the execution of the Contract Agreement; they have been
initialed by the contractor and _____, **AA Dir (Contracts)**.

The said officer (s) is/are hereby authorised to sign and initial on my behalf of the
documents forming part of this contract.

The above tender was accepted by me on _____ Day of _____ 2026
on behalf of **The President of India** for the Lumpsum of
Rs. _____ (Rupees _____
_____ only).

Signature _____ Dated this _____ Day of _____ 2026.

Appointment: Chief Engineer (Navy)
Military Engineer Services
Station Road
Visakhapatnam-530 004
For and on behalf of the President of India

**GENERAL CONDITIONS OF CONTRACTS (IAFW-2249, 1989 PRINT) FOR
FOR LUMP SUM CONTRACT FOR WORKS BY MEASUREMENT (IAFW-2159)**

1. A copy of the General Conditions of Contracts (IAFW-2249), 1989 Print, with Errata 1 to 20 and Amendments No. 1 to 49 has been supplied to *me/us and is in *my/our possession. *I/We have read and understood the provisions contained in the aforesaid General Conditions of Contracts before submission of this tender and *I/We agree that *I/We shall abide by the terms and conditions thereof, as modified, if any, elsewhere in these tender documents.
2. It is hereby further agreed and declared by *me/us, that the General Conditions of Contracts (IAFW-2249), 1989 Print, including Condition-70 thereof pertaining to settlement of disputes by Arbitration, containing 33 pages, with Errata 1 to 20 and Amendments Nos. 1 to 49 form part of these tender documents.

- Notes:** (a) The documents mentioned above can also be seen in the office of the **Chief Engineer(Navy), Station Road, Visakhapatnam-530 004** or in any other MES office during working hours.
- (b) In case of difference in interpretation due to wordings of English and Hindi versions, the English version will prevail as per Article 348 of Constitution of India.

*Delete whichever is not applicable.

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

SCHEDULE OF MINIMUM FAIR WAGES
(See condition 58 of IAFW-2249)

1. It is hereby agreed that the 'Schedule of Minimum Fair Wages'(SMFW)as published vide Government of India Notification dated 19 Jan 2017 and further Notification and as amended subsequently from time to time by the orders of the competent Central/State Governments/Local Authorities till last date of submission of T-Bids, forms part of these tender documents.
2. My/Our signature hereunder amounts to my/our having read and understood the provisions contained therein and I/we agree that I/we shall abide by the same and that aforesaid documents form part of this tender.
3. It is also agreed by me/us that although latest notification, as available with the Accepting Officer, has been formed part of the contract, in case the Government has further revised the wages, the latest revised wages for labour shall only be applicable.
4. Schedule of Minimum Fair Wages is not enclosed along with tender but the contractor is deemed to have full knowledge regarding the minimum wages payable to labourers as legally effective on the last date of submission of T-Bids and his tendered rates shall be deemed to have been based on the same. For the purpose of reimbursement of price variation (PV) clause for wage escalation of labour, the minimum wages legally effective on the last date of submission of T-Bids shall be the basis.
5. The minimum wage legally effective referred to above is the minimum wages notified in Gazette/ governed by any local regulations or by Central Government, whichever is higher.

Notes: (a) The documents mentioned above can also be seen in the office of the **Chief Engineer (Navy), Station Road, Visakhapatnam-530 004** or in any other MES office during working hours.

(b) In case of difference in interpretation due to wordings of English and Hindi versions, the English version will prevail as per Article 348 of Constitution of India.

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

SPECIAL CONDITIONS**1. GENERAL:**

- 1.1. These Special Conditions shall be read in conjunction with the General Conditions of contracts (IAFW-2249)(1989 Print) and IAFW-2159 (Revised 1947) including Errata and Amendments thereto. If any provisions in these Special Conditions are at variance with the provision in the above mentioned documents the provisions made hereinafter shall be deemed to take precedence there over.
- 1.2. The work under this contract shall be carried out in accordance with Schedule 'A', the Particular Specifications, Drawings and other provisions in MES Schedule.
- 1.3. The term 'General Specifications' referred to hereinbefore as well as referred to in IAFW-2249 (General Conditions of Contracts) shall mean the specifications contained in the MES Schedule Part-I.
- 1.4. General Rules, Specifications, Special Conditions and all preambles in the MES Schedules shall be deemed to apply to the work under this contract. In case of any discrepancy, the provisions in these documents shall take precedence over the aforesaid provisions in the MES Schedule.
- 1.5. **SITE CLEARANCE (Refer Condition 49 of IAFW-2249):** The contractor shall remove from the site all unused stores and materials, tools plant equipment, scaffolding, temporary buildings, huts and the like belonging to the contractor provided for the execution of work under this contract and the site of works shall be cleared of rubbish and all waste materials by the contractor and deliver the site in neat, clean and tidy manner to the satisfaction of the Engineer-in-Charge on or before the date of completion. Nothing extra, whatsoever will be paid to the contractor for such clearance of site and the rates quoted shall be deemed to include the same.

2. ADMISSIONS TO SITE BY CONTRACTOR AND RESPONSIBILITY TO ASCERTAIN HIS OWN INFORMATION:

- 2.1. The tenderers shall contact the Garrison Engineer for the purpose of the inspection of site(s) and relevant documents other than those sent herewith, who will give reasonable facilities for this purpose. The tenderers shall also make themselves familiar with working conditions, accessibility of site(s), availability of materials and other cogent condition etc. which may affect the entire completion of work under this contract.
- 2.2. Once the tenderers submit their tender/bid, they shall be deemed to have visited the site(s) and made themselves familiar with the working conditions accessibility of site(s), availability of materials and other cogent conditions etc. which may affect the entire completion of work under this contract. No extra payment consequent to any mistake or misunderstanding or otherwise on this account will be allowed.

3. SECURITY AND PASSES:

- 3.1. Contractor attention is invited to Condition-25 of IAFW-2249. He shall employ only Indian Nationals as his representatives, servants and workmen and verify their antecedents and loyalty before employing them for the works. He shall ensure that no person of doubtful antecedents and nationality is, in any way, associated with work. If for reasons of technical collaboration or other consideration, the employment of any foreign national is unavoidable, the contractor shall furnish full particulars to this effect to the Accepting Officer at the time of submission of his tender.

- 3.2. The contractor shall, on demand by the Engineer-in-Charge, submit list of his agents, employees and working people concerned and shall satisfy the Engineer-in-Charge as to the bonafides of such people.
- 3.3. The Engineer-in-Charge shall at his discretion have the right to issue passes as per rules and regulations of the installation/area in force to control the admission of the contractor, his agents, employees and work people to the site of the work or any part thereof. Passes should be returned at any time on demand by the Engineer-in-Charge or the authorities concerned and in any case on completion of works.
- 3.4. The contractor and his agents, employees and work people shall observe all the rules promulgated by the authority controlling the installations/area in which the work is to be carried out e.g., prohibition of smoking and lighting, fire precautions, search of persons on entry and exit, keeping to specific routes, observing specified timing, etc., nothing extra shall be admissible for any man-hour etc. lost on this account.

4. **CONDITIONS OF WORKING:**

4.1. **RESTRICTED AREA:**

4.1.1. **VISIT TO SITE WITHIN THE RESTRICTED AREA:** Permission to enter the restricted area at the time of submission of tenders can be obtained through the Garrison Engineer. Tenderers are advised to send prior intimation of their agents, representatives etc. if any, dates and time of their proposed visit, so that necessary arrangements may be made by GE to secure admission. Whether a tenderer visits the site or not he shall be deemed to have full knowledge of the restrictions of entering into/exit from and working within the restricted area, once he submits his quoted tender.

4.1.2. **ENTRY/EXIT:** The contractor, his agents, representative, workmen, etc. and his materials, carts, trucks or other means of transport, etc. will be allowed to enter through and leave from only such gate or gates and at such times as the GE or authorities in-charge of the Restricted Areas may at their sole discretion permit to be used. The contractor's authorised representative is required to be present at the place of entry and exit for the purpose of identifying his carts, trucks, etc. to the personnel in-charge of the security of Restricted Area.

4.1.3. **IDENTITY CARDS OR PASSES:** The contractor, his agents and representatives are required individually to be in possession of an identity card or passes duly verified by the police department. The identity card or pass will be examined by the security staff at the time of entry into or exit from the Restricted Area and also at any time or number of times inside the Restricted Area. Verification of antecedents of contractor's representative/labour deployed at site in connection with execution of work under the contract as per security requirement of user/installation shall be responsibility of the contractor and all expenses/fees charges in connection with verification of antecedents by police authority/security agency or any other authority shall be borne by the contractor.

4.1.4. **IDENTITY OF WORKMEN:** Every workman shall be in possession of an identity card. The identity card will be issued after thorough investigation of the antecedents of the labourers by the contractors and attested by the Officer-in-Charge of the unit concerned in accordance with the Standing Rules and Regulations of the units. Contractor shall be responsible for the conduct and action of his workmen, agents or representatives.

4.1.5. **SEARCH:** Thorough search of all persons and transport shall be carried out at each gate and for as many times as a gate is used for entry or exit and may also be carried out at any time or any number of times at the work site within the Restricted Area.

4.1.6. **FEMALE SEARCHER:** If the contractor desires to employ female labour on works to be carried out inside the area of a Factory, Depot, Park etc., and a female searcher is not borne on the authorized strength of the Factory, Depot, Park etc., at the time of submission of the tender, he shall be deemed to have allowed in his tender for pay and allowances etc. for a Female Searcher (Class IV servant/Group 'D' servant) calculated for the period, female labour is employed by him inside that area. If more than one contractor has/have to employ a female searcher in addition to the authorized strength of the Factory, Depot, Park etc. the salary and allowances paid to the additional female searcher (s) shall be distributed on an equitable basis between the contractors employing female labour taking into consideration the value and period of completion of their contracts. The GE's decision in regard to the amount recoverable on this account from any contractor shall be final and binding.

4.1.7. **WORKING HOURS:**

- (a) The unit controlling Restricted Area, usually, works during six days in the week and remain closed, on the 7th day. The working hours available to contractor a labour and staff however, accordingly get reduced because of the time taken in security checks observed at the time of entry, exit and during working hours.
- (b) The exact working hours, days and non-working days observed for the restricted area, where works are to be carried out shall be deemed to have been ascertained by the contractor before submitting his tender. The tenderer's attention is invited to the fact that the total number of working hours for a unit is prescribed in regulations and they cannot be increased by the Garrison Engineer.
- (c) Contractor's materials, transport etc. shall normally be permitted to come in/go out of the area between 9 AM to 5 PM only and this time also may be reduced by the concerned unit authorities due to security reasons and contractor shall not have any claim on this account.
- (d) Contractor may also be allowed to carry out the work beyond 6 PM and up to 6 AM (day and night) with prior approval of GE. No claim of contractor whatsoever shall be entertained if such permission is not given by GE due to security reasons of the area. No movements of materials and transport to/out of site of works shall be permitted during night, unless special permission is obtained from the factory/unit authorities.
- (e) **WORKON HOLIDAYS:** The contractor shall not carryout any work on gazette holiday, weekly holidays and other non-working days except when he is specially authorised in writing to do so by the GE. The GE may at his sole discretion declare any day as holiday or non-working day without assigning any reason for such declaration.

4.1.8. **ACCESS TO AREA AFTER COMPLETION OF WORKS:**After the works are completed and surplus stores etc. removed, the contractor, his agents, representatives, workmen etc. may not be allowed to have access to the restricted area except for attending any rectification of defects pointed out to him by the GE.

4.1.9. **FIRE PRECAUTIONS:** The contractor, his agents, representatives, workmen, etc. shall strictly observe the orders pertaining to fire precautions prevailing within the restricted area. Motor transport vehicles, if any allowed by authorities to enter the restricted area, must be fitted with serviceable fire extinguishers.

4.2. **UN-RESTRICTED AREA:**The restrictions for entry to the work site for certain portion of work and conditions of working in unrestricted area shall be as under:

- (a) The work lies in Unrestricted Area. However, the contractor, his agents, servants, workmen and vehicles may pass through the unit lines, in which case, the Engineer-in-Charge at his discretion, has the right to issue the passes, control their admission to the site of work or any part thereof. The contractor on demand by the Engineer-in-Charge shall submit a list of personnel etc. concerned and any other information called for by the Engineer-in-Charge and shall satisfy the Engineer-in-Charge as the bonafide of such people. Passes shall be returned at any time on demand by the Engineer-in-Charge and in any case on completion of work.
- (b) The contractor and his work people shall observe all the rules promulgated from time to time by authority controlling the area where the work is to be carried out e.g. prohibition of smoking etc. Any person found violating the security rules laid down by the authority shall be immediately expelled from the area without assigning any reasons whatsoever and the contractor shall have no claim on this account. Nothing shall be admissible for any man hours lost on this account.

5. **MINIMUM WAGES PAYABLE TO LABOUR:**

- 5.1. Refer Condition 58 of IAFW-2249. The contractor shall not pay wages lower than minimum wages for labour as fixed by the Government of India/State Government/ Union Territory/Competent local bodies whichever is higher.
- 5.2. The fair wages referred to in Condition-58 of IAFW-2249 will be deemed to be the same as the minimum wages as referred to above.
- 5.3. The contractor shall have no claim whatsoever, if on account of local factor and regulations, he is required to pay the wages in excess of minimum wages as described above during the execution of work.

- 6. **ROYALTIES:** Refer to Condition-14 of General Conditions of Contracts (IAFW-2249). No quarries on defence land are available.

- 7. **LAND FOR TEMPORARY WORKSHOP, STORES ETC.:** Please refer Condition-24 of IAFW-2249. The contractor shall be allotted land in the area as marked on the layout plan(s) for the purpose of erection of temporary shed for storage of materials etc. only at a nominal rent of Rs.1.00 per year or part thereof in respect of each and every separate area of land allotted to him. Plot of land so allotted shall not be used for accommodation of labour and canteen for which the contractor shall make his own arrangements at his own expense outside the defence land.

8. **WATER:**

- 8.1. Refer Condition 31 of General Conditions of Contracts IAFW-2249 and Clause 1.13 of MES Schedule Part-I.
- 8.2. **Water will supplied by the MES.**
- 8.3. The exact location of the water point [s] will be shown by the GE. Water meters to register the quantum of supply of water shall be provided and installed by the MES. Contractor shall provide all necessary pipes, fittings, etc, from the tapping point in order to ensure a proper and suitable supply of water for execution of work at his own cost. All contractor's installations and the layout of pipe line etc as proposed by him shall be as per plan approved by the Engineer-in-Charge / GE. The contractor will be charged for the water drawn for execution of works @ Rs. 123.49 per every One Thousand Litres of water consumed. However the contractor shall get the water tested from standard laboratory approved by GE. Testing charges shall be borne by the contractor.

- 8.4. The contractor to note that the water supply will be at the timings as fixed by GE. The contractor has to make necessary arrangements/ storage facilities so that the progress/execution of work is not affected. No claim whatsoever will be admissible in this regard.
9. **CO-OPERATION WITH OTHER AGENCIES:** The contractor shall permit free access and generally afford reasonable facilities to other agencies or Department workmen engaged by the Government to carryout their part of the work, if any, under separate arrangements.
10. **ELECTRIC SUPPLY:**
- 10.1. Electric supply required for the work shall be made available by MES at point (s) shown on site plan. The exact location of the electric point (s) will be shown by the GE. KWH meters to register the electric energy supplied and main switch shall be provided and installed by the MES. Contractor shall provide all necessary cables, fittings, etc., from the tapping point in order to ensure a proper and suitable supply of electricity for execution of work. All contractors' installation shall conform to and strictly in accordance with Indian Electricity Rules. Moreover, the layout of cables etc. as proposed by him shall be as per plan approved by the Engineer-in-Charge. The contractor will be charged for the electric energy consumed for execution of works at the following rates:
- (a) **At Rs. 14.64 per unit for Lighting.**
(b) **At Rs. 14.64 per unit for Power.**
- 10.2. MES does not guarantee continuity of supply and no compensation whatsoever shall be allowed for supply becoming intermittent or for breakdown in the system.
- 10.3. GE or his representative shall be free to inspect all the power consuming devices or any electric lines provided by the contractor. Any devices or electric lines provided by the contractor, which is not to the satisfaction of GE, shall be disconnected from the supply, if so directed by him.
11. **PERIOD OF KEEPING THE TENDER OPEN:** The tender for the works shall remain open for acceptance for a period of **90 (Ninty) Days** from the next date subsequent to last date of bid submission.
12. **NET WORK ANALYSIS:**
- 12.1. The time and progress chart to be prepared as per Condition-11 of General Conditions of Contracts (IAFW-2249) shall consist of detailed network analysis and a time schedule. The critical path network will be drawn jointly by the GE and the contractor soon after acceptance of tender. The time scheduling of the activities will be done by the contractor so as to finish the work within the stipulated time. On completion of the time schedule a firm calendar date schedule will be prepared and submitted by the contractor to the GE who will approve it after due scrutiny. The schedule shall be submitted in four copies within two weeks from the date of handing over the site.
- 12.2. During the currency of the work, the contractor is expected to adhere to the time schedule and this adherence will be a part of the contractor's performance under the contract. During the execution of the work, the contractor is expected to participate in the reviews which may be undertaken at the discretion of the GE, either as a periodical appraisal measure or when the quantum of work ordered on the contractor is substantially changed through deviation orders or amendments. Any provisions of the time schedule as a result of the review will be submitted by the contractor to the GE within a week for his approval after due scrutiny.

- 12.3. The contractor shall adhere to the revised time schedule thereafter. In case of contractor disagreeing with revised schedule the same will be referred to the Accepting Officer, whose decision shall be final, conclusive and binding. GE's approval to the revised schedule resulting in a completion date beyond the stipulated date of completion shall not automatically amount to a grant of extension of time. Extension of time shall be considered and decided by the appropriate authority mentioned in Condition 11 of IAFW-2249 and separately regulated.
- 12.4. The contractor shall mobilize and employ sufficient resources to achieve the detailed schedule daily within the broad frame work of the accepted method of working and safety. No additional payment will be made to contractor for any multiple shift work or other intensive methods contemplated by him in his schedule even though the time schedule is approved by the department.
- 12.5. The contractor shall provide CPM chart and revised CPM chart along with all requisite details viz., material and labour etc.

13. MATERIAL AND SAMPLE: (Refer Condition 10 of IAFW-2249)

- 13.1. The materials and articles, which have been specified from certain makers/manufacturers, shall be of makes/manufactures as specified here-in-after. If the manufacturers specified in tender documents make both ISI marked and conforming to ISI, the materials/articles shall be ISI marked.
- 13.2. The materials and articles, which have not been specified in tender documents by makes/manufacturers, shall be as under:
- (a) If ISI marked materials are being manufactured the same shall be ISI marked. For list of ISI marked manufacturers refer web site of BIS i.e. www.bis.org.in.
- (b) If ISI marked materials are not being manufactured, the same shall be conforming to IS specifications.
- 13.3. Materials of local origin shall be as specified and conforming to samples kept in GE's office. The tenderer is advised to inspect sample of materials which are displayed in the office of GE, before submitting his tender. The tenderer shall be deemed to have inspected the samples and satisfied himself as to the nature and quality of materials, he is required to incorporate in the work irrespective of whether he has actually inspected them or not.
- 13.4. The contractor shall not procure materials and articles unless the samples are first got approved from the Garrison Engineer.

14. PROPRIETARY MATERIALS:

- 14.1. The contractor shall ensure that proprietary materials such as paint, Water proofing compound and chemical for Anti Termite Treatment and similar items, the quantity of which cannot be checked after incorporation in the work shall be inspected by the Engineer-in-Charge when brought to site. The quantity brought shall be measured and recorded in the measurement book(s) and signed by the contractor and Engineer-in-Charge as a check to ensure that the required quantity has been brought to site for incorporation in the work.
- 14.2. Proprietary materials brought to site shall be stored as directed by the Engineer-in-Charge. The quantity already recorded in the measurement book(s) shall be suitably marked for identification.

14.3. The contractor shall obtain/procure proprietary branded materials only from manufacturer or their authorised dealers/stockists where such authorised stockists have been appointed. The contractor shall produce original receipted vouchers of suppliers to the GE to ensure that the contractor has actually brought the required quantity and the quality of the materials from authorised dealers/manufacturers and also to find out the rates thereof. These vouchers shall be endorsed, dated and initialed by the Engineer-in-Charge giving the contract number and name of work and a certified copy of each of such vouchers signed by both the Engineer-in-Charge and the contractor shall be kept in MES record. Materials used in the work are identical with approved samples and uniform throughout. GE has the right to affect recovery against default of contractor for non-production of cash bills/invoices and/or test results/certificate of the materials at his discretion keeping in view the standard laboratory test charges also. CE's decision shall be final and binding in case of contractor's objection on quantum of recovery made by GE. GE may also with-hold/recover requisite amount from RAR/final bill for any devaluation against material/workmanship out of executed work arising of Technical Examination of Works.

14.4. The contractor shall ensure that materials are brought to site in original sealed containers/packing, bearing manufacturers markings.

15. **RECORD OF CONSUMPTION OF CEMENT:**

15.1. The contractor shall maintain a pucca bound register with serially numbered pages with all pages initialed by Engineer-in-Charge, showing quantities of cement received, used in work and balance at the end of each day. The form of record shall be as approved by Engineer-in-Charge. The register shall be signed daily by representatives of MES and the contractor in token of verification of its correctness and will be checked by Engineer-in-Charge at least once in a week and on the days cement is received.

15.2. The register shall be kept at site in safe custody of the contractor's representative during the progress of the work and shall on demand be produced for verification to the inspecting officer(s).

15.3. On completion of the work the contractor shall deposit the cement register with the Engineer-in-Charge for record.

16. **ADVANCE ON ACCOUNT OF MATERIALS:(Referto Condition 64ofIAFW-2249)**

16.1. The contractor may be paid advance on account to the full value of the under-mentioned materials only, brought on the site, on his furnishing Bank Guarantee Bond(s) from a Scheduled Bank for the amount of the retention money which should otherwise be recoverable from him under contract:

- (a) Factory made door shutters.
- (b) Factory made steel windows/vents.
- (c) Sanitary fittings.
- (d) Iron Mongery
- (e) Electrical fittings/fixtures
- (f) Water supply pipes and pipe fittings/fixtures
- (g) Steel.
- (h) Cement
- (j) SGSW Pipes and Reinforced cement concrete pipes

16.2. The Bank Guarantee Bond(s) shall be executed on a Stamp Paper for a period and on a form as directed by the Accepting Officer. The contractor shall further arrange to extend the period of Guarantee Bond(s) if and when necessary, as directed by the Accepting Officer or shall furnish fresh Guarantee Bond(s) of similar value in lieu.

17. RECORD OF MATERIALS AND PURCHASE VOUCHERS:

- 17.1. The quantity of materials such as cement, steel, paints, water proofing compound, chemicals for anti-termite treatment and the like, as directed by Engineer-in-Charge (the quantity of which cannot be checked after incorporation in the works), shall be recorded in Measurement Books and signed by the contractor and the Engineer-in-Charge as a check to ensure that the required quantity has been brought to site for incorporation in the work.
- 17.2. Materials brought to site shall be stored as directed by the Engineer-in-Charge and those already recorded in Measurement Book shall be suitably marked for identification.
- 17.3. Contractor shall produce vouchers/invoices from the manufacturers and/or their authorized agents for the full quantity of the following materials as applicable as a pre-requisite before submitting claims for payment for advance on account of the work done and/or materials collected in accordance with Condition 64 of General Conditions of Contracts (IAFW-2249):
- (a) Materials for which payment is claimed as material lying at site in RAR.
 - (b) Cement and Steel
 - (c) Ceiling fan, Exhaust fan and wall mounted air circulator fan
 - (d) LED fittings
 - (e) LTP panel board with accessories
 - (f) RCC hume pipe
 - (g) Electrical, water supply, HVAC and fire fighting fittings/fixtures where names of manufacturers/brands are specified or approved.
 - (h) Cable/wires.
 - (j) Transformer, APFC panel
 - (k) Galvalume sheet
 - (l) Flame proof fittings
- 17.4. The contractor shall, on demand, produce to the GE, original receipted vouchers/ invoices in respect of the materials other than as stated in condition 18.3 above. Vouchers/invoices so produced and verified shall be stamped by Engineer-in-Charge indicating contract number. The contractor shall ensure that the materials are brought to site, in original sealed containers/packing, bearing manufacturer's marking except in the case of the requirement of materials(s) being less than smallest packing.
- 17.5. The vouchers/invoices will clearly indicate the contract number and the IS No., specific alternative to which the material conforms in case of various alternative in IS.

18. **OFFICIAL SECRET ACT:** The contractor shall be bound by the Official Secret Act 1951.

19. SECURITY OF CLASSIFIED DOCUMENTS:

- 19.1. Contractor's special attention is drawn to Condition 2-A and 3 of General Conditions of Contracts (IAFW-2249). The contractor shall not communicate any classified information regarding works either to sub-contractors or others without prior approval of the Engineer-in-Charge. The contractor shall also not make copies of the design/drawings and other documents furnished to him in respect of the works and he shall return all documents on completion of the work or on earlier determination of the contract. The contractor shall along with final bill attach a receipt from Engineer-in-Charge in respect of his having returned the classified documents as per Condition 3 of General Conditions of Contracts (IAFW-2249).

20. **SECURITY AGAINST LOSS OR DAMAGES:** The contractor shall furnish to the Engineer-in-Charge every morning distribution/return of his plants/equipment on the site of work stating the following particulars:

- (a) Particulars of plants/equipment, their make manufacturers model No., if any, registration No., if any, capacity, year of manufacture and year of purchase, etc.
- (b) Total No. (Quantity) on site of work
- (c) Location, indicating No (quantity) at each location on the site of work.
- (d) Purchase value on the date of purchase. The details of trucks and lorries and work-man's tools or any manually operated tools/equipment are not required to be given. The Engineer-in-Charge shall record the particulars supplied by the contractor and send the return to the GE for record in his office.

21. **CLEANING DOWN:**

21.1. Refer Condition 49 of IAFW-2249, General Conditions of Contracts.

21.2. The contractor shall clean all floors, walls, remove cement /lime paint marks/drops, etc. clean the joinery, glass panes, etc. touch up all painting works and carryout all other necessary items of works in connection there with and leave the whole premises clean and tidy before handing over the building.

21.3. The contractor shall also clean all surrounding areas where building materials were kept or where ground was disturbed during execution of the work and make it as per original condition without any extra cost.

22. **GST ON WORKS CONTRACTS BY STATE GOVERNMENT:** The tenderer's quoted sum shall deemed to include the GST levied by the Government as fixed from time to time and no claim on account of GST shall be admissible. As per GST Act, tax at applicable percent will be deducted at source by GE as per Government Orders issued from time to time. Contractor's unit rates/quoted sum shall be deemed to include this aspect and nothing extra shall be payable to contractor on this account.

23. **LABOUR WELFARE TAX/CESS:** The amount quoted by the tenderer shall be deemed to include labour welfare tax as fixed by the Government.

24. **SETTING UP OF SITE LABORATORY BY THE CONTRACTOR:**

24.1. The contractor shall establish the site laboratory within 30 days of date of commencement of work as per Work Order No.1 within the area directed by GE with the following equipment/instruments as well as the equipment mentioned hereinafter without any extra cost to the Government.

- (a) Compressive (Crushing) strength testing machine.
- (b) Timber moisture content meter.
- (c) Weight/Weighing measuring machine.
- (d) Sieve set both for fine and coarse aggregate.
- (e) Cube moulds for cement testing and concrete testing.
- (f) Cone for slump test.
- (g) Field Proctors density test equipment.
- (h) Cement testing machine for initial/final setting/ consistency.
- (i) Working plat form.
- (j) Rebound Hammer
- (k) PH meter
- (l) Digital Vernier Scale
- (m) Hydrometer
- (n) Marsh Cone

24.2. In addition to the above equipment/ instruments, any additional requirement as per CA provisions and as approved by GE shall be arranged by the contractor without any extra cost.

- 24.3. A list of equipment/instruments with their brief details viz., capacity/size, least count as applicable, shall be submitted by the contractor to GE for approval within 02 weeks of placement of Work Order No.1.
- 24.4. After obtaining approved list of equipment/instruments from GE, site lab shall be established by the contractor and fact reported by the contractor to GE in writing who will verify the fact and satisfy himself of the facilities provided, condition of the equipment/instruments, their calibration certificate etc. Thereafter GE shall issue a certificate to this effect in writing. Listing out equipment particulars etc. only after issue of this certificate by GE, the tests shall be carried out and materials so approved shall be incorporated in the work. If any equipment/instrument is found unsuitable by GE, the same shall be removed/corrected without any extra cost to Government and tests on these equipment shall be carried out only after taking written approval from GE.
- 24.5. The above said equipment/instruments as mentioned above shall be exclusively used for this subject contract only by the department and by the contractor.
- 24.6. Only after the completion of the subject work in all respects and as approved by GE, then only the contractor shall remove the site laboratory equipment/instruments from the site.
- 24.7. All equipment/plants shall be got calibrated initially by the contractor at his own cost from competent agency and calibration certificate for each equipment shall be submitted to the GE for record. Thereafter periodical calibration of the equipment as per laid down periodicity will be got carried out by the contractor from competent authority during currency of the contract till completion of the work in all respects. Periodic calibration certificate will also be submitted to the GE for record.
- 24.8. The cost for the equipment/instruments including calibration etc., as specified above shall be included in the contract sum and no extra payment for any deviation on this account shall be paid to the contractor.
25. **QUALIFIED TRADESMEN:** In compliance with the Condition-26 of IAFW-2249 (General Conditions of Contracts), the contractor shall employ skilled/semi-skilled tradesmen who are qualified and possessing certificate in particular trade from Industrial Training Institute (ITI)/National Institute of Construction Management and Research (NICMAR)/National Academy of Construction (NAC) Hyderabad/Similar reputed and recognised institutes by State/Central Government, to execute the works of their respective trade. The number of such qualified tradesmen shall not be less than 25% of total skilled/semiskilled tradesmen required in each trade. The contractor shall submit the list of such tradesmen along with requisite certificates to Garrison Engineer for verification and approval. Notwithstanding the approval of such tradesmen by GE, if the tradesmen are found to have inadequate skill to execute the work of their trades, leading to un-satisfactory workmanship, the contractor shall remove such tradesmen within a week after written notice to this effect by the GE and shall engage other qualified tradesmen after prior approval of GE. The GE's decision whether a particular tradesman possesses requisite qualification, skill and expertise commensurate with nature of work, shall be final and binding. No compensation whatsoever on this account shall be admissible.
26. **SAFETY MEASURES, PRECAUTIONS, RISKS ETC INVOLVED IN CONSTRUCTION OF HIGH-RISE BUILDINGS:**
- 26.1. The contractor shall take all measures and practices as stipulated in SP 70 : Handbook on Construction Safety Practices and as stipulated in relevant IS codes mentioned in Appendix 'E' therein. The contractor shall also follow all the safety measures during construction as stipulated in Clause 9 of Part 7 of NBC 2016 (Volume 2) and special attention shall be

given to clause 9.11 which lays down additional safety requirements for erection of concrete framed structures (High-rise buildings).

26.2. SAFETY MANAGEMENT SYSTEM (SMS) FOR HIGH-RISE BUILDING CONSTRUCTION:

26.2.1. The contractor shall have a strong and powerful Project/Construction Management team who will monitor, control, and handle the safety matters. The project management team should identify the potential risks/unsafe conditions during construction like falling debris, crane and hoist problem, electrical shocks, falling from heights etc and formulate a comprehensive safety plan and strictly implement it during construction work to ensure hazard free working environment. The safety plan should include the following:

- (a) Safety management/hierarchy/organization
- (b) Proper Scaffolding (fixed and mobile) including ladders & platforms
- (c) Electro-mechanical activities and controls
- (d) Site status
- (e) Temporary power supply and tools
- (f) Health & welfares
- (g) Storage condition
- (h) Fire prevention
- (j) Waste/pollution control
- (k) Monitoring and control of working on height
- (l) Aid/first aid and evacuation
- (m) Emergency plan for unanticipated circumstances

26.2.2. All employees (worker, site charges and others) of the contractor shall wear the Personal Protective Equipment (PPE) at site all the times. Only approved PPE will be supplied to all persons. This equipment may include: Hard hat, safety boots, gloves, hearing protection, respirator, eye protective safety glasses etc.

26.2.3. All works at height shall be done with the help of proper Equipment and specification. The contractor shall ensure that all the works are done with proper use of scaffolding. Routine checks shall be conducted to ensure integrity and safety of scaffolding.

26.2.4. The contractor shall take all precautions, safety measures etc to avoid any damage, mis-happening, accident etc to the workmen engaged by him. The lumpsum amount quoted by the contractor shall be deemed to have included the element of adopting safety measures, precautions etc involved in work and nothing extra shall be admissible on this account.

27. **EMPLOYEES' PROVIDENT FUND:** The contractor shall be in possession of EPF Code Number and all the workers employed by him shall be enrolled as member of Employees' Provident Fund and shall have Universal Account Number (UAN). The contractor shall render a certificate that all workers directly or indirectly employed by him are registered for EPF and the due contributions have been credited in to their accounts, before claiming for any payment. The payments will be released only on verifying the same from Official Website of EPFO (www.epfindia.gov.in).

28. **PHOTOGRAPHY AT SITE OF WORKS:** The Contractor shall submit colour photographs of various stages of construction at the site of works in properly bound album all as directed by GE and as follows:

(a)	Size	:	Post Card
(b)	No. of Sets	:	03 (Minimum 36 Photographs in each set)
(c)	Soft Copy in CD in JPEG format	:	In Original

29. DIGITAL RECORDS:

- 29.1. During execution of works, records of all hidden works, deviation and important stages of work shall be maintained using digital photography duly signed by AGE, GE and Contractor. All such records shall be submitted to higher authorities when called for and/or for verification during finalization of Dos. These records need to be produced as proof by the GE/AGE in case of disputes. The decision of the GE with regard to recording of part/portion or full details of hidden works, deviation and important stages of works shall be final and binding. In case of dispute between the GE and Contractor with regard to measurements/finalization of Dos (in respect of recorded works) the decision of Accepting Officer shall be final and binding.
- 29.2. Contractor shall not proceed with the next stage unless photographs are taken for the previous stage. These photographs shall be preserved on CDs for future reference. GE shall arrange for digital camera and CDs required for the same.
- 29.3. Contractors shall consider all such provisions in their quotation before quoting the tender and their quoted rates shall be deemed to include all the incidental expenses (direct or indirect) required for such provisions and nothing extra will be entertained on this account.

30. INFORMATION ON STONE PLAQUE AT SITE:The contractor shall provide a Granite/Marble Stone engraved plaque of adequate dimensions in single piece indicating the following information at work site as directed by GE on every building/structure:

- (a) Job No.
- (b) CA No. and Year
- (c) Amount of CA
- (d) Name of the Work
- (e) Name of Contractor
- (f) Name of GE
- (g) Name of Engineer-in-Charge/JE
- (h) Date of Commencement
- (j) Date of Completion Phase wise
- (k) Date of Expiry of Defects Liability Period
- (l) Date of Expiry of Warranty period given for works like ATT/ Water Proofing.

31. PROJECT SIGN BOARD:Project sign board of size 1200mmx900mm shall be provided and fixed at the project site, at the locations, as directed by the GE. The sign board shall be of metal frame made out of angle iron 45x45x5mm, with MS sheet of 16 gauge. The board shall have the legs continuing from the frame for erection purpose and shall not have any joint. The top of the board shall be at a height of 1.800m, above the GL and the legs shall be taken up to 0.700 m below the GL. The legs portion below the GL shall be embedded in PCC 1:2:4, Type B1, the size of the concrete block shall be 0.30x0.30x0.20 m (Each Leg). The steel and iron surfaces shall be prepared and painted with 2 coats of synthetic enamel paint over a coat of zinc chrome primer, as specified hereinafter. The shade shall be as decided by the GE. The amount quoted shall be deemed to include this aspect. The following project information shall be provided on the board:

- (a) Name of the Work
- (b) C. A. No and Year
- (c) Amount of CA
- (d) Date of Commencement
- (e) Date of Completion Phase wise
- (f) Name of GE
- (g) Name of Contractor/Firm executing the Project.

32. **REIMBURSEMENT/REFUND ON VARIATION IN 'TAXES DIRECTLY RELATED TO CONTRACT VALUE':**

32.1. The rates quoted by the contractor shall be deemed to be inclusive of all taxes (including Goods and Services Tax (GST) on Material and labour, GST on works contract, Labour Welfare Cess etc.,) & Other levies payable under the respective statutes. No reimbursement/refund for variation in rates of taxes, duties, Royalties, Octroi & other levies, and/or imposition/abolition of any new/existing Taxes, Duties, Royalties, Octroi & other levies shall be made except as provided in Para 30.2 herein below.

- (a) The taxes which are levied Government at certain percentage rates of contract sum/amount shall be termed as 'taxes directly related to contract value' such as Goods and Service tax (GST) on works contracts, Labour Welfare Cess and like but excluding income tax. The tendered rates shall be deemed to be inclusive of all 'Taxes directly related to contract value' with existing percentage rates as prevailing on last due date of submission of Bids. Any increase in percentage rates of 'Taxes directly related to contract value' with reference to prevailing rates on last due date for submission of Bids shall be reimbursed to the contractor and any decrease in percentage rates of 'taxes directly related to contract value' with reference to prevailing rates on last due date for submission of Bids shall be refunded by the contractor to the Government/deducted by the Government from any payments due to the contractor. Similarly, imposition of any new 'taxes directly related to contract value' after the last due date for submission of Bids shall be reimbursed to the contractor and abolition of any 'taxes directly related to contract value' prevailing on last due date for submission of Bids shall be refunded by the contractor to the Government/deducted by the Government from the payments due to the contractor.
- (b) The contractors shall within a reasonable time of his becoming aware of variation in percentage rates and/or imposition of any further 'taxes directly related to contract value' give written notice thereof to the GE stating that the same is given pursuant to this Special Condition, together with all information relating thereto which he may be in a position to supply. The contractors shall also submit the other documentary proof/information as the GE may require.
- (c) The Contractor shall, for the purpose of this Condition keep such books of account and other documents as are necessary and shall allow inspection of the same by a duly authorised representative of Government, and shall further, at the request of the GE furnish, verified in such a manner as the GE may require, any documents so kept and such other information as the GE may require.
- (d) Reimbursement for increase in percentage rates/imposition of 'Taxes directly related to contract value' shall be made only if contractors necessarily and properly pays additional 'Taxes directly related to contract value' to the Government, without getting the same adjusted against any other tax liability or without getting the same refunded from the concerned Government Authority and submits documentary proof for the same as the GE may require.

33. **DISPUTE RESOLUTION BOARD (DRB) (CONDITION-71 OF IAFW-2249 GENERAL CONDITIONS OF CONTRACTS REFERS):**

33.1. During execution of the works or after completion or after determination/cancellation/termination of the contract all disputes between the parties to contract arising out of the contract (except those for which decision of Accepting Officer or any other officer (CWE and/or GE) is expressed to be final and binding), including any disagreement by either party with any action, inaction, opinion, instruction, certificate or valuation by the Accepting Officer or his nominee, the matter in dispute shall, in the first place be referred to the

Dispute Resolution Board (DRB). In case of disagreement with the decision of such DRB, any party may invoke arbitration clause.

33.2. The Constitution of the DRB shall be a three member body as under:

(a) **Chairman:** Joint DG (Contracts) of the concerned Command Chief Engineer, Where Joint DG (Contracts) is not posted in the Command, any other Chief Engineer/Brigadierlevel Officer posted in CE Command shall be nominated by Command CE at his sole discretion.

(b) **Member1:** } Colonel/Director rank officers of Command CE or any other Zonal CE
(c) **Member2:** } be nominated by Command CE

33.3. The name of chairman and members shall be notified by the Accepting Officer within one month of the date of acceptance of contract.

33.4. Once the DRB is constituted the members and Chairman shall disclose in writing their neutrality and impartiality about any personal interest in the work.

33.5. The dispute shall be referred to the chairman of the DRB by the concerned party after giving notice to the other party for invoking of this clause.

33.6. The DRB shall decide the dispute in accordance with the terms of the contract, principle of natural justice, equity and fair play.

33.7. The DRB may fix oral hearing at a place, date and time as decided by the Chairman.

33.8. The requisite administrative support to the DRB shall be provided by the Accepting Officer.

33.9. All the contract documents pertaining to the case shall be provided by the Accepting Officer for reference by the DRB.

33.10. DRB shall give its decision on the disputes within three months of notice from any party invoking the DRB clause. This period can be extended by one month with the consent of the parties.

33.11. All the decisions given by the DRB shall be by majority and such decision shall be communicated in writing by Chairman to the parties.

33.12. If the decision of the DRB is not to the satisfaction of either party or if the DRB fails to give decision within the laid down time either party shall indicate his reservations on the decision to Accepting Officer within 30 days of such decision and to refer that dispute for arbitration within the provisions of Condition-70 of IAFW-2249 General Conditions of Contract.

33.13. It shall be mandatory for the party invoking arbitration on any particular dispute to have first exhausted the remedy provided under the DRB clause for that particular dispute.

33.14. The mandate of the DRB shall terminate on completion of one year from the date of completion/determination/cancellation/termination of the contract.

33.15. If any member or Chairman of the DRB is unable to function due to any reason whatsoever, or the resigns his appointment, Chief Engineer Command as the case may be, shall fill the vacancy so cause within 15 days of happening of such vacancy.

- 33.16. Any dispute referred to the DRB and having been decided by the DRB and not objected to by either party within 30 days shall attain finality and shall not be referable to arbitration.
- 33.17. Accepting Officer shall ensure implementation of the decisions of the DRB which attain finality, i.e. except those which are objected by him or by contractor within 30 days as per para 12 above.
- 33.18. Findings and decision of DRB shall be admissible as evidence, to the extent permissible as per law, in the subsequent Arbitration and/or litigation.
- 33.19. DRB Chairman/Members shall not, in any case, be liable to be called as witness or to produce any evidence in any Arbitration or departmental proceedings of any kind.
- 33.20. During execution of work, the disputes may be referred to the DRB as per the requirement of each party after having exhausted the decision making process provided in the contract. In case of completion of work or after determination/ cancellation/termination of the contract all the disputes including payment/non-payment/delay in final bill shall e simultaneously referred to the DRB within six months of completion/determination/cancellation/termination of the contract.
- 33.21. The department case before the DRB shall be presented by Accepting Officer himself and/or Dir (Contracts) of CE zone assisted by CWE and his DCWE (Contract), GE and his AGE (Contracts) and any other officer and legal counsel nominated by Accepting Officer. The contractor may present his case by himself and/or by his nominated representatives & authorised legal/technical counsel.

34. **OUTPUT OF ROAD ROLLERS:**

- 34.1. (Refer Condition15 of IAFW-2249). Where road rollers are hired by the Department to the contractors, a logbook for each road roller shall be maintained by the Department recording hours of working of the road roller. In case, however, when the contractor procures road roller from, sources other than the Department, a logbook for each road roller shall be maintained by him for recording hours of working of the road roller. Entries in the log book shall be signed by the contractor or his authorised representative and by the Engineer-in-Charge.
- 34.2. To ensure proper consolidation roller must work for at least number of days assessed on the basis of output given hereinafter. If the roller has not worked for the number of days so assessed, recovery shall be effected from the contractor for the number of days falling short of the days assessed on the basis of output stipulated. The recovery shall be effected as under:
- (a) Where road roller is hired out only by the Department to the contractor at rates given in Schedule 'C'.
 - (b) Where road roller is hired by the contractor only from sources other than the Department at the rate of Rs. **2,500.00** per working day of 8 hours for static power roller and at the rate of **Rs. 4,000.00** per working day for tandem vibratory roller.
 - (c) Where road roller is hired by the contractor from the department and also from sources other than the department, at higher of the two rates given in Schedule 'C' of the contract and Para (b) above.
 - (d) The above provisions shall not, however, absolve the contractor of his responsibility of properly consolidating surface as required under the provisions of contract.

34.3. **OUTPUT OF ROAD ROLLER PER DAY OF 8 HOURS WORK:**

(a)	Consolidation of formation Surface/Sub Grade	:	1850 Sq.m.
(b)	Consolidation of Stone Soling/Hardcore		
	(i) 10 cm thick (Spread Thickness)	:	1000 Sq.m.
	(ii) 15 cm thick (Spread Thickness)	:	800 Sq.m.
	(iii) 23 cm thick (Spread Thickness)	:	518 Sq.m.
(c)	Consolidation of Water Bound Macadam (Stone Metal) including Spreading and Consolidation with Binding Material		
	(i) 7.5 cm (Compacted Thickness)	:	372 Sq.m.
	(ii) 10 cm (Compacted Thickness)	:	283 Sq.m.
	(iii) 11 cm (Compacted Thickness)	:	248 Sq.m.
(d)	Consolidation of Premixed Carpet Including Seal Coat		
	(i) 20mm thick (Compacted Thickness)	:	744 Sq.m.
	(ii) 25mm thick (Compacted Thickness)	:	600 Sq.m.
	(iii) 40mm thick (Compacted Thickness)	:	500 Sq.m.
(e)	Consolidation of Single Coat Surface Dressing	:	774 Sq.m.
(f)	Consolidation of Two Coats of Surface Dressing	:	558 Sq.m.
(g)	Consolidation of bituminous mixture 2 Parts broken stone metal and 1 Part of sand and bitumen		
	(i) 4 cm (Compacted Thickness)	:	372 Sq.m.
(h)	Consolidation of 15 cm thick (Spread Thickness) Earthen/Moorum Berms	:	1800 Sq.m.
(j)	Premixed Bituminous Macadam	:	15 Cu.m.
(k)	Semi Dense Asphaltic Concrete	:	18.40 Cu.m.
<u>Note:</u> Regarding output of road roller in respect of other items catered in the CA, GE shall order a board of officers and ascertain the required output of road roller to achieve the desired/specified compaction over a trial area which will be the basis for the corresponding works.			

34.4. Road roller shall not be issued by the Department under Schedule 'C' and shall be arranged by the contractor under his own arrangements. Provision of Condition hereinbefore shall be deemed amended accordingly.

34.5. The number of hours/days assessed for proper consolidation and number of hours/days for each surface of each stretch/piece of road consolidated, shall be submitted by the contractor to Engineer-in-Charge and GE for each stage and only after written approval of GE, contractor shall proceed to next stage of work.

35. **ENGINEERING ESTABLISHMENT (Refer Condition 25 of IAFW-2249):**The requirement of Engineering Staff for this tender shall be as under:

Sl. No.	Role	Nos.	Essential Qualification	Desirable Qualification
1.	Project Manager	01	Graduation in Civil Engineering from a Govt. recognized University/Institute with a minimum of 10 years experience in handling PEB Structure.	One of the Engineers should be familiar with Auto CAD, MS Projects, Primavera and MS Office
2.	Site Engineer Civil	01	Graduate in Civil Engineering from a Govt. recognised University/ Institute with at least 05 years of practical experience in handling of PEB Structure.	
3.	Site Engineer Electrical	01	Graduation in Electrical Engineering from a Govt. Recognized University/Institute with a minimum of 10 Years experience in handling PEB Structure.	
4.	Site Supervisor	02	Diploma in civil engineering from a govt recognized university/ institute with a minimum of 05 years experience in Building Construction.	
5.	Lab Assistant	01	(10+2) holders from a Govt. recognized college with a minimum of 05 years experience in relevant field.	
6.	Safety Engineer	01	Diploma holder from a Govt. recognised University/ Institute with at least 02 years of experience in high rise building construction.	
7.	Quality Control Engineer	01	Graduate in Civil Engineering from a Govt. recognised University/ Institute with at least 05 years of experience in quality control checking in building and project documentation.	

36. **SPECIAL T&P/MACHINERY/TRANSPORT:**The minimum requirement of T&P for this tender shall be as under. The contractor shall deploy T&P as per the requirement according to the scope of work:

Sl. No.	T&P/MACHINERY/TRANSPORT	MINIMUM REQUIREMENT
1.	Self loading mobile SLM) concrete mixer, (4 Cum capacity)	02
2.	Excavator	01
3.	Back hoe	01
4.	Grader	01
5.	Concrete Vibrator	25mm-03

		40mm-03 Plate vibrator-02
6.	Concrete Pump	01
7.	Total station	01
8.	Automatic level	01
9.	Personal Protective Equipment	For at least 60 Labour
10.	Tower Crane – with Boom of 60Meters	01
11.	Towable Light Tower	01
12.	Scaffolding material	As per Requirement
13.	Steel Shuttering	1500 Sqm
14.	Tower builder hoist	04
15.	Goods carrying lift	01 Ton capacity
16.	Welding machine with cable etc.complete set	01
17.	Cutting machine with accessories complete set	01
18.	Truck/Tipper	04
19.	DG Set 10 KVA	01
20.	Concrete Cube Moulds (15 x 15 x 15 cm Size)	50 Nos
21.	Concrete Mixer 0.25 Cum Capacity	02
22.	Hydraulic Pile Driving Machine	01
23.	Civil Engineering Lab Equipment	01 Set with site lab

37. **LABOUR (REGULATION & ABOLITION) ACT:**

- 37.1. Contract labour (Regulation & Abolition) Act 1970 is applicable to MES Contractors. Rates quoted by the tenderer shall be deemed to take into account the cost, etc., required to comply with the provisions contained in the said act and the rules framed under the said act.
- 37.2. Refer Condition 58 of IAFW-2249. The 'Schedule of Minimum Wages' as published vide Govt. of India Notification as applicable on date of receipt of tender forms part of these tender documents. However, the Contractor shall not pay wages lower than minimum wages for labour as fixed by the Govt. of India/ Union territory under Minimum Wages Act or Contract Labour (Abolition and Regulation Act), whichever is higher.
- 37.3. The fair wages referred to in condition 58 of IAFW-2249 will be deemed to be the same as the minimum wages referred to above as upto date from time to time.
- 37.4. Schedule of Minimum Wages is not enclosed along with the tender documents. However Contractor shall be deemed to have verified the minimum fair wages payable as on the last due date of the receipt of the tender.
- 37.5. The Contractor shall have no claim whatsoever, if on account of local factors and/or regulations, he is required to pay the wages in excess of minimum wages as described above during the execution of work.
38. **DAMAGE TO STRUCTURE:** Any damage done to the structure already built or being built by other agency during execution of work shall be made good by the contractor at his own cost and the site of work left clean and tidy on completion. Rectification, reinstatement, making good, etc. shall conform to the standard of materials originally used in the work and finished work shall match with existing work in all respect to the entire satisfaction of the GE. In case of any dispute on this account the matter shall be referred to the Chief Engineer whose decision in writing shall be final, conclusive and binding.

39. CONTRACTORS PLANT/EQUIPMENT AT SITE:

39.1. The Contractor shall furnish to the Engineer-in-Charge every morning distribution return of his plants/ equipment on the site of work stating the following particulars:

- (i) Particulars of plants/equipment, their make, manufacturers model No. if any, registration number if any, capacity, year of manufacture and year of purchase, etc.
- (ii) Total number (Quantity) on site of work.
- (iii) Location, indicating number (quantity) at each location on the site of work
- (iv) Purchase value on the date of purchase. For the purpose of the condition, plant/equipment, vehicle number, i.e. of trucks and lorries but neither the workman's tools or any manually operated tools/equipment shall be given. The Engineer-in-Charge shall record the particulars supplied by the contractor in the works diary and send the return to the GE for record in his office.

39.2. Loss or damage on account of enemy action. If as a result of enemy action the Contractor suffers any loss or damage the Government shall reimburse to the Contractor such loss or damage to the extent and in the manner hereinafter provided:

- (i) The loss suffered by him on account of any damage or destruction of his plant/equipment (as defined in Special Condition(a) above) or materials or any part or parts thereof. The amount of loss assessed by the Accepting Officer of the Contract or the CWE in case of contracts accepted by GE, on this account shall be final and binding.
- (ii) The compensation paid by him under any law for the time being in force to any workman employed by him for any injury caused to him or to the workman's legal successors for loss of the workman's life.
- (iii) Payment of compensation for loss or damage to any work or part of work carried out. The amount of compensation shall be determined in accordance with condition 48 of General Conditions of Contracts IAFW-2249.
- (iv) No reimbursement shall be made nor shall any compensation be payable under the above provision unless the Contractor had taken Air Defence Precautions ordered in writing by the GE/OC concerned or in the absence of such orders, reasonable precautions. No reimbursement shall be payable nor shall any compensation be payable for any plant/ equipment or materials not lying on site of work at the time of enemy action.

40. **WATCH/LIGHTING:** The Contractor shall at his own cost take all possible precautions to ensure safety of life and property by providing necessary fencing, barrier, light, watchmen, etc. during the progress of work and as directed by the Engineer- in-charge.

41. STACK MEASUREMENTS:

41.1. Aggregates required for the work shall be stacked at suitable level places and their measurements recorded in measurement book and signed and dated by the MES representative and the Contractor as a check to ensure that the required quantities have been brought at site for incorporation in the work. No deductions shall be made in the stack measurement for unevenness of ground.

- 41.2. This provision, however, shall not absolve the Contractor from providing more materials required to complete the work to the required specification and to repair potholes, cracks, etc. that may occur during rolling.

42. **SIGNING OF TENDER:**

- 42.1. The person signing the tender on behalf of another partner or on behalf of a firm shall attach with the tender a proper power of attorney duly executed in his favour by such other person or by all the partners, stating that he has authority to bind such other person(s) or the firm as the case may be in all matters pertaining to the contract including arbitration clause.

43. **OUT OF POCKET EXPENSES:**No out of pocket expenses incurred by the tenderer in submitting his tender shall be reimbursed whether his tender is accepted or not.

44. **MATERIALS IN METRIC SIZES:**If the material (other than those issued under Schedule 'B') are not available in metric sizes as shown on drawings, the contractor shall provide materials in equivalent inch sizes which would not be less than the metric size dimension under any circumstances, at no extra cost to the Government.

45. **REIMBURSEMENT/REFUND ON VARIATION IN PRICES:**

- 45.1. Refer Condition 63 of the General Conditions of Contracts (IAFW-2249)/Reimbursement/Refund on Variation of prices. The Condition 63 of General Conditions of Contracts shall be deemed to be modified to the extent mentioned hereinafter. Increase or decrease in prices of Cement, Steel and other materials shall be adjusted on the basis stipulated hereinafter irrespective of the actual variation in prices (to the contractor) for Phase-I works:

(a) Cement: The cement cost component for the contract as a whole shall be taken as $K_C\%$ of the value of works executed under the contract. Accordingly, value/cost of cement consumed in the work as well as that lying at site for which reimbursement/ refund is applicable shall be:

$$V_{MC} = \frac{(K_C \times V_g)}{100} + V_C$$

Variation in prices of cement shall be worked out by applying the following formula:

$$E_{MC} = (V_{MC2} - V_{MC1}) \times \frac{(C_1 - C_0)}{C_0}$$

E_{MC} = Variation in prices of cement to be adjusted.

K_C = Constant representing the percentage cost of Cement as compared to the total value of work under the contract as a whole. The value of K_C for this work shall be **10 (Ten)** only.

V_g = Amount of work done priced at contract rates up to for the last date of the period of reckoning excluding amount payable to the contractor towards items on star rate and PC sum.

V_C = Cost of all cement lying at site for incorporation in the work excluding cement issued under Schedule 'B' and excluding cement brought and paid or payable to contractor under Price Cost Sum and/or Star Rate (s).

C_1 = Wholesale Price Index for Cement (Base Year 2011-12) published by the Economic

Adviser to the Government of India as on the date of commencement of the period of reckoning. In case the original contract period is extended under condition 11 of General Conditions of Contracts (IAFW-2249), the Price Index as applicable on the date of commencement of the last period of reckoning before the original completion date(s) (phase wise except where phasing has been done only for sample quarter/block) shall only be applicable during the extended period. If phasing has been done for only sample quarter/sample block, the price index as applicable on the date of commencement of the last reckoning period before the original completion date of the project as a whole shall only be applicable during the extended period.

C_0 = As per C_1 but the index as on the last due date of bid Submission. In case of tenders for specialist works made in two parts viz "T" and "Q", C_0 shall be as on date of opening of "Q" Bid.

Note: The type of cement wholesale price index shall be considered for C_0 & C_1 , shall be based on the type of cement used in the work and after verifying the type of cement for which Wholesale Price Index is published by Economic Adviser to the Government of India.

V_{Mc2} = Amount of cement up to the last date of the period of reckoning for which is adjustable as worked out as per formula for V_{Mc} .

V_{Mc1} = As per V_{Mc2} but as on date of immediate preceding period of reckoning.

(b) Steel: The Steel cost component for the contract as a whole shall be taken as $K_s\%$ of the value of works executed under the contract. Accordingly value/cost of steel consumed in the work as well as that lying at site for which reimbursement/refund is applicable shall be:

$$V_{MS} = \frac{(K_s \times V_g)}{100} + V_s$$

Variation in prices of steel shall be worked out by applying the following formula:

$$E_{MS} = (V_{MS2} - V_{MS1}) \times \frac{(S_1 - S_0)}{S_0}$$

E_{MS} = Variation in prices of steel to be adjusted.

K_s = Constant representing the percentage cost of steel as compared to the total value of work under the contract as a whole. The value of K_s for this work shall be **27.50 (Twenty Seven Point Fifty)** only.

V_g = Amount of work done priced at contract rates up to for the last date of the period of reckoning excluding amount payable to the contractor towards items on star rate and PC sum.

V_s = Cost of all steel lying at site for incorporation in the work excluding steel issued under Schedule 'B' and excluding steel brought and paid or payable to contractor under Prime Cost Sum and/or Star Rate (s).

S_1 = Wholesale Price Index for Mild steel (Long Products) (Base Year 2011-12) published by the Economic Adviser to the Government of India as on the date of commencement of the period of reckoning. In case the original contract period is extended under condition 11 of General Conditions of Contracts (IAFW-2249), the Price Index as applicable on the date of commencement of the last period of reckoning before the original completion date (s) (phase wise except where phasing has been done only for sample quarter/block) shall only be applicable during the extended period. If phasing has been done for only sample quarter/sample block, the price index as applicable on the date of commencement of the

last reckoning period before the original completion date of the project as a whole shall only be applicable during the extended period.

S_0 = As per S_1 but the index as on the last due date of bid Submission. In case of tenders for specialist works made in two parts viz. "T" and "Q", S_0 shall be as on date of opening of "Q" Bid.

V_{MS2} = Amount of steel up to the last date of the period of reckoning for which is adjustable as worked out as per formula for V_{MS} .

V_{MS1} = As per V_{MS2} but as on date of immediate preceding period of reckoning.

(c) Other materials (Except Cement & Steel): The materials cost component including the cost component except cement & steel for the contract as a whole shall be taken as K_{OM} % of value of works executed under the contract. Accordingly value/cost of other materials consumed in the work as well as that lying at site for which reimbursement/refund is applicable shall be;

$$V_M = \frac{(K_{OM} \times V_g)}{100} + (V_{OM} - V_B)$$

Variation in prices of materials (except cement & steel shall be worked out by applying the following formula:

$$E_M = (V_{M2} \cdot V_{M1}) \times \frac{(W_1 - W_0)}{W_0}$$

E_M = Variation in price of materials to be adjusted except cement & steel.

K_{OM} = Constant representing the percentage cost of other material except cement & steel as compared to the total value of work under the contract as a whole. The value of K_{OM} for this work shall be **20.50 (Twenty point fifty)** only.

V_g = Gross value of work done at contract rates up to the last date of the period of reckoning excluding amount payable to the contractor towards items on Star Rate and PC sum.

V_{OM} = Value of all materials (except cement & steel) lying at site for incorporation in the work including material (except cement & steel) issued under Schedule 'B' and including materials (except cement & steel) brought and paid or payable to contractor under Prime Cost Sum and/or Star Rate(s).

V_B = Value of all materials (out of V_g and V_{OM}) (except cement & steel) issued under Schedule 'B' plus value of all materials (except cement & steel) brought and paid or payable to contractor under Prime Cost Sum and/or Star Rate(s).

W_1 = Whole sale price index for all commodities (Base Year 2011-12) published by Economic Adviser to the Government of India, as on the date of commencement of the period of reckoning. In case the original contract period is extended under Condition 11 of IAFW-2249, the price index as applicable on the date of commencement of the last period of reckoning before the original completion date (s) (phase wise except where phasing has been done only for sample quarter/sample block) shall only be applicable during the extended period. If phasing has been done for only sample quarter/sample block, the price index as applicable on the date of commencement of the last reckoning period before the original completion date of the project as a whole shall only be applicable during the extended period.

W_0 = As for W_1 but the index as on the last due date of bid submission.

V_{M2} = Value of material (except cement & steel) up to the last date of the period of reckoning for which price variation adjustable as worked out as per formula for V_M .

V_{M1} = Value of materials up to the last date of immediate preceding period of reckoning.

Notes:

1. No adjustment, whatsoever, due to variation in prices of materials on account of coming into force of any fresh law or statutory rule or order as provided in Condition 63 of IAFW-2249 or otherwise than provided in this condition shall be made.
 2. No adjustment in prices shall be made for any work done with materials brought at site after the original date of completion of the work as mentioned in work order No.01 under contract except as contemplated under definition of C_1 , S_1 and W_1 hereinbefore.
 3. Periodicity of working out the escalation on account of variation in prices will be three months. The last calculation shall, however be done for the value of work at contract rates and materials lying at site for incorporation in the work as on date of completion or extension thereof as mentioned in Note 2 above. Valuation of RARs is to be timed in such a manner that relevant data required for quarterly calculation under this condition is available from RARs. In case on these dates no RAR is preferred by the contractor, dummy RAR would be prepared & shall be kept on record duly technically checked and audited. Amount payable relevant to work done and materials collected in any quarter will be worked out after firm wholesale price indices for the relevant quarter are available. Once the amount adjustable for any quarter is worked out, the same shall be adjusted as and along with advance on account payment in the subsequent RAR (s).
 4. Any dispute arising out of interpretation or application of this Special Condition shall be referred to the Accepting Officer whose decision shall be final and binding.
 5. For the purpose of calculation of Retention Money, Liquidated Damages, GST on Works Contracts, deduction of Income Tax at source and recovery of water charges (in case of unmetered supply) the value of contract as revised by the above price variation will be taken in to account.
 6. In cases, where value of $V_{M2}-V_{M1}$ works out to minus on account of higher utilisation of Schedule 'B' stores (i.e. value of Schedule 'B' Stores under contract as a whole is higher than K_{OM} value) and the reimbursement on account of variation in prices of materials (except cement & steel) works out to be negative in spite of the whole sale price index for all commodities published by Economic Adviser to Government of India going up from W_0 , reimbursement on account of variation in prices of materials shall be treated as "Nil".
 7. The Value/Percentage of K_C , K_S & K_{OM} i.e. cement steel and other materials component, depends on type of construction However, the summation of K_C , K_S & K_{OM} shall not exceed the value of sum of K_M and K_P given in the table hereinafter.
- 45.2. **REIMBURSEMENT/REFUND ON VARIATION IN PRICES-WAGES OF LABOUR (Refer Condition 63 of IAFW-2249):** Increase or decrease in prices consequent on variation in wages of labour shall be adjusted on the basis stipulated hereinafter irrespective of the actual variation in price-wages of labour to the contractor for Phase-I works.

45.2.1. **LABOUR:** The labour component for the work under the contract as a whole shall be taken as K_l of the value of the work executed under the contract. Variation in the labour wages shall be worked out by applying the following formula:

$$EI = \frac{K_l \times V_{g1}}{100} \times \frac{(L_1 - L_0)}{L_0}$$

Where,

E_l = Variation in wages of labour reimbursement to be made to the contractor or refund to be made by the contractor.

K_l = Constant representing the percentage cost of labour element as compared to the total of the work under the contract as a whole. The value of K_l for the work shall be **21 (Twenty One)** Only.

V_{g1} = Gross value of work done at contract rates during the period of reckoning less value of work paid or payable to the contractor based on actual cost (eg. Star Rate(s), work executed under prime cost sum, etc) during the period of reckoning.

L_1 = Minimum wage in rupees of an unskilled adult male mazdoor as fixed under any law, statutory rule or order as on the date of commencement of the period of reckoning.

L_0 = As for L_1 but the minimum wage in rupees of an unskilled adult male mazdoor as on the last due date for submission of Bids. If the labour wage on date of submission of Bids is increased afterwards with retrospective effect, the value of L_0 shall be fixed keeping in view the following aspects:

- (a) If the increase/decrease in wages of labour are made known to the public by any means of media before last due date for submission of Bids but the same is officially notified thereafter giving retrospective effect, the value of L_0 shall be as per notification though made subsequently.
- (b) If a net wage comprises a fixed basic wage and the living allowance revised from time to time based on consumer price index (CPI) and increase CPI is made known to the public by any means before the last due date for submission of Bids, the L_0 will be the revised wages corresponding to the revised CPI, though the formal notification for the net wage (considering the revised living allowance corresponding to revised CPI) is made subsequent to last due date for submission of Bids.
- (c) In case the labour enforcement officer makes the announcement before last due date for submission of Bids but gazette notification is made subsequently making wages applicable with retrospective effect, the value of L_0 shall be as per the Gazette Notification subsequently made.
- (d) If the increase/decrease in wages of labours is notified/announced subsequent to last due date for submission of Bids with retrospective effect without making the same publicly known by means of publicity/media prior to the last due date for submission of Bids, then the value of ' L_0 ' shall be as per wage known at the time of last due date for submission of Bids.

Notes:

- (a) The contractor shall within reasonable time of his becoming aware of any alteration to the payment of wages of labour consequent on fixation of minimum wages under any law, statutory rule or order, give written notice thereof, to the GE stating that the same is given pursuant to this Special Condition together with all information relating thereto which he may be in a position to supply.

- (b) Irrespective of the variation in minimum wages for any category of labour, for the purpose of adjustment under this Special Condition, the variation in minimum wage fixed under any law, statutory rule or order for an unskilled adult male mazdoor, if any, shall only form the basis.
 - (c) Periodicity of working out the variation in wages of labour will be three months commencing from the last due date for submission of bids. The last adjustment for variation in wages of labour shall however, be done for the period up to the date of completion or extended date of completion. Valuation of price adjustment due to increase/decrease in minimum wages under any law, statutory rule or order for the purpose of making reimbursement/refund in RARs will be timed in such a manner that relevant data required for quarterly calculation under this Special Condition is available from the RARs. The first price adjustment in respect of variation in wages of labour will be worked out for the relevant quarter during which alteration to the wages of labour took place. For implementing this provision, the period of reckoning in such quarter will have to be divided into two periods i.e., the first period up to the RAR payable immediately after the date of variation and the other up to the end of the quarter. Value of L_1 at the beginning of the other period shall be the altered wage. If there are more than one change in wages in a quarter there will be more than two periods of reckoning on similar basis. Amount payable relevant to work done for any quarter will be worked out after the minimum wage of an un-skilled adult male Mazdoor as fixed under any law, statutory rule or order for the relevant quarter is available. Once the amount adjustable for any quarter is worked out, the same shall be adjusted in subsequent RARs as 'Advance on Account' adjustment along with adjustment for Material and Fuel.
 - (e) No adjustment in prices shall be made for any work done after the due date of completion or extension of time granted under Condition 11 of IAFW-2249 (whichever is later) for the work under the contract.
 - (f) No adjustment, whatsoever, due to variation in wages of labour on account of coming into force of any fresh law or statutory rule or order as provided in Condition 63 of IAFW-2249 or otherwise than provided in this special condition shall be made.
 - (g) Any dispute arising out of interpretation or application of this special condition shall be referred to the Accepting Officer whose decision shall be final and binding.
 - (h) For the purpose of calculation of Retention Money and Liquidated Damages, GST, deduction of Income Tax at source and recovery of water charges (in case of unmetered supply) the value of contract as revised by the above price variation will be taken in to account.
- 45.3. The provisions of this Special Condition shall supersede the provisions of Condition 63 of IAFW-2249 (MES General Conditions of Contract) and the provisions of Condition 63 ibid shall not be applicable.
46. **NORMS TO BE ADHERED BY THE CONTRACTOR:**
- 46.1. All construction and demolition waste generated from the site shall be disposed off properly and shall not affect the surface/ground water.
 - 46.2. The diesel generator sets to be used during construction phase shall be low sulphur diesel type and shall conform to E (P) Rules prescribed for air and noise emission standards.
 - 46.3. All provisions shall be made for management of disasters as mentioned in the Disaster Management Plan.

- 46.4. Necessary arrangements shall be made with respect to fire hazards/ forest fires as mentioned in the Disaster Management Plan.
- 46.5. Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.
- 46.6. Any hazardous waste generated during construction phase, shall be disposed off as per applicable rules and norms with necessary approvals of the Andaman & Nicobar State Pollution Control Committee.
- 46.7. Ambient noise levels shall conform to specific standards for the designated place both during day and night. Incremental pollution loads on the ambient air and noise quality shall be closely monitored during construction phase. Adequate measures shall be taken to reduce ambient air and noise levels during construction phase, so as to conform to the stipulated standards by CPCB/APCB.
- 46.8. Regular supervision of the above and other measures for monitoring shall be in place all through the construction phase, so as to avoid disturbance to the surroundings.
47. **ARBITRATION.**
- 47.1. Refer condition to General Conditions of Contracts (IAFW-2249).
- 47.2. The condition 70 of IAFW-2249 shall be amended as under:

(a) Arbitration Where Applicability Of Section 12 (5) Of The Arbitration And Conciliation Act Has Been Waived Off:-

All disputes, between the parties to the contract (other than those for which the decision of the CWE or any other person is by the Contract expressed to be final and binding) shall, after written notice by either party to the Contract to the other of them, be referred to the Arbitral Tribunal of a Sole Arbitrator (in case of contract sum less than or equal to Rs.100 Crore) from MoD Panel of Arbitrators. The officers so considered for appointment of Arbitrator, either as sole Arbitrator or for Arbitral Tribunal, shall be having degree in Engineering or equivalent or having passed Final/Direct Final Examination of Sub-Division II of Institution of Surveyor (India) or similar other Institutes recognized by the Government of India.

In case of arbitration by Sole Arbitrator, the Arbitrator shall be appointed by the Authority mentioned in the contract document within a period of thirty days of having received the notice from any of the parties of Contract, out of MoD Panel of Arbitrators. In case of Arbitral Tribunal consisting of panel of three Arbitrators, both the parties will be asked by the Appointing Authority to suggest at least two names out of MoD Panel of Arbitrators within thirty days. The Appointing Authority will appoint two Arbitrator, one Arbitrator each out of the suggested names. The two Arbitrators so appointed will select one Arbitrator from the MoD Panel of Arbitrators who will be the 'Presiding Arbitrator'. The Serving Officer(s) so appointed as Arbitrator(s), either as Sole Arbitrator or as one of the three Arbitrators in the Arbitral Tribunal, can continue as Arbitrator even after retirement, provided both the parties to the contract give written consent to this effect. In such case, however, the Arbitrator shall not be entitled for any fee even after retirement.

(b) Arbitration Where Applicability of Section 12 (5) Of The Arbitration & Conciliation Act Has Not Been Waived Off :

All disputes between the parties to the contract (other than those for which the decision of the CWE or any other person is by the contract expressed to be final and binding) shall, after written notice by either party to the contract to the other of them, referred to the Arbitral Tribunal of a Sole Arbitrator (in case of contract sum less than or equal to Rs. 100 Crore) or to Arbitral Tribunal of three Arbitrators (in case of contract sum exceeding Rs. 100 Crore). The officers so considered for appointment of Arbitrator, either as Sole Arbitrator or for Arbitral Tribunal, shall be having degree in Engineering or Equivalent or having passed Final/Direct Final Examination of Sub-Division II of Institution of Surveyor (India) or similar other institutes recognized by the Government of India.

In case of arbitration by Sole Arbitrator, the Arbitrator shall be appointed by the Authority mentioned in the contract document from the MoD Panel of Arbitrators within a period of thirty days of having received the notice from any of the parties of Contract. In case of Arbitral Tribunal consisting of panel of three Arbitrators, both the parties shall be asked by the Appointing Authority to suggest at least two names out of MoD Panel of Arbitrators within thirty days. The Appointing Authority will appoint two Arbitrators, one Arbitrator each out of the suggested names. The two Arbitrators so appointed shall select one Arbitrator from the MoD Panel of Arbitrators who will be the 'Presiding Arbitrator'.

(c) Common for All Arbitration :

Unless both parties agree in writing, such reference shall not take place until after the completion or alleged completion of the works or termination or determination of the contract under Condition Nos 55, 56 and 57 hereof.

Provided that in the event of abandonment of the works or cancellation of the Contract under Condition No. 52, 53 or 54 hereof, such reference shall not take place until alternative arrangements have been finalised by the Government to get the works completed by or through any other Contractor or Contractors or Agency or Agencies.

Provided always that commencement or continuance of any arbitration proceeding hereunder or otherwise shall not in any manner militate against the Government's right of recovery from the Contractor as provided in Condition 67 hereof.

If the Sole Arbitrator or one or more Arbitrators of the Arbitral Tribunal so appointed resign(s) from his/her appointment or vacate(s) his/her office or in unable or unwilling to act due to any reason whatsoever, the Authority appointing him/her will appoint a substitute Arbitrator to act in his/her place in the manner specified hereinabove. In case the Arbitrator resigning in this manner is the Presiding Arbitrator, the other two Arbitrators of the Arbitral Tribunal shall appoint the substitute Presiding Arbitrator.

The Arbitral Tribunal may proceed with the arbitration, exparte, if either party, inspite of a notice from the arbitrator fails to take part in the proceedings.

The Arbitral Tribunal may from time to time with the consent of the parties, enlarge the time for making and publishing the award subject to the limit laid down in the Arbitration & Conciliation Act 1996 as amended upto the date on which arbitration proceedings commence.

The Arbitral Tribunal shall make the award within the period as provided in the Arbitration & Conciliation Act 1996 (as amended upto the date on which arbitration proceedings commence) from the date of entering on the reference or within the extended period as the case may be on all matters referred to it and shall indicate findings alongwith

sums awarded separately on each individual item of dispute. The Arbitral Tribunal shall give reason for the award in each and every case irrespective of the value of claims or counter claims.

The venue of Arbitration shall be such place or place or places as may be fixed by the Arbitral Tribunal in the sole discretion.

The Award of the Arbitral Tribunal shall be final and binding on both parties to the contract.

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

PARTICULAR SPECIFICATIONS**1. GENERAL:**

- 1.1. The work under this contract shall be carried out in accordance with Schedule "A", Special Conditions, Particular Specifications, Drawings, General Specifications, relevant Indian Standard and codes of practice and other provisions in MES Standard Schedule of Rates, Part-I (2009) (Specifications) and MES Standard Schedule of Rates, Part-II (2020) (Rates) (here-in-after called as MES Schedule Part-I & MES Schedule Part-II respectively) read in conjunction with each other including amendments and errata.
- 1.2. The term "General Specifications" referred to here-in-before as well as referred to in IAFW-2249 (General Conditions of Contracts) shall mean the specifications contained in the MES Schedule Part-I including amendments and errata as applicable thereto.
- 1.3. General rules, specifications, special conditions and preambles/special conditions in the MES Schedule shall be deemed to be applicable to the works under this contract unless mentioned otherwise in these tender documents in which case the provisions in these tender documents shall take precedence over the above said provisions in the MES Schedule.

2. EXCAVATION AND EARTH WORK:

- 2.1. **SITE CLEARANCE AND SURFACE EXCAVATION:** Before setting out the building and commencing the construction, Preparatory work such as removal of grass, vegetation, jungle clearance etc, surface excavation to a depth not exceeding 30 cm and averaging 15 cm, in any type of soil for the entire area occupied by the building and structure including plinth protection ramps, steps etc. shall be carried out by the contractor.
- 2.2. **PREPARATORY WORK:** The existing ground levels shall be recorded jointly at an interval not more than 3.0 metres grid on graph sheet. Level sheet shall be prepared clearly indicating proposed building work, external services such as roads, culverts, sewage disposal, area drainage and information such as proposed plinth level of building, invert level of man holes, drains, culverts etc required for proper execution of the work as per Engineering norms, within 15 days from the date of commencement of work (prior to execution of work) duly signed by GE and contractor. Level sheet shall be kept in record by GE in duplicate before execution of work. One copy of the level sheet approved by the GE shall be forwarded to the Accepting Officer, prior to execution of the work for record purpose.
- 2.3. **SURFACE DRESSING:** Surface dressing around the entire buildings and structure to a width of 3 Metres beyond the external edge of plinth protection/steps/ramp or external wall as applicable shall be carried out by the contractor as per clause 3.6 and 3.10 of MES Schedule Part-I (2009). Area around outer edge of building/structure shall be dressed to slope away from the buildings as directed by Engineer-in-Charge.
- 2.4. Unit rates for Schedule 'A' Part-I shall be arrived based on excavation and earth work in any type of soil i.e. soft/loose/hard/dense soil. Change of classification of strata will be ordered as deviation by GE. In case of deviation, rate for any type of soil shall be the average of rates for soft/loose and hard/dense soil available in MES Schedule subject to percentage, derived from the quoted amount of Schedule 'A' Part-I for valuation of deviations.
- 2.5. Any depth in excess of required depth in excavation shall be made good by the contractor at his own cost with the concrete of same proportion of foundation base concrete.
- 2.6. **DEWATERING:** No extra payment over the lump sum amount quoted shall be admissible for dewatering, if water is met with or accumulated in the foundations or any other

excavations due to any cause whatsoever and for excavation in mud. Bailing and pumping of water, if required, shall be done as described in para 3.17 of MES Schedule Part-I.

- 2.7. **DISPOSAL OF SOIL:** Surplus soil/useless soil obtained from excavation in foundation of buildings and soil obtained from surface dressing shall be removed to outside MOD land without any extra cost to Department.
- 2.8. **HARD CORE:** The material for hard core shall be broken granite stone of size not exceeding 63 mm from the quarries approved by the GE. The hard core shall be watered and well rammed. It shall be provided all as per specification laid down in Para 3.27 of MES Schedule Part-I (2009). Hard core shall be provided at location and to the thickness as indicated on drawings. Thickness of hard core shown on drawings shall be the consolidated thickness.
- 2.9. **FILLING UNDER FLOORS:**
- 2.9.1. Approved soil obtained from excavation (Other than those obtained from surface excavation and surface dressing) shall be used for filling in foundation up to ground level of developed area and under floor. No charges shall be levied for the use of soil obtained from excavation for filling. Nothing extra is payable on this account. Filling shall be spread, leveled, watered and well rammed in layers not exceeding 25 cm thick.
- 2.9.2. Any additional earth required for purpose of filling shall be arranged by the Contractor from outside MD land at no extra cost to the Department. Expansive or other unsuitable soil obtained from excavation shall not be used in filling. The decision of Engineer-in-Charge as to whether the soil obtained from excavation is suitable or not for filling, either partly or fully, shall be final and binding. If the quantity of suitable soil obtained from excavation falls short of the filling required, the contractor shall bring the requisite quantity of approved earth, without any extra cost to the Government.
- 2.10. **MOORUM:** Moorum shall be all as per clause No.3.21.1 of SSR Part-I. Moorum shall be obtained from approved pits and quarries of distengranted rocks containing silicious material and natural mixture of clay of calcareous origin. These shall not contain any admixtures of ordinary earth. Size of moorum shall vary from dust to 40mm gauge. Anything over in size shall be rejected or shall be broken down to bring within 40smm size. It shall conform to or be superior to the samples kept in Garrison Engineer office. No price adjustment shall be made on this account. Sources of good quality moorum shall be approved by GE. The moorum shall be ehaving MDD 2 gm/cc, LL less than 35% and Plasticity Index less than 15%. After site clearance the levels of filling shall be marked by fixing pegs on both sides at regular intervals as a guide before commencement of earthwork. The filling materials shall be spread in layers of uniform thickness not exceeding 15cm (spread thickness) over entire width or as mentioned in BOQ. Successive layers shall not be placed until the layer under construction has been thoroughly compacted.
- 2.11. **PRE-CONSTRUCTION ANTITERMITE CHEMICAL TREATMENT:**
- 2.11.1. The work of anti-termite treatment (pre-construction except mound treatment) shall be carried out all as specified in Para 3.26 of MES Schedule Part I, to all the buildings/structures covered under the scope of the subject contract agreement except Septic tanks, Soakage Wells, Overhead tanks, underground sumps etc. It shall be got executed through a specialist firm or agency who is a member of Indian pest Control Association holding valid license as per clause 13 of insecticides Act 1968 and persons employed to do the work of anti-termite treatment shall be qualified as per Rule 10 of Insecticides Rules 1971.

- 2.11.2. Anti termite treatment shall be carried out with emulsion of chemical Chloropyrifos 20 % EC (IS-8944: 1978), as per IS 6313 Parts I & II of 2001. Concentration by weight percent of chemicals shall be as indicated by the manufacturer and shall be used for different stages of treatment as stipulated in relevant IS.
- 2.11.3. The main contractor shall be responsible to furnish guarantee for at-least 10 years for the effectiveness of pre-construction anti-termite treatment carried out by specialist firm and for periodical checkup of the treatment carried out by the firm at suitable intervals as mutually agreed upon by the GE and contractor. If on such periodical inspection any termite activities are noticed the same shall be got rectified by the contractor at no extra cost to Govt.
- 2.11.4. Chemical used for anti-termite treatment shall be treated as proprietary item and the quantity procured shall be recorded in measurement book duly signed by Engineer-in-Charge and the contractor indicating the brand, name of Chemical, batch number, date of manufacturing, date of expiry etc.,
- 2.11.5. Should the GE at any time during the construction or prior to the expiration of Guarantee period, finds that any Building/Structure showing any sign of infestation with termites of any type, the contractor shall, on demand in writing from the GE specifying the location complained of, notwithstanding that the same may have been inadvertently passed/certified and paid for, undertake to carry out such treatment at his own expense as may be necessary forthwith to render the building (s) free from termite infestation to the full satisfaction of GE. In the event of his failure to do so, within the period as specified by the GE in his aforesaid demand, the GE may undertake such treatment as may be necessary through other agency at the risk and cost of the contractor in all respects. The liability of the contractor under this condition shall not extend beyond the period of 10 Years from the certified date of completion, unless the GE had previously given notice to the contractor to rectify the defects. Condition-46 of General Conditions of Contracts (IAFW-2249) shall be deemed to be amended to the extent mentioned above.
- 2.11.6. The contractor shall provide a plaster plate of requisite size but not less than 45 cm x 30 cm in situation as decided by the Engineer-in-Charge on the wall of each of the building. The plate shall be 10mm thick in cement mortar (1:4) to indicate the C. A. No., Name of the contractor, name of agency who executed the work, the date of completion of the work and the date of expiry of 10 years guarantee for anti-termite treatment by engraving and painting (black). The cost of plaster plates is deemed to be included in the Lump sum quoted for the buildings.
- 2.11.7. The security deposit referred to in Condition 22 of General Conditions of Contracts (IAFW-2249) is independent of the guarantee amount referred under this Condition. Condition 10, 46 and 68 of General Conditions of Contracts (IAFW-2249) shall be deemed to be amended to the extent mentioned above.
- 2.11.8. The security deposit referred to be held from the contractor against the guarantee period for anti-termite treatment shall be calculated as per the scale laid down below enhanced by 25 % or equal to 10 % of the cost of anti-termite treatment at contract rates. This amount shall be refunded to him after the expiry of the guarantee period. Alternatively, the Contractor may give a separate interest bearing security deposit to GE valid for 10 Years for this amount.

Cost of Anti-termite Treatment at Contract Rate	Security Deposit
Up to Rs.50 Lakhs	2% of the amount subject to a minimum of Rs.5,000/-
Over Rs.50 Lakhs and up to Rs.100 lakhs	Rs.1,00,000 + 1.5 % amount exceeding Rs.50 Lakh
Over Rs.100 Lakhs and up to Rs.500 lakhs	Rs.1,75,000 + 1 % amount exceeding Rs.100 Lakhs

2.12. NON WOVEN GEO TEXTILE LAYER :

2.12.1. The requirements of non-woven geotextile are given in table below:

NON-WOVEN GEOTEXTILE PROPERTIES

Sl. No.	Property	Minimum Average Roll Value
1.	Material	Polypropylene/ polyamide/ polyethylene/ polyester or combination thereof
2.	Structure	Non-woven needle punched and mechanically or thermally bonded or equivalent.
3.	Thickness	2.5 mm
4.	Mass per unit area	285 g/sqm
5.	Tensile Strength (Average of MD,CD)	≥20 kN/m
6.	Elongation at break as per ASTM D 4632 and IS 13162 Part 5	50-75 %
7.	MINIMUM STRENGTH PROPERTY (MARV – Min average roll value in weaker principal direction under moderate installation conditions)	
(a)	Grab Strength as per ASTM D 4632/ IS 13162 Part 5 (elongation at failure > 50 %)	1200 N
(b)	Tear Strength as per ASTM D 4533/ IS 14293 (elongation at failure > 50 %)	250 N
(c)	Puncture Strength as per ASTM D 6261 (elongation at failure > 50 %)	3000 N
(d)	Burst Strength as per ASTM D 3786/ IS 1966 (elongation at failure > 50 %)	1300 N
8.	ULTRA VIOLET SENSITIVITY: Grab, tear, puncture and burst strengths should be retained by more than 70 % after 500 hours of exposure.	
9.	HYDRAULIC REQUIREMENTS	
(a)	Max Apparent Opening Size as per ASTM D 4751/ IS14294	180 micron
(b)	Permittivity as per ASTM D 4491/ IS 14324	>1.5/second
(c)	Flow Rate	95 l /sec/sqm

2.12.2. **INSTALLATION OF NON-WOVEN GEOTEXTILE:**

2.12.2.1. **SHIPMENT AND STORAGE:** The geotextile shall be kept dry and wrapped such that it is protected from the exposure to ultraviolet light during shipping and storage. At no time shall the paving fabric be exposed to ultraviolet light for a period exceeding fourteen days. Geotextile rolls shall be stored in a manner, which protects them from elements. If stored outdoor, they shall be elevated and protected with a waterproof cover. The geotextile shall be labelled as per ASTM D 4873, "Guide for identification, storage and handling of geotextiles".

2.12.2.2. **FABRIC PLACEMENT:** The geotextile shall be laid smooth without wrinkles or folds on the sand blanket in the direction of construction traffic. Adjacent geotextile rolls shall be overlapped, sewn or jointed, (Preferably sewn or joined). On curves the geotextile may be folded or cut & overlap to conform to the curves. The fold or overlap shall be in the direction of construction and held in place by pins, staples, or piles of fill or rock. Prior to covering, the geotextile shall be inspected by the Engineer to ensure that the geotextile has not been damaged (i.e. holes, tears, rips) during installation. Damaged geotextiles, as identified by the Engineer, shall not be allowed. The surcharge shall be placed such that at least the minimum specified lift thickness shall be between the geotextile and the equipment tyres or tracks at all times. Turning of vehicles shall not be permitted on the first lift above the geotextile.

2.12.2.3. **SEAMING:** A sewn seam is to be used for the seaming of the geotextile. The thread used shall consist of high strength polypropylene or polyester. Nylon thread shall not be used. The thread shall also be resistant to ultraviolet radiation. The thread shall be of contrasting colour to that of the geotextile itself, For seams, which are sewn in the field, the Contractor shall provide at least a 2 m length sewn seam for sampling by the GE before the geo-textile is installed. For seams which are sewn in the factory, the GE shall obtain samples of the factory seams at random from any roll of geotextile which is used on the project. For seams that are field sewn, the seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, samples of seams from both directions shall be provided. The seam assembly description shall be submitted by the Contractor along with the sample of the seam. The description shall include the seam type, stitch type, sewing thread and stitch density.

3. **CONCRETE:**

3.1. Contractor shall submit quality assurance plan for concrete works to the GE within one month of the acceptance of the tender for approval of GE. The GE shall approve the same in writing. GE and contractor shall ensure that every person involved in the concrete work shall establish and implement a quality Assurance plan. The responsibility and tasks of all persons involved in the work shall be defined. The following documents shall be maintained:

- (a) Test reports and manufacturer's certificate for material.
- (b) Concrete mix design details.
- (c) Pour card for site organization indicating, location of concrete, type of concrete, water cement ratio, proportion of concrete, ingredient for day adopted, surface moisture content of aggregate, weather, temperature of concrete, cement consumed and test specimen detail etc.
- (d) Non conformance report, change orders.
- (e) Statistical analysis.

3.2. **COARSE AGGREGATE:**

3.2.1. Coarse aggregate for all cement concrete works shall be graded crushed granite stone all as specified and shall conform to the grading given in clause 4.4.7 (I) of MES Schedule Part-I. Nominal sizes of graded stone aggregate in various situations shall be as indicated hereinafter.

3.2.2. Size and grading of aggregate for reinforced concrete shall be as specified in IS-456: 2000 but in no case more than 20 mm graded aggregate.

3.3. **FINE AGGREGATE:**

- 3.3.1. Fine aggregate shall be **Natural River sand**. Fine aggregate for concrete shall generally conform to the requirements of clause 4.4.7 (2) of MES Schedule Part-I and conforming to zone II grading of IS 383 except for finer finishes.
- 3.3.2. The sand shall be stored at site in dumps. The contractor shall take necessary precaution to avoid contamination or risk of shoveling of earth or other impurities by keeping sand over firm level ground as stipulated in IS-4082.
- 3.3.3. The sand shall be stored at site in dumps. The contractor shall take necessary precaution to avoid contamination or risk of shoveling of earth or other impurities by keeping sand over firm level ground as stipulated in IS-4082.

3.4. **CEMENT:**

- 3.4.1. **GENERAL:** Cement required for the work under the contract shall be procured, supplied and incorporated in the works by the contractor under his own arrangement. Cement shall be of tested quality and shall comply with the requirements mentioned in the drawings, MES Schedule, IS specifications as amended and particular specifications given hereinafter.
- 3.4.2. The type of cement to be used in different components situations in respect of the subject work shall be as under:

Sl. No.	Description	Type of cement
(a)	RCC Work & Pile Foundation including Pile Caps	43 Grade Ordinary Portland Cement confirming to IS 269 2015
(b)	Masonry, Plastering, Flooring	PPC Conforming to IS 1489: 2015 or PSC Conforming to IS 455 :2015

- 3.4.3. Portland Pozzolona Cement (PPC) as per IS-1489 will be allowed as stipulated subject to the following:

- (a) GE is required to ensure that PPC meets the strength criteria of 43 Grade OPC as laid down in IS- 269-2015.
- (b) While procuring PPC the following requirements are to be ensured and certificate to that effect shall be obtained for each batch from the manufacturers:
- (i) The quality of fly ash is strictly as per IS-1489 (Part-I).
 - (ii) Fly ash is inter-ground with clinker not mixed with clinker.
 - (iii) Dry fly ash is transported in closed containers and stored in silos.
 - (iv) Only pneumatic pumping has been used.
 - (v) The fly ash received from thermal power plants using high temperature combustion above 1000°C has been used.

- 3.4.4. **STRIPPING TIME:** Refer provision given in clause 4.11.6.3 OF MES Schedule Part-I and clause 11.3 of IS-456. However for PPC, the stripping time shall be as under:

- (a) For members/items under sub-paras (a) & (b) of clause 11.3.1 of IS-456: Period specified for the members/items by using OPC under sub-paras (a) & (b) of clause 11.3.1 of IS-456 + 01 day.

- (b) For members/items under sub-paras (c) to (e) of clause 11.3.1 of IS-456: Period specified for the members/items by using OPC under sub para (c) to (e) of clause 11.3.1 of IS-456 + 07 days.
- 3.4.5. **SOURCE OF PROCUREMENT:** Cement shall be procured by the contractor under his own arrangement and at his own cost from any of the producers of cement mentioned here-in-after. However, for repairs, maintenance and works where the entire requirement is less than 1200 bags, same can be procured from authorized dealers of the main producers. In addition, Cement may also be procured even from the manufacturers approved by E-in-C's Branch after date of receipt of tenders. The particulars of manufacturer of cement alongwith the date of manufacture shall be submitted by the contractor separately for every consignment of cement procured. Each consignment of cement procured by the contractor shall be recorded in the measurement book as "Not to be abstracted" and shall be supported with authentic original purchase vouchers highlighting the makes, batch Nos., quantity etc.
- 3.4.6. **IDENTIFICATION:** Marking of each cement bag shall be as per relevant IS code.
- 3.4.7. **SCHEDULE OF SUPPLY:** Schedule of supply of cement shall be finalised by Contractor with the GE and shall be incorporated in CPM chart so that supply of cement is monitored in a way to avoid any delay in completion of the work. The complete requirement of cement will be worked out before making any RAR payment. Procurement of cement by the Contractor shall be completed sufficiently in advance of the date of completion. No extension of time will be considered for non-availability of cement. Cement godown shall be provided with two locks on door. The key of one lock of door shall remain with the Engineer-in-Charge or his representative and that of other lock with the Contractor or his authorised agent at site of work.
- 3.4.8. **TESTING OF CEMENT:** The contractor shall submit the manufacturer's test certificate in Original along with the test sheet giving the result of each physical test as applicable and the chemical composition of the cement or authenticated copy thereof, duly signed by the manufacturer with each consignment. The Engineer-in-charge shall record these details in the Cement Acceptance Register as given at Appendix after due verification. The GE shall also organize independent testing at random samples of every 250 MT of cement (If batch changes within 250 MT then testing of each batch has to be carried out) from the labs as from the labs as stipulated. In case cement test result does not fall with-in the acceptable limits, respective consignment of cement shall be rejected and shall be rejected and shall be removed by the contractor within 24 hours from the site. The cost of tests shall be borne by the contractor irrespective of status of the results and no claim shall be/to be entertained on this account. The provision of relevant clause of IAFW-2249 and Para 1.7.3 of MES Schedule Part-I shall be deemed to be amended accordingly. Sample of cement from each consignment should be collected by the Engineer-In-Charge and GE in accordance with IS: 3535-1986.
- 3.4.9. **STORAGE OF CEMENT:** The cement shall be stored in such a manner as to prevent deterioration due to moisture or intrusion of foreign matters. In case of store rooms, the stack should be at least 20 cm away from floors and walls. The stacking of cement shall not be more than 10 bags high. Inspection shall be carried out once a day by rep of GE associated with the work and rep of contractor. It shall be ensured that tested and untested Cement shall be segregated and stored separately with distinct identification. **Not more than three months requirement should be procured and held in stock to avoid its deterioration.**

3.4.10. **DOCUMENTATION:** The Contractor shall submit original Vouchers and original manufacturer's test certificates from the manufacturer for the total quantity of Cement supplied under each consignment to be incorporated in the work. The Original Vouchers and the Test Certificate shall be defaced by the Engineer-in-Charge showing CA No., Year and dated signature and kept on record in the office of GE duly authenticated and with cross-reference to the Control number recorded in the Cement acceptance register. The cement acceptance register will be signed by JE (Civil), Engineer-in-Charge, GE and the Contractor or his rep. The entire quantity of all type of cement shall be suitably recorded in the measurement Book (Not to be abstracted) for record purposes before incorporation in the work and shall be signed by the Engineer-in-Charge and the Contractor.

3.4.11. **RECORD OF CONSUMPTION OF CEMENT:**

- (a) For the purpose of keeping a record of cement used, the contractor shall maintain a properly bound register serially numbered (all pages initialed against the numbering by the Engineer-In-charge) in the form approved by the Engineer-In-Charge showing daily quantity used in the work and balance in hand at the end of each day. The register shall be maintained with daily entries duly authenticated by the contractor or his authorised representative and the Engineer-in-Charge. Separate register shall be maintained for OPC & PPC indicating locations where the cement was used.
- (b) The register shall be kept at site in the safe custody of the contractor's rep and Engineer-In-Charge during the progress of the work and shall on demand be produced for verification to the inspecting officer.
- (c) On completion of the work, the contractor shall deposit the cement register with the Engineer-In-Charge for record.

3.5. **CEMENT CONCRETE:**

3.5.1. **TYPE OF CONCRETE:** Type of concrete with nominal size of coarse aggregate required for works in various situations unless otherwise specifically mentioned elsewhere or shown on drawings or notes thereon and structural notes, etc shall be as under:

(a)	PCC in Foundation & PCC in Foundation of Dwarf Wall	PCC 1:4:8 Type D2 (using 40mm graded stone aggregate)
(b)	Concrete Pre-Cast Blocks, Padding and Coping.	PCC 1:3:6 Type C1 (using 20mm Graded stone aggregate)
(c)	PCC in all Other Situations	PCC 1:2:4 Type B1 (using 20mm graded stone aggregate)
(d)	All RCC Works	M-30 Design Mix for all RCC works Ready mix concrete will only allowed

3.5.2. **BATCHING, MIXING, DEPOSITING AND RAMMING:**

- (a) Controlled concrete materials shall be batched by weight only. Combined batching with digital weighing system and mixing plant with auto cut off and computer printout facility shall be used for concreting. The capacity of batching plants provided at site shall be adequate enough to execute the work as per the CPM. The plant shall have the digital system of adding specified quantity of water into concrete mix as per the

- design mix requirement.
- (b) Water shall be measured either by volume in calibrated tanks or weighed. All measuring equipments shall be kept in a clean serviceable condition and their accuracy checked periodically.
 - (c) Provisions as in clause 4.11.3.2 to 4.11.3.5 of MES Schedule Part-I shall be followed. All batching of concrete and accuracy of batching shall be as per Clause 10.2 of IS-456.
 - (d) The mixing shall be done for at least 2 minutes and until a uniform colour and consistency is achieved.
 - (e) Quantity of concrete mixed in any one batch shall not exceed the rated capacity of the mixer. The whole of the mixed batch shall be removed before materials for fresh batch enter the drum. Concrete mix as approved shall not be modified by addition of water or otherwise in order to facilitate handling or any other purpose. On ceasing of work and on stoppages exceeding 20 minutes, the mixer and other plants used for handling wet mix shall be thoroughly washed with clean water. Pickup and throw over blades in the drum of the mixer which are worn down 20mm or more in depth shall be replaced with new blades.
 - (e) All cement concrete, both plain and reinforced shall be mixed in mechanical mixer as specified in para 4.11.5 and 4.11.5.1 of MES Schedule Part-I. However for small quantity of concreting (other than RCC works) i.e., the quantity of concrete required being less than one batch of mix, the contractor may after obtaining written approval of Engineer in charge which shall be exceptional, adopt hand mix subject to addition of 10% extra cement without price adjustment. Where hand mixing permitted, it shall be carried out on a concrete platform and care shall be taken to ensure that mixing is continued until the concrete is uniform in colour and consistency.
 - (f) All cement concrete both plain and reinforced concrete, shall be deposited and compacted all as specified in Clause 4.11.10 and 4.11.11 of MES Schedule Part-I. However, RCC work in columns, foundation, beams, walls, chajjas and slabs etc., shall be compacted using mechanical vibrator, compaction of lean concrete shall be carried out by ramming and consolidated by tamping and rodding as specified. In the event of breakdown of mechanical mixer and vibrator, the contractor must have arrangements for standby mechanical mixer and vibrator.

3.5.3. **DESIGN MIX CONCRETE (CONTROLLED CONCRETE):**

- (a) Grade of design mix concrete shall be as specified here-in-before and shall be as referred to in IS-456 and as specified hereinafter. Design mix concrete may also be referred to as controlled concrete. Mix design shall be done as per IS-10262 (Recommended Guidelines for Design Mix Concrete) and as described in SP-23 (An IS Publication).
- (b) The requirement of cement per cubic meter of controlled concrete of Grade **M-30** shall be as per IS-456. The actual requirement of cement for the controlled concrete shall be ascertained by the tests as specified hereinafter. The design mix shall be carried out for SEVERE environment conditions with good quality control. The tenderer shall ascertain the quantity of cement required and quote the lump sum accordingly. No claim whatsoever arising on account of quantity of actual cement incorporated in the work on account of design mix is admissible.

Notes:

1. Contractor shall use liquid admixtures (Super plasticizers) to achieve the work-ability and to reduce the water content in design mix. Admixtures shall confirm to IS 9103: 1999 shall be from approved manufacturers as stipulated

- in the list of makes.
2. Para 5.5 of IS 456: 2000 be also referred for quality of admixtures.
 3. For maximum dose of admixtures, please refer Para 10.3.3 of IS-456.
 4. Various tests as specified in IS-9103 shall be carried out for each batch of Admixtures at contractor's cost.
 5. Contractor shall submit original purchase voucher and test certificate of manufacturer for complete quantity of admixtures used in the work before claiming payment for the same.
 6. Complete quantity of admixtures including name of manufacturer, its brand name, date of manufacturing, date of expiry, voucher No. and details of test certificates shall be entered in MB as "Not to be Abstracted" duly signed by JE, Engineer-in-Charge, GE and representative of contractor before making payment in RAR.
- (c) As soon as possible after receiving the work order to commence the work, the contractor shall submit samples of the materials required for preparing design mix concrete viz. cement, coarse aggregate, fine aggregate and admixtures for approval of GE and intimate the place out of the following where they propose to carry out the design mix and preliminary tests RCC M-30 grade concrete:
- (i) IIT Chennai, Hyderabad, Mumbai, Bhubaneswar, Kharagpur
 - (ii) NIT Trichy, Calicut, Warangal, Suratkal
- (d) After the samples of all the materials are approved by GE in writing sufficient quantities of these materials shall be forwarded by GE at contractor's expense for carrying out design mixes.

3.5.4. **PRELIMINARY TESTS:**

- (a) Preliminary tests are tests conducted on the trial mixes of concrete produced in the laboratory with the object of:
- (i) Designing concrete mixes before the actual concreting operation starts.
 - (ii) Determining the adjustments required in the design, when there is change in the materials used during execution of work.
 - (iii) Verifying the strength of concrete mix at 28 days
- (b) The preliminary tests shall consist of 3 separate sets of tests covering possible variation of gradation of aggregates and each set of test using a minimum 9 Cubes of size 150mm x 150mm x150mm and one slump test. Three cubes shall be tested at 7 days to get indication of minimum strength. Other three Cubes shall be tested at 28 days and remaining three Cubes shall be preserved for Department use for subsequent testing. The compressive strength tests of cubes shall be performed as per IS-516. Casting of cubes and testing of these cubes shall be carried out in the presence of contractor's representative, and GE/GE's representative. It will be contractor's responsibility to ensure that design mix is carried out at the earliest. Contractor shall ensure that design mix calculations, supporting trial mix (03 Nos.) details and test results of trial mixes along with recommended trial mix are submitted to GE at the earliest for his further action. Based on test results, the GE shall

approve the design mix in writing. Copy of approved design mix shall be submitted to Accepting Officer within 10 days of approval by GE. The cost of materials, labour transport and the testing charges for the design mix and the tests conducted shall be borne by the contractor.

3.5.5. WORK TESTS:

- (a) The work tests shall be carried out at Site Lab/ Command Testing Lab situated in the premises of Chief Engineer (Navy), Visakhapatnam Zone.
- (b) Work test shall be conducted as per Clause 15 of IS-456. At the commencement of the concreting, samples of concrete shall be taken on each day as specified in Clause 15 of IS-456 and specimens made at the work site out of the concrete being used in the works, for the purpose of testing compressive strength.
- (c) From each of these samples, 9 Test Cubes of size 150 x150 x 150mm shall be taken to test 3 Specimens at 7 days and 3 Specimens at 28 days. C. A. No., date of casting and location where concrete is being used shall be marked on each concrete cube. 3 Test Cubes of preliminary test and work test each shall be preserved duly marking the date of casting and C.A. No. for verification/subsequent testing, if required. These cubes shall be preserved by the GE/Engineer-in-Charge until the defects liability period of the work is over.
- (d) The testing charges for the work tests conducted in the Command Testing Lab shall be at the rate mentioned hereinafter in Particular specifications and the same shall be effected from the payments due to the contractor in RAR/Final bill whichever is earlier. The cost of materials, labour, transport, and testing shall be borne by the contractor.
- (e) The contractor shall carry out cube testing in site lab, in presence of Engineer-in-Charge, however, random testing up to 5 percent of total tests to check the compressive strength of cube shall be carried out in Command Testing Lab for which testing charges shall be recovered from the contractor at the rate mentioned hereinafter.
- (f) The Engineer-in-Charge shall maintain the record for all the tests carried out in Site Lab and Command Testing Lab separately.

3.5.6. MIXING:

- (a) The mix design and also execution of work shall be carried out by weigh batching. The quantum of cement for execution of work by weigh batching shall be as per mix design.
- (b) It shall be ensured that the grading characteristics as adopted in the mix design are followed throughout. Wherever the type and/or batch of cement/ aggregate is changed, a fresh mix design shall be carried out. Nothing extra is payable on this account.
- (c) The contractor during the progress of work shall not change the mix design without the prior approval of the GE.
- (d) Engineer-in-Charge shall maintain a record of actual consumption of cement in proper register (other than the cement register mentioned in special conditions) and initial the entry for every day of quantity of materials used by the contractor. The register shall be got checked and signed by GE. In case the consumption of cement as per cement consumption register is found to be more than the estimated quantity of cement due to whatsoever reason, the contractor shall not have any claim,

whatsoever for such excess consumption of cement.

3.5.7. **WATER CEMENT RATIO:**

- (a) It is most important to maintain the water cement ratio constant to its correct value. To this effect determination of moisture content in both fine and coarse aggregate should be made as frequently as possible. The frequency for a given job shall be determined by the Engineer-in-Charge. According to weather conditions, the amount of water to be added shall be adjusted to compensate for any variations in moisture content of the aggregates. In this regard, **IS-2386 (Part III): Method of test for aggregate for concrete Part III** Specific gravity, density, voids, absorption and bulking of aggregates due to variation in their moisture contents shall apply. The maximum quantity of water to be added shall be determined by mix design as specified hereinbefore.
- (b) Workability of concrete shall be checked at frequent intervals. The slump test or the compacting factor test in accordance with IS-1199 may be adopted for this purpose.
- (c) The slump shall be for medium degree workability as given in Clause 7 of IS-456.
- (d) Curing shall be carried out all as specified in MES Schedule Part-I.

3.5.8. **ACCEPTANCE CRITERIA:** As per Clause 16 of IS-456.

3.6. **READY MIXED CONCRETE (RMC):**

3.6.1. RMC shall conform to the requirements of the following Indian Standards:

- (a) IS-4926 - Ready Mixed Concrete-Code of Practice
- (b) IS-9103 - Concrete Admixtures-Specifications
- (c) IS-269 - OPC Grade 43 or Portland-Specifications or
- (d) IS-456 - Plain and Reinforced concrete-Code of Practice

3.6.2. The contractor shall engage any of the following manufacturers for manufacture and supply of RMC. It is the responsibility of the contractor to make payments to the RMC supplier independently and the department is not responsible for any disputes between contractor and RMC manufacturer for non-payment or delayed payment or on account of any other reasons. The contractor may alternatively establish Ready Mixed Concrete (RMC) plant of required capacity at site without any extra cost to Government.

- (i) M/s RMC Ready Mix India Pvt. Ltd. [Prism Johnson LTd]
- (ii) Associated cement Co Ltd
- (iii) Ultratech
- (iv) M/s Vipasana Concrete, Visakhapatnam
- (v) M/s Sarvani RMC, Visakhapatnam
- (vi) M/s Nuvoco RMC Concrete
- (vii) M/s JK Concrete, Visakhapatnam
- (viii) ICON Ready mix concrete
- (ix) Coastal concrete
- (x) SVK Ready mix Industry concrete
- (xi) Anjani Ready mix concrete, Rambilli

3.6.3. **SELECTION OF RMC MANUFACTURER:** Immediately on commencement of the work, the contractor shall intimate the name of manufacturer of RMC whom he proposes to engage.

3.6.4. Even though the firm for manufacturing and supply of RMC is approved, the responsibility to maintain quality and grade of concrete fully rests with the contractor.

3.6.5. **MATERIALS:**

- (a) CEMENT: Cement shall conform to specifications as specified here-in- before.
- (b) FINE AGGREGATES: Fine aggregates shall be as specified here-in-before.
- (c) COARSE AGGREGATE: The coarse aggregates shall be as specified here-in-before.
- (d) WATER: Water shall comply with the requirements as per IS-456 and IS-3025.
- (e) **ADMIXTURES (LIQUID TYPE ONLY):** Admixture shall be retarding super plasticizing type and shall conform to IS-9103 and of approved manufacturers as given here-in-after in list of makes

Note: Admixture shall not exceed 1.5% of cement contents by volume in any case.

3.6.6. Mix design shall be got carried out by the contractor from the approved RMC manufacturer incorporating materials complying with the requirements given hereinbefore. The mix design shall be properly bound in booklet form and submitted in triplicate for approval by the Garrison Engineer. The RMC incorporated in the work shall be in accordance with the approved mix design. The CWE/GE/Engineer-in-Charge/JE (Civil) who are connected with administration and execution and other operations connected with the execution of this work shall have access to inspect /check the quality of materials used for manufacturer of RMC in RMC manufacturer's yard as well as the quality/grade of RMC supplied by the manufacturer. The contractor shall make all arrangements for the aforesaid inspections and checks as required.

3.6.7. Contractor shall obtain a certificate from RMC manufacturer for the RMC supplied for each day to the effect that materials used for manufacturing of RMC complies strictly as per mix design requirements and the materials incorporated are conforming to the specifications given herein before. In addition, the contractor shall collect samples of materials for each days concreting in the presence of Engineer-in-Charge which shall be tested in approved lab as specified herein before to ensure that materials used are as per requirement as specified. Such tests for each material shall be made as per relevant BIS requirements and shall be entered in register of test results. Register shall be signed by the contractor, GE, Engineer-in-Charge & JE.

3.6.8. A register shall be maintained by the contractor duly signed by the Engineer-in-Charge showing the following details of RMC in addition to the information given on delivery ticket for each delivery of concrete (Refer Clause 9.4 and ANNEX-G of IS-4926):

- (a) Time of mixing of each batch.
- (b) No. of batches in each delivery.
- (c) Location where used in the work and reference to cube test register.

3.6.9. For the RMC delivered at site and incorporated in work, sample for cube test shall be taken as per requirements of IS-4926 and as specified hereinafter.

3.6.10. If the condition of RMC delivered at site is not acceptable to the Engineer-in-Charge, it shall be removed from site by the contractor at his own cost. The decision of the GE with regard to non-acceptability of RMC shall be final and binding. No claim of contractor, what so

ever, shall be admissible on this account. Some of the conditions under which RMC can be rejected are given below:

- (a) Initial setting due to delay in transit.
- (b) Segregation of aggregate due to excessive rotation of mixer during transit.

3.6.11. **ACCEPTANCE OF CONCRETE:** Acceptance criteria for the RMC shall be as per IS-456. In case the RMC supplied and incorporated fails to meet the strength requirements as per IS-456, work done shall be rejected by GE and contractor shall demolish the rejected work and re-do the same with-out extra payments so as to produce the work complying with the strength requirements as per IS-456. The contractor will have no claim whatsoever on this account.

3.6.12. **DESIGN, MANUFACTURE, TRANSPORTATION, PLACEMENT & TESTING:**

- (a) The design mix shall be carried out as per the durability condition stipulated in the contract. Concrete mix information shall be supplied by the Contractor to the RMC manufacturer on the format as per Annexure D of IS-4926, which shall form the basis of mix design.
- (b) RMC supplier will ensure that the concrete is transported in truck/transit mixers conforming to IS-5892 to the point of placing as rapidly as possible by methods that will maintain the required workability and will prevent segregation, loss of any constituents or ingress of foreign matter or water.
- (c) RMC shall be used in the work only after design mix has been approved by GE in writing.
- (d) Contractor should plan their work in such a way so as to full load of concrete is discharged within 30 minutes of arrival at site and placed immediately. Re-handling should be avoided as far as practicable.
- (e) The concrete shall be discharged from the truck mixer within 2 hours of the time of loading at the plant.
- (f) Conveying equipments for concrete shall be water tight, well maintained and thoroughly cleaned before commencement of concrete mixing.
- (g) Concrete shall not be dropped from a height, thrown or otherwise treated so that segregation, undesirable finish, or defective structural quality results.
- (h) No extra water shall be added to the concrete mix after it has left the batching plant. The contractor shall take adequate precautions to protect concrete in transit from the effects of the weather.
- (j) Pumping operation whenever commences shall proceed continuously so as to prevent "Cold" joints between placed sections. Concrete less than 6 cubic metres may be deposited manually. Concrete for columns may be deposited manually.
- (k) The delivery line of the pump shall be 100 mm dia or greater and pump shall be capable of pumping concrete containing 20 mm nominal size aggregate.
- (l) The pump shall have receiving hopper and pumping chamber shall be capable of pumping at least 15 Cum of concrete per hour against horizontal delivery head of at least 90 m and/or a vertical delivery head of 20m.
- (m) Pumping lines shall be of approved metallic type laid to avoid bends. The joints in

pumping lines shall be sealed tight to prevent leakages.

- (n) All equipments, pump chamber, hoppers, lines etc. shall be kept clean at all times. Any build-ups in the lines of materials from previous operations shall be cleaned out prior to pumping.
- (o) In the event of breakdown in the equipment causing delay not exceeding 20 minutes, the time within which concrete can not be replaced, the following procedure shall be adopted:

“With the approval of Engineer-in-Charge, the concrete already placed shall have the “Wet Edge” and vibrated into mass. Where atmospheric temperature exceeds 30 degree centigrade, the receiving hopper and lines shall be cleaned out and concrete contained therein discarded and immediately removed from the site. The concrete shall be discarded if initial setting of the concrete has begun in the hopper or discharge lines. All lines shall be cleaned free of concrete prior to resumption of pumping after each breakdown. Concrete in the lines shall be pumped at approximately 8 minutes intervals to ensure the concrete in the line is live, whenever delivery of concrete in the pump is delayed. This pumping interval shall be reduced to 5 minutes during extra hot weather conditions. Delivery lines where exposed to hot sun, shall be protected by covering with gunny bags, wet hessian or other approved means.”

- (p) Due to mechanical malfunctioning, if concreting is required to be stopped, necessary precautionary measures shall be taken by the contractor. Cost of any additional work caused due to these stoppages shall be contractor's responsibility.
- (q) No concreting shall be commenced until formwork and reinforcement and other preparatory work required are completed, inspected and approved by the Engineer-in-Charge/GE.
- (r) The contractor shall take adequate precautions and strengthening measures to strengthen the shuttering as required to withstand the pressure that will be created due to pumping of concrete.
- (s) Slump of concrete shall be as per IS-456 and as specified. The workability shall be within the following limits on the specified value as appropriate:

Slump	:	+ 25 mm or + 1/3 of the specified value whichever is less.
Compaction Factor	:	+ 0.03, where the specified value is 0.90 or greater + 0.04, where the specified value is less than 0.90 but more than 0.80 and + 0.05, where the specified value is 0.80 or less

- (t) Slump test shall be carried out at site by the contractor in the presence of Engineer-in-Charge/JE.
- (u) The contractor shall obtain from RMC manufacturer computer printout of the data sheet of every batch of concrete and submit to GE. The same shall be signed by the Contractor, Engineer-in-Charge & JE.
- (v) The minimum cement content shall be as per IS: 456-2000 (durability criteria).

3.6.13. **CONSOLIDATION OF CONCRETE:** Consolidation shall be done by mechanical vibrators, plate type for slab and needle type for other locations.

3.6.14. **SAMPLING AND TESTING OF READY MIX CONCRETE:**

- (a) Allow at least the first 1/3 cum of concrete to be discharged from the truck mixer prior to taking any samples. Take required number of samples from the remainder of the load avoiding sampling the last cubic meter of concrete. Thoroughly re-mix this composite sample either on a mixing tray or in the sampling bucket and proceed with the required testing.
- (b) In addition to the tests carried out by the RMC manufacturer at the plant site, sampling and testing of concrete shall be carried out at the site after delivery as per IS-456 by the department along with the representatives of the contractor at contractor's expense.
- (c) Samples from fresh concrete shall be taken as per IS-1199 and cubes shall be made, cured and tested in accordance with IS-516 for 7 & 28 days compressive strength. The samples shall be taken as follows:

Place Of sample	Quantity of Concrete	No of Samples	Remarks
At RMC Plant	For every 6 Cu.m or part thereof	1	One sample will comprise of 4 test specimens. 3 specimens for testing and one for preservation.
At Site	For every 6 Cu.m or part thereof	1	(a) One sample will comprise of minimum 7 test specimens, 3 specimens each for 7 days and 28 days testing and 1 specimen for preservation. (b) One sample for slump/compaction factor for workability.

Notes:

1. At least one sample shall be taken from each delivery.
2. The test specimens will be marked showing clearly the C. A. No., date of sample, location and name of building/pile reference where it has been taken from.

3.7. **FINISH TO CONCRETE SURFACES:**

3.7.1. Refer Clause 4.11.16.1, 4.11.16.2 (b), (c), (d), (e), 4.11.16.3 of MES Schedule Part-I. Exposed surfaces of PCC/RCC such as soffits of floor/roof slabs, roof beams, independent columns, fins, chajjas and stair case, etc which are ultimately required to be treated by application of white washing/colour washing, distemping, exterior weather proof paint/cement paint etc shall be plastered in CM (1:3), 5mm thick, finished fair and even without using extra cement all as specified.

3.7.2. Exposed surfaces of lintels, beams, columns, etc which are continuous with plastered surfaces of walls shall be plastered as for wall plastering specified hereinafter.

3.8. **PRE CAST CONCRETE ARTICLES:** Cement concrete lintels (without chajjas) up to 1.5 meters clear span, shelves and bed blocks and the like may be either pre-cast or cast -in-situ as indicated in Schedule 'A' or as directed. If, it is pre-cast, these shall be set in

cement mortar (1:3). In case of deviation involving these items, pricing shall be done on the basis of cast-in-situ work.

- 3.9. **CONCRETE PADDING:** Padding under bearing of RCC lintels, beams, slabs, shelves etc. to make up height, shall be of plain cement concrete (1:3:6), Type C1. Cut brick of less than the height of normal brick course shall not be used in such positions.

- 3.10. **BEARING OF RCC WORKS:** Bearing surfaces of masonry walls on which beams, slabs and lintels will rest shall be plastered in cement mortar 1:4, 20mm thick. Top surfaces to be made smooth over which bituminised building craft papers conforming to IS-5134 in two layers are to be placed. Similar treatment is to be given for all other wall surfaces in contact with beams, slabs and lintels etc. Bearing plaster with bituminous builder craft paper shall also be laid for bearing of shelves. No bearing plaster shall be done under lintel bands running on walls. Weight of craft paper shall not be less than 100 grams per Sq.m.

- 3.11. **PCC PLINTH PROTECTION:** Plinth protection shall be 75 mm thick M-15 (Nominal Mix) over 75 mm thick hard core gauge not exceeding 63 mm, over rammed earth. The top surface of concrete shall be finished fair and even without using extra cement. Plinth protection will be laid in outward slope of 1 in 12 and in alternate bays/panels. Length of panels shall not exceed 2.50m. The joints shall be filled with mastic filling comprising of 01 Part of heated bitumen blown grade any penetration and 3 parts of sand (all by weight).

- 3.12. **WATER PROOFING COMPOUND:** Water proofing compound shall be anti-algae conforming to IS-2645, Specifications for integral cement water proofing compound. The quantity of water proofing compound shall be as recommended by the manufacturer. However, in the event of deviations the quantity of water proofing compound shall be considered @ 2% by weight of cement. The make shall be as specified hereinafter.

- 3.13. **FORM WORK:**

- 3.13.1. Form work shall be of steel plates stiffened by steel angles.

- 3.13.2. Propping and centering shall be of steel sections, tubular sections or combinations, properly designed. Contractor may use "AGRO" or other equal and approved propping and centering methods precautions like supporting minimum two floors below and locating props exactly below one another shall be strictly adhered to. (MES Schedule Part-I, clause 7.15.3 to 7.15.4.2 refers).

- 3.13.3. Form surfaces shall be coated with soap solution or linseed oil or refined pale paraffin mineral oil. Use of waste engine oil etc shall not be permitted. (MES Schedule Part I clause 7.15.6 refers).

- 3.13.4. In all other respects like lining to shuttering, obtaining desired shape to edges, camber, erection and assembly, striking and removal, reuse etc, specifications, in all sub clauses of clause 7.15 of MES Schedule Part-I and all sub clauses of clause 4.11.6 of MES Schedule Part I shall be applicable.

4. **PRECAST CEMENT CONCRETE SOLID BLOCK MASONRY:**

- 4.1. Precast cement concrete block masonry indicated in the drawings shall be built in PCC solid blocks.
- 4.2. The blocks will be machine moulded with mix prepared in a mechanical mixer and manufactured as per IS: 2185 (Part -I) 2005. The class grade and density shall be as under:-

Type of	Minimum average	Classification	Minimum Block
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Block	compressive strength at 28 days		Density
Solid Block	50 Kg/Cm2	Grade 'C(5.0)'	1800 kg/m3

- 4.3. The size of the concrete block solid shall be 400 X 200 X 200mm and 400 X 200 x 100 respectively. The size of block for 300mm thick wall shall be 400 X 300 X 200 mm. The physical requirements viz dimensions, density, compressive strength, water Absorption, Drying shrinkage and Moisture movement of the block shall conform to IS : 2185 (Part-I) 2005.
- 4.4. The crushed stone aggregates of nominal size 12.5mm graded and conforming to the requirements of IS:383-1970 shall be used. The grading of the combined aggregate (ie fine and coarse) shall conform as near as possible to the requirements indicated in IS:383-1970. It is also recommended that the fineness modulus of the combined aggregate shall be between 3.6 and 4.0.
- 4.5. Sampling and Testing shall be as per IS: 2185 (Part –I) 2005. A sample of 20 block shall be taken from every consignment of 5000 blocks or part thereof of the same size and same batch of manufacture. All the 20 blocks shall be checked for dimensions and inspected for visual defects. The other tests shall be as under:-

(a)	Block density	-	3 Blocks
(b)	Compressive strength	-	8 Blocks
(c)	Water absorption	-	3 Blocks
(d)	Drying shrinkage and lateral to moisture movement	-	3 Blocks
(e)	Reserve for retest for drying shrinkage and moisture movement if need arises	-	3 Blocks

- 4.6. The criteria for conformity of the lot shall be as specified in IS: 2185 (Part I) 2005. The cost of PCC blocks for testing and testing charges shall be borne by the contractor. The manufacturer of PCC blocks shall issue a certificate that these masonry units conform to the requirement of IS: 2185 Part I 2005. The blocks shall also bear the identification for the manufacturer and the grade of the unit supplied.
- 4.7. Unless otherwise specified here-in-after precast cement concrete block masonry shall be built in CM 1:6 for 200 mm thick wall and CM 1:4 for 100 mm thick wall. PCC masonry wall 100 mm thick having height more than 1.5 m shall be reinforced with two 8 mm dia MS bars horizontally at every forth course starting from floor level and anchored in walls at junctions.
- 4.8. Precast PCC masonry wall of 100 mm thick shall be constructed over PCC sub base in ground floor and from top of RCC slab with reinforcement details in upper floors in case of concealed beam/beam not shown on drawings. PCC masonry wall 100 mm thick having height more than 1.5 m shall be reinforced with two 8 mm dia MS bars horizontally at every forth course starting from floor level and anchored in walls at junctions . The anchorage length shall be not less than 100 mm. Unless otherwise shown be provided with depth 150mm at lintel or opening height level with 4 Nos of 10mm dia deformed bars as longitudinal reinforcement and 8mm dia deformed bar stirrups at 100mm centre to centre.
- 4.9. The In the event of deviation precast PCC block masonry shall be priced at the applicable rates in MES schedule (Part II) for materials and labour with contractor's percentage as applicable.

- 4.10. The particular of sources/ manufacturers of PCC solid block shall be approved by GE.
- 4.11. Width of concrete lintels, beams, cills, columns and the like coming in conjunction with block masonry walls/pillars shall be kept to the actual width of masonry work of that place unless offsets have been specifically shown; in which case, the width as shown on drawings shall be maintained.
- 4.12. Center line dimensions of rooms, verandahs etc., shown in drawings shall be maintained. Internal and overall dimensions, if at variance from whatever shown in drawings, shall be deemed to have been amended accordingly. The dimensions for various height shall be maintained as shown on the drawings.

5. DOORS AND WINDOWS:

5.1. POWER COATED ALUMINIUM DOORS, WINDOWS, VENTILATORS AND PARTITIONS:

- 5.1.1. All aluminium doors, windows and ventilators shall be powder coated as per manufacturer's instructions. Powder coated Aluminium doors, windows, ventilators and partitions shall be provided at locations and as per the details as shown on drawings. All sections shall be of heavy extruded sections. The thickness of standard aluminium frame shall not be less than 1.5 mm thick if not specified. The material shall be procured from any one of the manufacturers as specified hereinafter and shall conform to designation 63400 given in IS-737. Powder coating shall not be less than 50 micron thick.

- 5.1.2. The doors, windows and ventilators shall be fabricated and fixed by any one of the firms as specified hereinafter. The entire workmanship and material shall comply with the relevant IS standards and as per manufacturer's instructions. The thickness of glass shall be as indicated in drawing. Where not indicated the thickness of glass shall be 6 mm. Provide builders hardware as specified and indicated on drawing and as directed by the Engineer-in-Charge. The window shutters shall be fixed box type as shown on drawing and as directed by GE. Aluminium doors, windows and ventilators shall conform to IS-1948. All other specifications for aluminium doors, windows and ventilators shall be as per relevant drawings mentioned in the list of drawings. The powder coated article shall be marked legibly and indelibly with grade of coating and the name or trade mark of the manufacturer. All Aluminium doors shall be provided with Floor springs of suitable capacities.

- 5.2. **POWDER COATED ALUMINIUM GRILLS AND GUARD BARS:** Provide powder coated aluminium grills to aluminium windows and powder coated aluminium guard bars to aluminium ventilators as shown on drawings. Powder coated Aluminium Grills shall be of pattern DG 916 or as approved by GE. Powder coated Aluminium grills shall be procured from reputed manufacturers such as Deco Grill/Dura Grill/Aero Grills or as approved by GE. Powder coating shall not be less than 50 micron thick. Aluminium anodised grills shall be fixed to window using powder coated aluminium channel or riveted to panel of window frame all as directed by Engineer-in-Charge. Aluminium anodized guard bars shall be of 16 mm dia and shall be procured from reputed manufacturers as approved by GE. In case of window/ ventilators with mosquito proofing and glazing in the same opening, grills shall be provided to one of the frames only as directed by GE. The grill shall be in a single piece for windows and ventilators.

5.3. PVC DOOR WITH FRAME:

- 5.3.1. Toilets shall be provided with PVC doors where ever shown on drawings. PVC factory made integral leaf (shutter) and frames shall be provided all as per drawing no CEVZ/2022/TD-11. The thickness of shutter shall be 30 mm (Minimum). Frames fitted shall

have concealed hollow MS square tube. MS tube shall have a coat of steel primer of approve make. Tie rod shall be provided (recommended size by manufacturer) at the bottom of frame in to floor to keep the frame in form. Electrometric gasket shall be provided in grooves of the frame. Irrespective of what is shown on drawing frames shall be fixed with expandable fasteners or lug plates as per manufacturers instructions. All builders hardware shall be stain less steel ISI marked. The PVC doors shall be provided with the builders hardware articles (except Aldrop) all as shown in the TD of PVC doors. The screws used in the work shall be counter sunk of aluminium. Frames and shutters shall be of colour as approved by GE. PVC doors shall be fixed as per manufacturer's instructions. PVC doors shall be of any on the makes mentioned in Appendix.

- 5.3.2. The tenderer shall arrange for testing of the door shutters as laid down in IS-3097 (1989) in any laboratory as approved by the GE at his own cost. Nothing extra shall be allowed for payment on account of testing of the door shutters.

5.4. **FIRE RETARDENT DOOR (FRD):**

- 5.4.1. Door FRD whenever shown/indicated in Drg's shal denote fire door of size 1200 x 2100mm. All fire doors shall be Outer layer Charcoal tinted plate 5mm thick on both side, Two layers of Teak wood batten 150 wide 15mm thick and middle 15mm thick incombustible material having minimum fire rating of 120 minutes.
- 5.4.2. All fire doors shall be fitted with an automatic self closing device of same fire rating as of the door, which is capable of closing the door from any angle and against any latch fitted to the door.
- 5.4.3. Fire door shall be made per the manufacturer's details confirming to al provisions inNational Building Code (NBC).
- 5.4.4. The contrctor shall submit the detailed drawings from manufacturer of fire door beforeprocurement and got it approved by GE.
- 5.4.5. All fire rated doors shall be provided with the certificate and labels prominently indicating the manufacturers identification, door details covering door type, serial/batch number, month and year of manufacture, fire resistance rating etc.
- 5.4.6. The door and its assembly shall be fitted with hardware such as hinges, locks, panic bars, and door closure and door viewers as per NBC norms.

6. **WOOD WORK/JOINERY:**

- 6.1. Provide wooden doors, windows and ventilators at locations shown on drawings. Wooden doors, windows and ventilators shall be of factory made. Timber for factory made panelled, glazed and gauzed joinery shall be 2nd class hard wood, kiln seasoned and free from defects. The species shall be of Sal, Bija sal (Venga), Laurel (Nalla Maddi) for frames and Bija sal (Venga), Haldu (Kambha) for shutters. Other timber required for the work shall be of same specifications. The timber shall be treated with organic solvent type 2 as specified in clause 5.1 of IS-401.

6.2. **MOISTURE CONTENT:**

- 6.2.1. Attention is drawn to IS-207 and the map in the Indian Standard. It shall be ensured that the timber to be used in work is within the maximum permissible limit as specified in IS-287-1973. Adequate number of tests shall be carried out by the Engineer-in-Charge to determine the moisture content in the timber used in the work and the contractor shall

provide approved laboratory tests as required by Engineer-in-Charge without any extra cost to the Govt.

- 6.2.2. Contractor shall also arrange for testing of species of timber used in factory made joinery through Lab tests and cost of such tests including material to be borne by the contractor.

- 6.3. **TOLERANCE:** Tolerance for wrought faces of woodwork shall be as specified in MES Schedule. No tolerance is permitted in boarding the finished thickness of which is less than 12mm.

- 6.4. **SURFACE FINISH:**

- 6.4.1. Surface of timber in contact with or buried in masonry, concrete and plaster shall be clean sawn.

- 6.4.2. All other timber surfaces unless otherwise specified shall be wrought on all faces.

- 6.5. **PLASTIC PLUGS/RAWL PLUGS:** Irrespective of what is shown on drawing provide plastic plugs/rawl plugs for fixing wooden/steel members to walls, concrete surfaces and the like. The spacing of plugs/rawl plugs shall be as indicated on drawings, wherever the same is not indicated, plugs shall be provided at not exceeding 30 cm c/c.

- 6.6. **DIMENSIONS OF JOINERY:** Dimensions of various parts of panelled, glazed and gauzed joinery shown in drgs shall supersede those stipulated in MES Schedule Part-I. The relevant clause in MES Schedule Part I shall not apply to this contract in regard to the size of various members of joinery.

- 6.7. **CHOWKATS AND SHUTTERS:**

- 6.7.1. Chowkats and shutters of wooden doors, windows and ventilators shall be of factory made as approved by GE, factory made chowkats shall conform to IS-4021 and factory made shutters except panels shall conform to IS-1003 (Part I).

- 6.7.2. **PANELLED SHUTTERS:** The panelled and open rebate shutters shall be as per size/dimensions given in the drawings. The door shutters shall be provided with 2 tenon joints for member of 140 mm width. The panel insert for factory made panelled door shutters shall be 12mm thick veneered particle-board in one piece and shall conform to IS-3097 of 1985. The particle board shall be bonded using phenol formaldehyde synthetic resin adhesive.

Note: In the event of deviation involving factory made chowkats, Paneled/gauzed shutters the pricing shall be done at the rates contained in MES schedule for 2nd clas hard wood joinery enhanced by the percentage quoted by the bidder.

- 6.7.3. The mosquito proof shutters of windows shall open inside and glass shutters to outside. Mosquito proof shutter of doors shall open outside. External doors shall open outside and gauzed shutter shall open inside.

- 6.7.4. **FLUSH DOOR SHUTTERS:**

- 6.7.4.1. Flush door shutter shall be solid core types with block board core, as indicated, and shall conform to **IS-2202 [Part-I]**. Flush door shutters shall be non decorative [commercial] type. These shall be ISI marked.

- 6.7.4.2. Flush door shutters shall be internally lipped. Internal lipping may be provided separately or as one piece with the frame. The width of frame including lipping shall not be

less than 50mm. where separate lipping is specifically desired it shall be so. Internal lipping shall have a total depth of not less than 25 mm. Joints shall not be permitted in lipping.

6.7.4.3. In the case of double leaved shutters, rebating shall be splayed or square as directed. Where separate lipping is indicated, the depth of lipping at the meeting of stiles shall not be less than 35 mm.

6.7.4.4. Flush door shall be free from twist or warp in plane and all the four edges of the door shutter shall be square. Both the faces of the door shutter shall be sanded a smooth even texture.

6.7.4.5. Tolerance on nominal thickness shall $[+]$ 1.2 mm. Thickness of shutter shall be uniform through out with the variation not exceeding $[+]$ 0.8 mm when measured at any two points.

6.7.4.6. Shutters shall be shop prepared for taking mortice locks and latches if specifically directed.

6.7.4.7. **FIXING OF SHUTTERS:** The size of openings and the frames shall be checked and also the verticality of the side frames and the level position of the floor and the wall. Any adjustment necessary shall be made before installation of the shutters. The shutter shall be installed only after the walls on either side have dried. Width of hinges shall suit the shutter thickness. Shutters shall be checked after fixing for proper location alignment and swinging. After all the fixtures have been fitted, the shutters shall be tried again for proper closure, handling and movement. Any rectification necessary shall be done.

6.8. **PARTICLE BOARD:**

6.8.1. Wherever Un-veneered particle board is shown/specified shall be flat pressed, BWp grade bonded with phenol formaldehyde synthetic resin adhesive conforming to IS-3087 (Type-I Part-I) all as specified in Para 12.13 of MES schedule Part-I.

6.8.2. Wherever particle board is shown/ specified shall be three layered flat pressed with commercial or teak veneer (one side or both sides) and shall be BWP grade bonded with phenol formaldehyde synthetic resin adhesive as per IS-3097 Grade I, Type-I for commercial veneer and Type-2 for decorative veneer all as specified in Para 12.14 of MES Schedule Part-I.

6.8.3. Wherever prelaminated particle board is shown/specified shall be flat pressed three layered exterior grade ISI marked (IS-12823) Gde I, type II with prelamination of approved shade on one side and balancing white on other side bonded with phenol formaldehyde synthetic resin adhesive.

6.8.4. All edges of particle board shall be sealed with a coat of primer and provided 6mm thick first class hard wood (teak) edging.

6.8.5. No block board shall be provided in the above work though may be shown at certain places in the drawing. In place of block board, pre laminated particle board of approved shade on one side and balancing white on other side shall be provided. Wherever 20mm thick board is shown on drawing prelaminated particle board of 18mm thick shall be provided all as specified herein before.

6.9. **PLYWOOD:**

6.9.1. Plywood shall be BWP grade bonded with phenol formaldehyde synthetic resin adhesive and marked with IS-303 for general purpose plywood and IS-1328 for decorative face plywood. Facing shall be of teak veneer or commercial veneer as shown on drawing/specified. The marine ply wood where specified shall be conforming to IS-710 and shall be ISI marked.

6.10. **DECORATIVE LAMINATED SHEETS:** Special decorative laminated sheet type-I with natural teak, plain mosaic or glossy finish on one face of 1mm shall be provided as per functional requirements. The laminated sheet shall conform to IS-2046 specifications of decorative thermosetting synthetic resin bonded laminated sheet. The sheet of each table top shall be in one piece. Piecing and jointing will not be allowed. The laminated sheets wherever required shall be in one piece. The laminate shall be fixed with marine grade synthetic adhesive as directed by GE.

7. **BUILDERS HARDWARE:**

7.1. Builders hardware for doors/windows/ventilator/cupboards etc shall be provided to meet the functional requirements.

7.2. All builders hardware shall be stainless steel (SS 304) ISI marked.

7.3. All items of builder's hardware shall bear ISI mark on them and the samples shall be got approved by GE before bulk procurement. Fittings shall be as approved by GE.

7.4. **TOWEL RAIL:**Stainless steel towel rail of size and length as stipulated in drawings shall be provided. Brackets shall be fixed to wooden plugs embedded in wall.

8. **STEEL AND IRON WORK:**

8.1. **GENERAL:**Steel and ironwork in various situations shall be carried out as specified in MES Schedule Part-I, Section-10 and as shown in drawings. However, TMT bars shall be used in lieu of CTD bars in case shown in any drawing. All steel required for the work under the contract shall be procured, supplied and incorporated in the works by the contractor under his own arrangement.

8.2. **GRADES AND QUALITY:**Steel supplied by the contractor shall conform to the following grades and quality.

8.2.1. **STEEL FOR CONCRETE REINFORCEMENT:**High strength corrosion resistant deformed steel bars produced by Thermo Mechanical Treatment process (TMT) of grades Fe-500 D, meeting all other requirements of IS-1786. Minimum elongation shall be 18%.

8.2.2. Mild steel bars shall conform to IS-432 (Part-I) and Grade-I.

8.2.3. **STRUCTURAL STEEL (REFER CLAUSE 10.4 OF MES SCHEDULE PART-I (2009)):**

(a) Standard quality structural steel of Grade E 250 (Fe-410W Quality A) conforming to IS-2062 shall be used for all types of steel structures including those subject to Dynamic Loading

(b) Ordinary quality structural steel wherever mentioned shall be conforming to IS-2062 of Grade E 165 (Fe-290). This shall be used for doors, windows, guard bars, grills, steel gates, hand railing, fencing posts etc.

8.2.4. **GALVANISED STEEL SHEETS (PLAIN & CORRUGATED):**Galvanised steel sheets (Plain and Corrugated) shall conform to IS-277. Unless otherwise specified the sheet shall be of

Galvanised Class-4. Grade of zinc coating shall be as per clause 10.29.1 of MES Schedule Part-I.

8.2.5. **HARD DRAWN STEEL WIRE FABRIC FOR CONCRETE REINFORCEMENT:** Fabric reinforcement shall conform to IS-1566.

8.2.6. **STEEL TUBES FOR STRUCTURAL PURPOSES:** Steel tubes for structural purposes shall conform to IS-1161 and shall be of grade YST-240.

8.3. **SOURCE OF PROCUREMENT:**

8.3.1. **TMT:** High strength corrosion resistant deformed TMT Steel Bars of Grade Fe-500D of all sizes supplied by the contractor shall be procured directly from manufacturers listed in relevant Appendix. In addition, Steel may also be procured even from the manufacturers approved by E-in-C's Branch after date of receipt of tenders.

8.3.2. **STRUCTURAL STEEL:** Structural steel supplied by the contractor shall be procured directly from manufacturers listed in relevant Appendix. In addition, Steel may also be procured even from the manufacturers approved by E-in-C's Branch after date of receipt of tenders.

8.3.3. Galvanised sheets and fabric reinforcement for concrete shall be procured directly from Main manufacturers like SAIL, RINL and TISCO or BIS marked manufacturers at the option of contractor without any price adjustment.

8.3.4. All finished steel shall be well and clearly rolled to the dimensions, sections and weights specified. The finished material shall be reasonably free from cracks, surface flaws, laminations, rough jagged and imperfect edges and any other harmful defects and shall be finished in a proper manner. Tolerance on size and weight of reinforcement bars shall not be more than as specified in Clause 10.17.4 and 10.17.5 of SSR Part-I and as specified in IS-1786 and IS-2062 and as per relevant IS codes.

8.4. **TESTING OF STEEL:**

8.4.1. The manufacturers of steel are to carry out inspection and testing of steel in accordance with the relevant BIS provisions. The contractor shall submit manufacturer's test certificate in original or authenticated attested true copy by the manufacturers along with the test sheet giving the result of each mechanical test as applicable in accordance with relevant IS provision and the chemical composition of the steel for each consignment. The Engineer-in-Charge shall record these details in a Steel Acceptance Register which will be signed by the Junior Engineer, Engineer-in-Charge, GE and Contractor as given in the format, after due verification and Engineer-in-Charge shall send a certified true copy of test sheet to GE for his records.

8.4.2. **Independent testing of Reinforcement steel, Structural Steel, GI Sheets and Fabric Reinforcement by the GE shall be mandatory.**

8.4.3. For independent testing, random samples of steel drawn from various lots and shall be got tested from IIT/NIT/Command Testing Labas per the minimum frequency given below. Samples from each lot shall be also tested for quality and elongation.

8.4.4. In all cases mentioned above contractor at his cost shall provide all facilities required for the testing. Cost of materials consumed in tests shall also be borne by contractor.

8.4.5. Ultimate tensile strength elongation, bend and re bend test for reinforcement steel bars shall be carried out as per clause 9 and test specimen shall be as per clause 11 and

delivery inspection shall be as per Clause 12 of IS-1786. Bend tests and tensile tests for structural steel shall be carried out as per IS-2062 and recorded.

8.5. **FREQUENCY OF SAMPLING FOR INDEPENDENT TESTING BY GE:**

- 8.5.1. Frequency for nominal mass, tensile strength, bend and re-bend tests of steel for checking nominal mass, tensile strength, bend, re-bend test, test specimen at random shall be selected by the GE at following frequency:

Sl. No.	Nominal Size	Frequency
(a)	STEEL FOR CONCRETE REINFORCEMENT:	
1	Bars size less than 10 mm	1 Sample (3 specimens) for each test for every 25 tonnes or part thereof
2	Bar size 10mm to 16 mm	1 Sample (3 specimens) for each test for every 35 tonnes or part thereof
3	Bar size over 16 mm	1 Sample (3 specimens) for each test for every 45 tonnes or part thereof
(b)	STRUCTURAL STEEL:	
4	Tensile Test	1 Test for every 25 tonnes of steel or part thereof
5	Bend Test	1 Test for every 10 tonnes of steel or part thereof

- 8.5.2. The testing by GE as per above frequency is mandatory before payment is released to the contractor in case of structural steel from secondary producers. The GE may also increase the frequency and number of samples/tests for his satisfaction. The cost of the additional tests over and above the frequency stipulated above shall be governed as per Condition-10 (A) of IAFW-2249. However cost of samples, transportation and other overheads shall be borne by the contractor irrespective of test results.

- 8.5.3. Test shall not be insisted upon for the steel required for guard bars, holdfasts, grills and such other allied items.

- 8.5.4. In case test results are not within the acceptable limits, then that consignment of steel shall stand rejected and contractor shall remove the same from site at his own cost. The rejected material shall not be incorporated in the work. The contractor shall have no claim on this account.

8.6. **DOCUMENTATION:**

- 8.6.1. Original purchase vouchers from the manufacturer, and original or authenticated test certificates of the manufacturers for the total quantity of steel supplied under each consignment to be incorporated in the work shall be produced to the Engineer-in-Charge by the contractor. All consignments received at the work site shall be inspected by the GE along with the relevant documents before acceptance. The original vouchers and the test certificates shall be defaced and signed by the Engineer-in-Charge and kept on record in the office of the GE duly authenticated and with cross reference to the control number recorded in the steel acceptance register. The steel acceptance register shall be signed by JE, Engineer-in-Charge, GE and contractor. The entire quantity of all consignments shall also be suitably recorded in the measurements book for record purposes as "NOT TO BE ABSTRACTED" before incorporation in the work and shall be signed by the Engineer-in-Charge and contractor. The following provisions shall also be complied:

- (a) All original vouchers will be kept in a file serially numbered and to be kept in GE's office.
- (b) Test certificates of each steel consignment will be kept in a file, serially numbered and shall be kept in GE's office.
- (c) Steel Acceptance Register will be maintained by the GE.
- (d) In/Out Register for details of receipt, acceptance/rejection and consumption of steel will be maintained.
- (e) Register containing results of independent and additional testing by GE.
- (f) Inspection registers

8.6.2. CWE will check the documents personally, connected with the steel, at least once a month and record of these check will be kept in the Inspection Register.

8.7. STORAGE ACCEPTANCE/PRESERVATION OF STEEL:

- 8.7.1. The steel procured by the contractor shall be stored in the site of work as directed by Engineer-in-Charge neatly in separate stacks at least 15 cm above GL for various grades/quality/sizes/consignments with distinct paint marks for identification. The steel so stacked shall be removed for incorporation in the work only in the presence of departmental representative. The quantity of steel of various sizes received at site and recommended for incorporation in the work shall be entered in a separate register and signed by the contractor and the Engineer-in-Charge daily.
- 8.7.2. Steel will be stored in a manner so as to prevent distortion and corrosion till it is consumed in the work. Any section that has deteriorated and corroded or if considered defective for any other reason, the same shall be removed from site by contractor at his cost.
- 8.7.3. The contractor will keep a separate stack of steel brought at site for inspection, away from the accepted stack of steel. In case, the consignment does not meet any of the requirements of the relevant IS codes, the steel will be rejected by the GE and it will be removed from the site within 24 hours at the cost of the contractor.

8.8. CONVERSION WEIGHT OF STEEL:

- 8.8.1. The weight of steel shall be calculated as per the conversion factors specified in the MES Schedule. For sections not listed in MES Schedule, ISI conversion table shall be followed or manufacturer's certificate if the weights are not available in SSR/ISI tables.
- 8.8.2. Normal waste and off-cuts shall be stacked neatly which shall be the property of contractor. Contractor shall be allowed to remove such cut pieces after inspection and certification by the Engineer-in-Charge.
- 8.8.3. Advance on account of payment made towards these cut pieces shall be adjusted from advance on account of payment immediately falling due and before removal of such cut pieces from site.

8.9. PAYMENT IN RAR:

- 8.9.1. Payment of the steel brought by the contractor should only be released by the GE after taking action on points enumerated, hereinbefore and after completing the documentation mentioned hereinbefore in this regard.
- 8.9.2. Before procurement of steel, structural drawings shall be read thoroughly and various grades/types of steel to be incorporated in the work shall be identified by contractor and got approved by the GE. Steel shall be procured sufficiently in advance as stipulated.
- 8.10. **SAFETY OF STEEL:** It will be responsibility of contractor to ensure that all possible arrangements are made for safe custody of the steel. In case of any loss of steel, only contractor will be responsible and the loss will be made good by contractor without any delay or claim what so ever.
- 8.11. **SCHEDULE OF SUPPLY:** Contractor shall work out complete requirement of steel size wise and phase the same as per the activities planned to be executed in terms of CPM networking. The contractor shall procure all the steel sections in accordance with CPM chart. Schedule of supply of steel will be finalized by GE in consultation with contractor and same will be incorporated in CPM chart so that supply of steel is monitored in a way to avoid any delay in completion of the work. The schedule of supply of steel will be vetted by CWE from time to time.
- 8.12. **BENDING OF BARS BY BAR BENDING MACHINE:** TMT bars used for reinforced concrete works shall only be bent using bar bending machine driven by motor powered by not less than 5 HP suitable for bars of dia up to 32 mm as approved by GE. Bending of bars shall in no case be allowed to be done manually. The number of bar bending machines to be provided at site shall be adequate enough to execute the works as per the CPM. No claim whatsoever arising out on this account shall be admissible.
- 8.13. **WELDING:** The welding work shall be executed all as specified in clause No. 10.15 & 10.16 of MES Schedule part I as applicable. All Welding shall be carried out by metal arc welding process conforming to the requirements of IS-1024. The welding electrodes shall conform to IS 814. Filler wire & flux shall conform to IS-3613.
9. **RCC ROOFING**
- 9.1. **GENERAL**
- 9.1.1. RCC roof slabs shall be cast/laid to slopes as indicated in the drawings and the thickness shown on drawings shall be considered as minimum thickness. Top of roof/terrace slab shall be applied 15 mm thick plaster with cement mortar 1:4 mixed with water proofing compound as per manufacturer's instructions when the concrete is green. In case of deviation, the same shall be considered as 3% by weight of cement.
- 9.1.2. RCC roof slab/terrace slab after application of plaster shall be prepared as described in Para 11.31.2 and 11.31.2.1 of MES Schedule Part-I (Specifications) before carrying out any treatment.
- 9.1.3. **PONDING TEST:** After RCC slab is laid, cured and fully set, ponding shall be done over slab by filling water and shall be kept for 48 hours. In case slightest indication of seepage/leakage is noticed, the same shall be rectified by grouting and/or plastering with cement mortar 1:3, after roughening the affected portion at no extra cost. Water proofing Treatment on roof slabs shall be carried out when there is no seepage/leakage observed.
- 9.1.4. Area below/around the location where water tank are to be placed shall be suitably raised with PCC 1:2:4 type B0 to drain off the over flow/leakage water effectively.
- 9.2. **WATER PROOFING TREATMENT OVER ROOF SLAB OF BUILDING:**

- 9.2.1. The water proofing treatment as stipulated here-in-after shall be provided over accessible roof, non-accessible roof, top of RCC Chajja/Canopy/Portico/Gutter etc.
- 9.2.2. The RCC roof slab shall be laid to slopes as indicated in drawings and padding concrete of 1:3:6 type C1 (Using 20 mm graded stone aggregate) shall be used in case the stipulated slope is not achieved with shuttering and slab casting.
- 9.2.3. **COVING:** Angular fillet at all corner joints of roof with parapet shall provided with coving of 75 mm x 75 mm by using polymer modified mortar prepared with SBR latex based modifier having > 38% solids at mixing ratio of cement [50Kg] + Quartz sand [150 Kg] + SBR admix [Lit] + Water @ 0.35 [17.5 Slit].
- 9.2.4. Prepare the inside surface of pipe by roughening using suitable file to get better adhesion prior to packing works. The surface shall be cleaned by wire brush followed by water jet to remove any laitance or loose flaky particles. Necessary formwork for packing the pipe using suitable arrangements [depending upon site conditions]. A coat of styrene- butadiene based polymer coating shall be enhance adhesion between the packing material; and other surfaces followed by packing the pipe gap using non-shrink cementitious grout, including final sealing and finishing with cold applied bitumen caulking sealant and flush finished to surface.
- 9.2.5. Water proofing membrane shall be tucked in wall to a depth 25mm [Minimum] where applicable groove made in wall shall be filled with bitumen mastic filling without any extra cost to government. Hot blown bitumen applied below membrane should be compatible with membrane all as per recommendation of manufacturers.
- 9.2.6. The work of APP membrane treatment i.e. primer, APP membrane, bituminous aluminium paint, shall be got executed through applicator authorized by the approved manufacturer only. Contractor shall submit a certificate from the manufacturer and applicator in this regard to the GE before commencing the water proofing treatment work.
- 9.2.7. APP membrane shall be APP modified (Polyester reinforced) membrane of 3mm thick weighing not less than 3.8 Kg/Sqm conforming to IS: 16532-2017.
- 9.2.8. Primer, APP membrane, bituminous aluminium paint shall be of same manufacturer.
- 9.2.9. **NON-ACCESSIBLE ROOF:** water proofing treatment of non-accessible roof slab shall be provided as under:
- (a) 10mm thick plaster in cement mortar 1:4 mixed with water proofing compound @ 3% shall be applied whilst concrete of roof slab is still green to have a smooth surface for laying of water proofing membrane.
 - (b) Before laying of APP membrane treatment, roof slab shall be cleaned thoroughly by using wire brush (Mechanical/hand brush) to make it free from any loose particle, dirt/dust etc.
 - (c) Oil based bituminous primer conforming to IS 3884 (latest) @ 0.3 litre/Sqm shall be applied over the cleaned surface.

(d) Over the primer, APP water proofing membrane shall be laid with side overlaps of 100mm and end overlaps of 150mm as per manufacturer's instructions. The overlaps shall be sealed by flames or as per manufacturer's instructions.

(e) Water proofing membrane shall be finally finished with a coat of bituminous aluminium paint @ 0.10 Lites/Sqm.

9.2.10. **ACCESSIBLE ROOF:** Water proofing treatment for accessible roof shall be provided same as (a) to (d) stipulated for Non-accessible roof with additional provision of minimum 20 mm size broken pieces of white coloured china mosaic tiles of 6-8mm thick laid on 15mm thick cement sand mortar 1:4 mixed with water proofing compound @ 3%, jointed and pointed in cement sand mortar 1:3 mixed with water proofing compound @ 3% (Joint thickness not exceeding 5mm) to be finished with white cement.

9.2.11. **TREATMENT OVER CHAJJA/CANOPY/PORTICS AND INTERNAL SURFACE OF RCC GUTTER:** Top of RCC Chajja/ Canopy/ Portico/ Gutter shall be plastered 15mm thick in cement mortar (1:4) mixed with water proofing compound @ 3% even and smooth and finished to a slope of 1:60. The plaster shall be taken upto 200mm height over adjacent vertical surfaces of walls in addition to external plaster for a length equal to length of chajja.

9.2.12. **TEST CERTIFICATE** : Contractor shall submit manufacturer test certificate and cash memo/ bill/ invoice in original for water proofing membrane before claiming payment and incorporating the same in the work.

9.2.13. **FLOODING TEST OF ROOF** : On completion of water proofing treatment as herein before the contractor shall carryout flooding test by forming earthen bunds over the roof at suitable intervals as desired by GE. Water will be ponded for three days and leakage/ seepage noticed shall be rectified by the contractor to the satisfaction of GE at no extra cost to government.

9.2.14. **GUARANTEE OF ROOF TREATMENT:**

9.2.14.1. The contractor shall give a written guarantee for effectiveness of roofing for 10(TEN) years from the certified date of completion of entire work. The guarantee amount shall be 3% of the cost of the water proofing treatment as decided by the GE and the same shall be retained by the Government from the contractor may however, furnish a fixed deposit receipt in lieu, from a schedule bank, pledged in favour of Garrison Engineer for the period of Guarantee.

9.2.14.2. Should the GE at any time during construction or reconstruction or prior to the expiry of the Guarantee period, finds that the buildings have been noticed with leakage the contractor shall, on demand in writing from the GE specifying the buildings complained of, not with-standing that the same may have been inadvertently passed/ certified and paid for, undertake to carryout such treatment as may be necessary forthwith to render the building(s) free from leakage at his own expense. In the event of his failure to do so, within the specified period to be specified by the GE in his demand aforesaid, the GE may undertake such treatment at the risk and expense in all respects of the contractor. The liability of the contractor under this condition shall not extend beyond the period of ten years from the certified date of completion, unless the GE had previously given notice to the contractor to rectify the defectd. The defects liability period mentioned under condition 46 of IAFW-2249 General Conditions of contracts shall be deemed amended accordingly for the purpose of this condition.

9.2.14.3. A cement mortar tablet of size 300 mm x 300 mm x 10 mm thick shall be prepared on external wall of each building in which water proofing treatment to be carried out and CA No., date of expiry of guarantee period and name of the contractor shall be written on the tablet on the date of completion of work under the heading "Details of water proofing treatment of roof".

9.3. **TRIANGULAR FILLETING:**

9.3.1. At the junction of roof slab with parapet wall with chajja/ canopy provide coving of PCC (1:2:4) type B0 (using 12.5 mm graded aggregate) type, mixed with water proofing compound.

9.3.2. Provide water proof plaster 5mm thick in CM 1:4 for height of 30 cm above top of coving in case of roof slab.

9.4. **TOILETS FLOORS ON SLABS WITH PARTIAL SUNK:**

- (a) Surface preparation: The surface shall be cleaned to ensure the removal of all dust, dirt, laitance, debris, mortar droppings, oily substance etc., which may affect adhesion of waterproof coating with the parent concrete surface. The cleaned area shall be dampened with water. Surface preparation includes rectification of any minor irregularities and voids by filling with polymer modified cement mortar.
- (b) Voids/ honey combs or cracks, if any, noticed in the sunken area shall have to be grouted with cement slurry at w/c ratio not exceeding 0.40 and added with shrinkage compensating additive as per manufacturer's instructions.
- (c) All loose particles in honeycombs or voids area shall be chiseled to perfect rectangle or square and with straight edges with the edges cut for a depth of 10mm and filled with ready to use polymer repair mortar.
- (d) Coving along the junction of floor and the wall shall be provided for a size of 75 mm x 75 mm using cement mortar 1:3 mixed with SBR polymer as per manufacturer's instructions and finished smooth.
- (e) Waterproof coating shall be provided by applying acrylic cementitious, elastomeric, two component waterproof coating by mixing both the components to a lump free consistency by suitable means and applied on the prepared surface in 2 or 3 coats at an interval of 4 to 8 hours between coats, depending on the atmospheric conditions, applied as per manufacturer's instructions to achieve a total dry fill thickness of 1.50mm and coating shall be continued along the wall upto a height of 300mm above floor finished floor level and allowed to cure etc. Coating shall offer the following performance properties.

Adhesive pull off strength to concrete: 1.50 Mpa as per ASTM D 4541

Tensile strength: 1 Mpa as per ASTM D 412

Elongation: 35% as per ASTM D 412

Water penetration: No leakage at 5 bars as per DIN 1048

Note: 50mm dia UPVC spout pipe 300mm long to be provided in sunk of the wall.

10. **PRE ENGINEERED STEEL STRUCTURE (PEB) FOR STORE BUILDING:[SERIAL ITEM No.1 OF SCHEDULE "A" PART II:]**

- 10.1. The work of Pre Engineered Steel Structures shall be got executed through specialist firms as mentioned herein below based on the capability and current performance.
- 10.1.1. The pre Fabricated elements of the structure shall be fabricated totally at the factory under controlled quality checks and no portion of the structure shall be contracted to any other fabricator.
- 10.1.2. The manufacturer shall have facility for welding of built up sections and frames by continuous submerged arc welding process using the electrodes conforming to IS – 814.
- 10.1.3. The pre fabricated structure manufacturer shall have a separate full-fledged quality control laboratory managed by competent technical personnel and maintain all quality records of fabrication.
- 10.1.4. The manufacturer shall have designed and executed at least one Pre Engineered Structure of clear span of minimum 40m.
- 10.1.5. The erection notes, painting notes, general notes, design codes, relevant material codes and strength of materials shall be referred from the General Notes on Structural drawings.
- 10.2. The reputed names and addresses of the agencies for fabrication and erection are given below. But it shall be ensured by the tenderers that all the conditions mentioned in Para 30.1 above shall be strictly complied by these firms and necessary documents in support of the same shall be submitted by the tenderers to the GE before placing order for Pre Engineered steel structures:
- 10.3. In case the details of manufactures in support of Pre qualification criteria are not submitted/ laid down criteria are not met as established later, the name of the manufacturer will have to be changed to the firm who is meeting the laid down prequalification criteria.
- 10.4. The specialist agency shall submit methodology for fixing and erection, and also submit the maintenance manual for subsequent routine maintenance of the structure.
- 10.5. Visits by the qualified representatives of the approved PEB agency shall be undertaken as required during the layout and foundation stage to avoid incompatibility between the foundation and superstructure of the PEB. Lumpsum quoted by contractor shall include for this provision. The main contractor shall be responsible for the structure executed by the approved specialist firm.

11. **STRUCTURAL MEMBERS:**

- 11.1.1. Primary Members / Built-up sections shall be fabricated from High Tensile Steel Plates conforming to relevant ASTM / IS Code as applicable. Sections shall be mill produced as per relevant ASTM / IS Code as applicable. Flanges of primary members shall be welded to the web by a continuous double sided fillet weld deposited by an automatic submerged arc welding process. The Built up sections shall be given a surface preparation by blast cleaning. Apply 2 pack of zinc rich epoxy primer with total thickness not less than 45µm (20 µm Pre FAB primer + 25 µm Post FAB primer) in the pre fabrication stage. Primer shall be allowed to dry completely and 2 pack of Epoxy Micaceous Iron oxide primer 120µm (Intermediate coat ≤ 35 µm and top coat ≤ 85 µm) shall be applied post fabrication. The provision of IS – 1477-1971 shall also be followed.
- 11.1.2. Secondary Members shall be galvanised and cold-formed with pre-punched system from steel coils conforming to relevant ASTM / IS Codes as applicable, with zinc coating of Z 275 Designation [275 Grams / Sq.m].

- 11.1.3. Wind ties provided are required to be treated with rust proof UV resistant coloured coating of matching colour, fixed with self drilling screws at the crests of the corrugations of roofing. The wind ties shall be provided irrespective of whatever shown in drawings or not and all as directed by GE.

11.1.4. GUARANTEE FOR EFFECTIVENESS OF PEB STRUCTURE:

- 11.1.4.1. The contractor shall give the guarantee for the performance of the entire structure for a period of 10(Ten) years from the certified date of completion of the work. Rs. 10 lakh (Rupees Ten lakhs only) shall be retained from the final bill as performance guarantee amount till the expiry of the guarantee period. The contractor may alternatively submit deposit at call receipt from any schedule/Nationalized bank in favour of the GE, for the said amount and period. The retained amount /deposit receipt shall be released by the GE only after the satisfactory completion of the guarantee period. Should the GE at any time during construction or reconstruction or prior to the expiry of the guarantee period, find that structural deflection, crack, bends or over stressed by any member due to defect in materials/joints of structural members, on demand in writing from the GE specifying the buildings complained of, notwithstanding that the same may have been inadvertently passed/certified and paid for, undertake to carry out such treatment as may be necessary forthwith to render the building free from defects at his own expense till the expiry of the guarantee period. In the event of his demand aforesaid, the GE may undertake such treatment at the risk and expense in all respects of the contractor. The liability of the contractor under this condition shall not extend beyond the period of 10(Ten) years from the certified date of completion, unless the GE had previously given notice to the contractor to rectify the defects. The defects liability period mentioned under condition 46 of IAFW- 2249 GCC shall be deemed amended accordingly for the purpose of this condition.

12. ROOFING:

- 12.1.1. The contractor shall ensure that no leakages take place from the roof. The roofing shall be Coloured Galvalume roofing system [olive green colour or as approved by GE] with feed material manufactured from 0.80 mm Total coated thickness [TCT], minimum 550 MPa yield strength and shall conform to the physical specifications of IS – 2062, coated with hot dip metallic Aluminium / Zinc alloy coating AZ150 at 150 Grams / Sq.m total on both sides. Galvalume sheet shall be deep depth trapezoidal profiled. The profile shall have a minimum crest depth of 32 to 35mm and maximum pitch of 350mm with minimum side and end lap as per manufacturer's instructions. The manufacturer's test certificate and individual test certificate for the chemical and mechanical properties of steel must be submitted for approval by the concerned authority prior to installation. As per Manufacturer's recommendations specially designed ridge capping, flashing, trims, gutter and down pipe shall be used for fixing roof system which shall be approved by concerned authority. Fastener shall be used for fixing roofing system as per manufacturer's recommendation. The painting shall be coloured baked enamel polyester with silicon coating of film thickness 25 microns nominal on the exposed face/exterior side and on the reverse side [Interior Face] shall be white with 15 microns film thickness, over a coat of 5 micron nominal thickness Primer.
- 12.1.2. Galvalume sheets shall conform to AZ 150 of AS 1397 or ASTM 792 with hot-dip metallic coating of 55% AL and 45% Zn alloy having total coating mass or minimum 150 Grams / Sq.m inclusive of both sides.
- 12.1.3. Base material for coloured Galvalume substrate steel panels shall conform to the specifications of IS – 2062.
- 12.1.4. Roofing sheet shall be crest fixed to purlins with hot dip galvanized self-drilling fasteners with integral EPDM washers [one fastener on each crest]. Fasteners shall also be provided on side laps. Penetrations and laps in sheet shall be sealed by using proper

sealant. Profiled HDPE fillers shall be provided where ever required to close voids between capping and troughs of the sheet to provide a weather tight exterior. Purlins shall be bolted to top flanges of rafters and purlin laps shall be as per relevant IS / ASTM / AS codes as applicable.

- 12.1.5. Roofing system shall be continuous from ridge to eave of the Store. End laps shall be provided as required. Each lap shall not be less than 200mm.
- 12.1.6. All laps of roof panels shall be sealed with a continuous ribbon of tape sealer.
- 12.1.7. Specifications & provisions contained in clauses 11.3, 11.3.1, 11.3.2, 11.3.3 & all other relevant clauses of MES Schedule Part – I [2009] shall be adopted, if not at variance with provisions of Particular Specifications.
- 12.1.8. The steel sheet / coil required for pre-painted Galvalume sheet shall be of approved make / manufacturers as specified hereinafter.
- 12.1.9. All other processes involved in the production of pre-painted Galvalume sheet such as alloy coating, pretreatment, application of primer, pre-painting, Profiling, bending, crimping etc., shall be got done from the approved manufacturers at their own factory premises or from the following profilers:
- 12.1.10. Paining of sheet shall be done with silicon modified polyster [SMP] 18-22 microns on exposed [top] surface & 5-8 micronson interior[bottom] surface,over acoat of5 micron nominal thicknessofepoxy primer on both faces. Sheet shall have protective guard film of 25 microns.
- 12.1.11. ZincaluminiumalloycoatingAZ150shallbeasperIS-277/ASTM1379.
- 12.1.12. Cold Rolled Steel Sheet conforming to IS – 513. It shall be zinc aluminum coated by Hot-dip process as per AS – 1397 / IS – 277 / IS – 14246. The bottom unexposed surface shall then be coated with alkyd backerofminimum 5micronsovera5microncoat aprimer.Topexposedsurface shallhave primerof minimum 5 microns followed by SMP/Super Polyester top coat of minimum 20 microns of specified colour.
- 12.1.13. Accessories such as specially designed ridge capping, flashing, trims, gutter and down pipe etc shall be used for roof system as per manufacturer's recommendations. Fastener shall be used for fixing as per manufacturer's recommendation.
- 12.1.14. Thecontractorshallproducetestcertificatesforeachlotissuedbytheapprovedmanufacturers.
- 12.1.15. ThecontractorshallproducepurchasevouchersforeachlotforverificationofEngineer-in-Charge.
- 12.1.16. The colour, overall width, laid width of Galvalume sheet, size and shape of roofing accessories shall be as approved by GE.

13. WALL CLADDINGS/PANELS:

- 13.1.1. Wall claddings/wall panels wherever indicated in drawings shall be of coloured Galvalume wall cladding systems[of colour as approved by GE] of 0.63 mm Total Coated thickness of minimum yield strengthof550MPa,coatedwithhotdipmetallicAluminiumandZincalloycoating,AZ150[150Grams/ Sq.m totalon both side]. The profile shall have a minimum crest depth of 32 to 35mm and maximum pitch of 250mm with minimum side and end lap as per manufacturer's instructions. Themanufacturer's test certificate and individual test certificate for the

chemical and mechanical properties of steel must be submitted for approval by the concerned authority prior to installation. The sheet shall have brand marking of the manufacturer giving product details on the back of the sheet at every 1 meter c/c for confirming genuinity of the material. The steel sheet shall be fastened with zinc-tin alloy coated, Hexagonal head, self-drilling screw of suitable size and strength as per relevant Indian standards with EPDM washer as per the requirements considering profile, shape and design load. The fastener size and fixing [crest fixed or valley fixed] shall be calculated as per the design / manufacturers recommendations. The painting shall be coloured baked enamel polyester with silicon coating of film thickness 25 microns nominal on the exposed face/ exterior side and on the reverse side [interior face] shall be white with 15 microns film thickness, over a coat of 5 micron nominal thickness Primer.

- 13.1.2. Base material for coloured Galvalume substrate steel panels shall conform to the specifications of IS – 2062.
- 13.1.3. Cladding sheets shall be fixed through valleys [pans] to grits with hot dip galvanized self drilling fasteners as required [minimum one fastener in each valley]. Also fasteners shall be provided on side laps at a gap of 500mm maximum. All sheets shall fully rest with end to end laps, if more than one length of sheet is used on a wall section, the overlap of sheets at the ends shall be minimum 150 mm.
- 13.1.4. Contractor shall submit purchase voucher from manufacturer or their authorized dealer along with manufacturer's and individual test certificates in original for each consignment before claiming payment for Galvalume sheets.
- 13.1.5. The cladding in front and rear gable portions, and upto tie level in both sides above annexe roof as shown on drawings shall be of same material and specifications as of the roof i.e. coloured Galvalume as specified here in before.

13.2. GUARANTEE FOR GALVALUME SHEET ROOF AND CLADDING SHEETING:

- 13.2.1. The contractors shall ensure that no leakage take place from the Galvalume sheet roof, cladding and skylight polycarbonate translucent sheeting. The contractor shall give a written guarantee for effectiveness of roofing for **10 [TEN] Years** from the certified date of completion of entire work. **The guarantee amount shall be 2% of the cost of the pre painted Galvalume sheet roofing and wall priced at MES Schedule Part-II [Rates] enhanced by the percentage quoted by the tenderer for Schedule "A" Part – I and the same** shall be retained by the Government from the contractor's dues. This amount shall only be released after successful expiry of the guarantee period. The contractor may however, furnish a fixed deposit receipt in lieu, from a Schedule bank, pledged in favour of Garrison Engineer for the period of Guarantee. However, the guarantee amount will be released to the contractor if a fixed deposit receipt in favour of GE for 10 Years is submitted by the contractor. The fixed deposit receipt amount shall be released to the contractor after expiry of guarantee period satisfactorily. Should the GE at any time during construction or reconstruction or prior to the expiry of the Guarantee period, finds that the buildings have been noticed with leakage the contractor shall, on demand in writing from the GE specifying the buildings complained of, not with-standing that the same may have been inadvertently passed/certified and paid for, undertake to carry out such repair/replacement of sheets as may be necessary forthwith to render the building[s] free from leakage at his own expense till the expiry of the guarantee period. In the event of his failure to do so, within the specified period to be specified by the GE in his demand aforesaid, the GE may undertake such repair/replacement of sheets at the risk and expense in all respects of the contractor. The liability of the contractor under this condition shall not extend beyond the period of ten years from the certified date of completion, unless the GE had previously given notice to the contractor to rectify the defects. The defects liability period mentioned under Condition – 46 of IAFW – 2249,

General Conditions of Contracts shall be deemed amended accordingly for the purpose of this condition.

13.3. SKYLIGHT POLYCARBONATE TRANSLUCENT SHEETING.

13.3.1. The sheet panel shall be nominal 2mm thick. Skylight panels are white having a minimum acrylic modified resin content of 15% and shall be structural/general purpose. Standard size is 1.2 x 5m long with UV protection and tensile strength of 100Mpa (nominal), shear strength 90Mpa (Nominal) manufactured as per AS 4256.3 or equivalent for external application with steel buildings, composed of a thermosetting polyester resin with a thoroughly impregnated glass fiber reinforcing material with or without an integrally bonded translucent film on the weathering face. The profile shall match with roofing profile. The fixings shall be done with specially designed lap seal and weather tight washer for fixing the translucent sheeting. The profile and properties shall be approved by Engineer-in-charge before installation. The make of translucent sheet shall be as approved by GE.

13.3.2. 16mm Thick multi cell clear sheet shall be provided to Parachute Airing and drying room to vertical side of cladding as shown in drawings. The framing shall be done as shown in Drawings.

13.4. Lightning Arresters: Provide lightning arresters as shown in drawings. Location of lightning arresters shall be as shown in drawings. Lightning arresters shall comply with IS:3070 (Part 2)-1989, Specification for lightning arrester for alternating current systems Part III lightning arresters.

13.5. HANGAR FRONT AND BACK DOOR WITH SUPPORTING STRUCTURE

13.5.1. The tender shall check the drawings before ordering the material for doors, foundation track and Geared electric motors for moving the doors as shown in drawings.

13.5.2. **HANGAR DOOR:** There shall be **FOUR DOOR LEAFS** for the hangar opening in front and back consisting of all leafs of door moved one side all as shown in drawing for Front gate and each two leafs moved either side from middle for Back gate. The door sliding arrangements shall be so provided so that full width of opening as shown in architectural drawing is made available. Each door leaf frames shall be provided all as per drawings and one of the middle door Gate door provision of opening size 2100 x 900. The frames shall be modular in design and all sections shall be prefabricated at workshop, ready for assembly & bolting at site.

13.5.3. **SUPPORTING STRUCTURE FOR HANGAR DOOR:** The supporting structure for the hangar door leafs shall be of size and requirements indicated in the structural drawings. The required fittings and fixtures along, shall meet all the functional and operational requirement of the hanger door. The supporting structure shall be fabricated out of heavy duty mild steel sections and shall be designed for the applicable loads as per relevant IS.

13.5.3.1. **DRIVE ELECTRICAL MOTOR :** Contractor shall provide suitable capacity Drive electrical motors 01 No for each leaf for smooth moving of hanger door for front and back gate. Min Capacity of gear motor is 10 HP or as per Manufacturers recommendation.

13.5.4. **Protective coating:** The protective coating for hanger door frame shall be same as PEB members and outer surface of cladding sheet shall be same finish of hanger cladding or as directed by GE.

13.5.5. **Coloured Panel Cladding:** Each modular section of the door leaf frame shall be provided with 40mm wall sheeting and coloring on external surface is same as that of hanger cladding on the external surface of the leaf frame. Each section shall be provided with cladding rails to suit the dimensions of the coloured sheet.

13.5.6. **Door Movement**: Door leaf frames shall be supported at the bottom on wheels. The wheels shall be of steel designed specially to run on bottom track wheels with electrical operated gear motors of suitable capacity. The wheels are steel specially machined to run on bottom track wheels with scaled ball bearings of make SKF and self lubricating. All wheels are bolted to the door frame. All the leafs are guided at the top with three heavy-duty steel rollers.

13.5.7. **Bottom Tracks**: The bottom tracks shall comprise three run of rails mounted on transverse support and alignment bearers along with fixing bolts etc. The bottom track assembly shall be assembled at site before grouting. The bottom tracks shall extend upto the extremities of the door parking bay on both sides.

13.5.8. **Buffers**: Heavy duty buffers shall be provided at the parking bay extremities of each bottom and top track. These buffers shall act as alternate mechanical stoppers.

13.5.9. **GENERAL NOTES**

- (a) All bearings shall be of self-lubricating type and of make 'SKF'.
- (b) Material for top & bottom rail shall be mild steel.
- (c) Door leaf frame over lap shall not be less than 50mm.
- (d) Each leaf shall be provided with 3 sets of cleat of suitable dimension which shall be capable of with standing the weight of the door including, in case rollers become free/fails/break then door shall not fall from its rails.
- (e) Each leaf contain 02 sets of wheels duly fitted Electrical motor of min 10HP drive electrical or as per manufacturer recommendation. The connection of electrical power each motor shall be one from top of hanger door as shown in drawing.

13.6. **EXPANSION JOINT/ISOLATION JOINT:**

13.6.1. **PREMOULDED JOINT FILLER IN EXPANSION JOINT** : It shall conform to IS 1836 Part 3. The thickness shall be 25mm with tolerance +/- 1.5mm and shall be of the maximum available standard length not less than one panel width. The filler board shall be positioned vertically with the prefabricated joint assemblies along the line of the joint within tolerance of +/- 10mm. The depth of the board shall be 25mm less than thickness of slab within a tolerance of +/- 3mm so that the top of the board shall be below the surface or will not impede the passage of the finishing straight edge or oscillating beam of the paving machine.

13.7. **SEALING COMPOUND:**

13.7.1. The joint sealing compound shall be fuel and heat resistant type conforming to IS 1836 Part 3 and polymer based. It shall be adhering to concrete without any cracking, spalling or disintegration. 25mm dia Backer Rod shall be provided throughout the joint separating the filler board and sealing compound as shown in Drawing.

13.8. **ROLLING SHUTTER [SEMI MOTORIZED]:**

13.8.1. Rolling shutter shall be of Semi Motorized type with ball bearing including top cover, anchoring, and other accessories all as specified in MES Schedule Part – I. The thickness of lath section shall be 1.25 mm thick and all the steel surfaces shall be painted with two coats of synthetic enamel paint over one coat of red oxide primer. Rolling shutters shall be any one of the makes specified hereinafter and shall conform to IS – 6248.

13.9. **BIRD PROOFING** :

13.9.1. The Design of the hanger roof should be such that no birds can sit and set up nest and hangers should be bird proof by covering all places/structural members (wherever there is a possibility of sitting and set up of nest by Birds). The bird proofing shall be mesh made of antibird net UV black in colour made of materials polyfin all-weather proof co-polymer of machine knotting using CNC machines with DSLS technology for antislip knotting heat setting shall be stearn set for greater dimensional stability and knot firmness and diameter of the mesh shall be 1mm and the size of mesh 25mm x 25mm (± 2 mm) and shall achieve twin strength of 16kg minimum and Mesh Breaking Strength (MBS) 12Kgf and KBS 22 Kgf minimum, fixed complete, all as per manufacturers instruction on trusses. Bird Proofing arrangement shall be fixed/tied to truss members with nylon wire as per manufacturer's instructions. **Makes: Leo Technova India / Pigeon control India [080 48074740]/ Omkar bird proofing [India] Pvt Ltd. / Reach netting solutions Pvt ltd / Kwality net MFG Co / Safety Net company.**

13.10. TURBINE VENTILATORS

13.10.1. Turbine ventilators/Turbo Air Ventilators (24" dia wind ventilators) shall be provided at locations shown in structural drawings. These shall be of make Mbient Turbo or equivalent as approved by GE. Brief specification of Turbine Ventilators are as under :

Throat Dia	:	600mm	
Outer Dia	:	800mm	
No of Vanes	:	42 Nos	
Top Cover	:	0.35mm thick Galvalume as IS : 513	Bearings : Twin ZZ Ball Bearings
Turbine Blade	:	0.40mm thick aluminium alloy as per IS 19000 Alloy BALCO or equivalent	
Throat Ring	:	0.60mm thick Galvalume as per IS : 513	
Bottom Ring	:	0.60mm thick Galvalume as per IS : 513.	

14. EOT CRANES :

14.1. The work under relevant item comprises of provision of EOT cranes of **15 Ton** and facilities as described in Schedule "A" and as per the following detailed specification.

14.1.1. **DESIGN APPROVAL:** The bidder shall submit complete design calculations, drawing and other details along with end carriage details such as wheel loads, wheel base and spacing, number of wheels, crane weight, weight of crab, number of crane girders, hook approach etc for the approval of the Accepting Officer before fabrication of the crane. Crane fabrication at factory shall commence only after obtaining approval of design details by the Accepting Officer.

14.2. DETAILS:

14.2.1. The crane facilities are to be provided on the gantry girders by fixing the rails and aligning to the required span, overhead clearance levels etc. as per drawings of the buildings.

14.2.2. The crane shall be complete in all respects with all necessary parts essential for operation and safety of crane as per prevailing standing practice. Whether particularly specified. All these shall be designed, supplied, packed and transported to site, delivered, installed, tested and commissioned by the contractor, the lump sum quoted by the tenderer is deemed to have been included for the same and the following:

- (a) Supply of all drawings and documents.
- (b) Any other item which is not covered above but are essential or the completion of work.
- (c) Erection, commissioning and guarantee tests as brought out in particular specification

14.2.3. In addition to normal safety devices, controls for the following are to be provided:

- (a) Limit of rise, lower, forward and reverse travel.
- (b) Audio visual alarm against any mal-functioning.
- (c) Emergency stop in the pendant.

14.3. TECHNICAL DETAILS FOR EOT CRANE:

14.3.1. **DESIGN:** In the design of components adequate factor of safety, as per IS 3177 is allowed, impact, fatigue, wear and stress concentration Factors are taken wherever applicable.

14.3.2. **MATERIAL AND WORKMANSHIP:** All material used in the crane are selected from quality material Adequate factor of safety are used in the design of all parts subjects to stress and shocks. Steel conforming to IS 2062 or equivalent is used in manufacturing of main load bearing member.

14.3.3. **MOTORS:** Crane duty electric motors for hoisting and LT motors as per IS 315, 415V, 50Hz AC rating class 'F' insulation three phase with low loss steel laminations, aluminium body with Thermistor Protection, moisture resistant insulation, dynamically balanced for vibration free and quiet operation are used.

14.3.4. **GEAR BOXES:** All gearboxes used in the Crane are totally enclosed in dust proof construction. The gears run in oil bath, teeth are designed to give an optimum balance between bending strength, contact stress and maximum durability rating based on dimensions of module as per IS-2535-1963. Pinions are of EN24 and Gears are of C-45 forged/Rolled steel and all keyed to C-40 shaft. Gears and Pinions of helical/spur are all precision hub cut machined. The shaft rotates on anti-friction type ball/roller bearings of totally enclosed gearbox increase transmission efficiency. And longer gear life. The gearbox body design enables the gears to have splash lubrication.

14.3.5. **BRAKES:** Hydraulic thruster, shoe type or disc Type brakes are provided in the hoisting and LT motion. These brakes are automatically released when motor circuit is ON and applied when motor circuit is OFF. This feature works as a positive device as the brake automatically comes into operation when the power supply fails to ensure safety and reliability in operation.

14.3.6. **BEARINGS:** All moving parts of Cranes are fitted with anti-friction type ball/spherical and roller bearings.

14.3.7. **COUPLINGS:** Geared couplings or spring type torque couplings are provided between all gear boxes and motors that hang higher torque to size flexible ration, thus offering a compact assembly capable of high load and speed. It accommodates ratings permit axle float or thermal expansion of connected shaft.

14.3.8. **LUBRICATION:** The crane is to be provided with necessary lubrication points/fittings to facilitate maintenance.

14.3.9. **POWER SUPPLY:** The Crane is suitable for operation of 415 volts.

- 14.3.10. **OPERATION AND CONTROLS:** The Cranes are floor operated type and for easy operation pushbutton station is suspended from hoisting unit at a suitable height from the floor level with control voltage of 110 volts 8 way push buttons are used.
- 14.3.11. **CRAB FRAME:** The frame construction is welded and fabricated out of plates and channels. The hoists and cross travel mechanism mounted on this frame and are provided railing for safety.
- 14.3.12. **HOIST MACHINERY:** The machinery consists of motor, brake; gear box rope drum and bottom block assembly.
- 14.3.13. **ROPE DRUM:** The rope drum is of seamless/tube fabricated from construction having right hand and left hand deep grooved machined to suit the hoisting ropes. The drum is such that there is only one layer when the rope is fully wound. Also the length of position and one spare groove for each rope lead when the hook is at its highest position.
- 14.3.14. **WIRE ROPE:** wire rope is of best plough steel, fiber/steel core normally 6*37 constructions having tensile strength of 1770N/Sq.mm. The wire rope has the factor of safety in accordance with IS 1377 depending on the Class and duty of the crane.
- 14.3.15. **BOTTOM BLOCK:** The hook is of single plane shank type confirming to IS 3815 and made of forged steel or equivalent supported on thrust bearing.
- 14.3.16. **ROPE SHEAVES:** These shall be of Grade 25 Casting; running on bearing adequate guards are provided the rope from leaving the sheaves.
- 14.3.17. **LIMIT SWITCHES:** Roller types Limit Switches are provided to prevent the over loading and hoisting.
- 14.3.18. **CROSS TRAVEL MACHINERY:** Cross travel machinery consists of motor totally enclosed dust proof gear box, brake, wheels etc.
- 14.3.19. **CRANE BRIDGE:** The Crane Bridge is designed to sustain all stress arising due to vertical and lateral force with impact to which they are subjected and saving in overall weight of the Crane and the essential structural rigidity. The maximum deflection of the main girder is limited to 1/1000 the span of live load including the weight of the Trolley. The bridge Girders with long span are provided in 2 pieces for easy transportation, which are later combined and erected.
- 14.3.20. **TYPE OF GIRDERS:** Single and Double type are provided as per design requirements fabricated out of plates into a box type construction and are made out of IS -2062 materials.
- 14.3.21. **PLATFORM:** M S plate/anti skid plate platform of IS 2062 shall be provided for full length on drive side of the bridge girder with safety rail.
- 14.3.22. **WHEELS:** The wheels of the trolley and the end carriages shall be EN-9 machined confirming to IS 2707 GR 11 duly spin hardened to 300 bhn material. Double-flanged straight tread type fitted with Anti friction bearing mounted on L/type bearing housing for ease of maintenance.
- 14.3.23. **END STOPPERS FOR CROSS TRAVEL:** Steel end stoppers are provided on either sides of the bridge to limit the motion of the trolley.

- 14.3.24. **END CARRIAGES:** End Carriages are fabricated from rolled steel section/ plates with adequate stiffeners to give rigid construction. The girders with gusset plates are section set on the carriages and are joined with the bolts in the rimmed holes. Rubber buffers are provided on either side of End carriage.
- 14.3.25. **LONG TRAVEL MECHANISM:** The driving machinery for the long travel motion is twin motion drive. Enclosed drive unit drives end carriages. This consists of totally lubricated spur/helical gearbox, motor, brakes, couplings with unique misalignment absorbing knuckle shaft assembly. The shaft drives one wheel of each end carriage.
- 14.3.26. **CURRENT COLLECTION SYSTEM:** 415 Volts, 3 phase, 50 Hz AC supply is required. LT and CT hoist panel includes all electrical components of SPRECHER AND SCHUH make only SOFT STARTER will be provided in the Longitudinal motion for elimination initial jerk while starting Power feeding arrangement like festoon trolley or Angle/insulated DSL system can be provided at an extra cost.
- 14.4. **GENERAL DETAILS:**
- [a] Power Supply : AC, 50 Hz, 415 Volts, 3 Phase, 4 wire with earthing neutral.
 - [b] Class of Crane : Class II as per IS – 807.
 - [c] Crane structure : EOT crane Non flame proof
 - [d] Main Hoist : IS – 3177.
 - [e] Type of hook : Standard single hook with safety latch and swiveling capability.
 - [f] Whether the crane is indoor or outdoor : Indoor
 - [g] Type of operation : EOT, Electrically operated for LT, CT & Hoist motions.
 - [h] Loading particulars : EOT: Safe working load each as specified in Schedule “A”.
 - [i] Operating speeds
 - [1] Hoist speed for EOT crane only : As per Data Sheet [Appendix ‘A’]
 - [2] LT Speed for EOT crane only : As per Data Sheet [Appendix ‘A’]
 - [3] CT Speed for EOT crane only : As per Data Sheet [Appendix ‘A’]
 - [j] Lift of the hook above floor level : As per Data Sheet [Appendix ‘A’]
 - [k] Type of control : Pendant push button system hanging type suitable for operation from floor level
 - [l] Span : [As per drawings and to be checked at site]
 - [m] Position and location of gantry girders : As shown in drawing.
 - [n] Position and location of gantry girders : As shown in drawing.
 - [o] Side clearance : As per drawings and to be checked at site.
 - [p] Distance from top of the gantry rail to lowest overhead obstruction : As per drawings and to be checked at site.
 - [q] Down shop lead [only for EOT] : Shrouded bus bar system.
 - [r] Rope Drum : Flanges required at both ends.
 - [s] Gentry rails: 105 lbs/yard
 - [t] Bay length : As per Data Sheet [Appendix ‘A’]
 - [u] Wire rope : As per IS [Size & Nos shall be submitted by the tenderer]

14.5. The tenderers shall ensure that the crane shall be manufactured as per the tolerances specified below:

- [a] Span over LT wheels : ± 6 mm
- [b] Diagonal on wheels : ± 5 mm
- [c] Long travel wheel alignment : ± 1 mm
- [d] Tilt of wheels or balance : ± 1 mm/1000 [Horizontal Vertical]
- [e] Trolley wheel gauge : ± 2 mm for gauge up to 2.5M.
 ± 2 mm for gauge above 2.5M.
- [f] Differences in height between trolley rails [H] in relation to the trolley track gauge [S] shall be within the following tolerances:
 - [i] 'S' up to 2500 mm : 'H' 3 mm
 - [ii] 'S' Above 2500 mm : 'H' 5 mm
- [g] Tolerances of speeds with rated load, voltage, frequency shall be as follows:
 - [i] Traveling & Traversing : $\pm 10\%$ of specified speed
 - [ii] Hoisting : $\pm 10\%$ of specified speed
 - [iii] Lowering : $\pm 15\%$ of specified speed.

14.6. STRUCTURAL DETAILS:

14.6.1. **GENERAL:** Crane structures shall be designed in accordance with the latest edition of IS 807 taking the following additions/deviation as applicable into account.

- (a) Unless otherwise specified, only welded joints shall be used.
- (b) Not less than two turned fitted bolts or equivalent length of welding at each joint shall be used for connection.
- (c) Black bolts shall not be used in the main structures of the crane and high tensile steel bolts shall not be used unless approved by the Engineer-in-Charge.
- (d) The calculated strength of joints made by friction grip bolts in structural members is not less than the calculated strength of the member.
- (e) Bolts used in shear shall be fitted into reamed holes.
- (f) Where bolts pass through sections having tapered flanges tapes pads shall be welded to the tapered flange. Taper washers shall not be used.
- (g) Transverse fill at welding on load carrying members shall be avoided.
- (h) All butt welds on structural members subjected to tensile stress shall be radiographically. Remaining all welded joints shall be liquid by penetration method as specified by IS: 822.
- (i) For plates, bars, angles and where practicable, other rolled sections used in the load bearing members of the structure shall be as per relevant IS specification.
- (j) Standard metric thread bolts only shall be used. Inch bolts are not to be used.
- (k) Splice shall be designed to resist all the forces and moments to which it is subject to plus 50% thereof. Whoever, in no case, the strength developed by the splice shall be less than 50% of the effective strength of the material spliced. Spliced shall be proportioned and arranged, so that the gravity axis of the splice is in line with the gravity axes of the members jointed so as to avoid the eccentricity of the loading:

- (I) The following shall be ensured for connecting bridge girders to the end carriages.
- (i) The bridge girders shall be connected to the end carriages by large gusset plates.
The bridge girders shall be attached to the end carriages by welded connection if the end carriages are in two pieces or by turned barrel bolts in case of one piece and carriage. The main girders shall extend over the whole width of the end carriages and the extension shall have sufficient section to take the maximum reaction and moment. The girders shall preferably be match at the ends to receive the end carriage and shall be secured along the vertical edge of the hatch in addition to being secured along the top edge. If this arrangement is not possible, bridge girders can be connected to the end carriages by means of shear connections, in which case the end carriages shall be designed to take up full effect of torsion in addition. Adequate top and bottom gussets shall also be provided between the end carriages and bridge girders.
 - (ii) Girders other than notched for four-wheel cranes shall be rigidly attached to end carriages. They shall be tied together by vertical end plates. The vertical end plates shall be capable of resisting the tensional moment at the end of the girder, and the rivets or welds on these plates shall be capable of developing this moment. Horizontal end plates shall have a section module equal to that at the end of bridge girder. Gusset plates shall be provided to assist the cranes remain square.
 - (iii) Notched girders for four wheel cranes shall also be provided with horizontal and vertical plates as above and shall be rigidly connected to the end carriage along the vertical edge of the notch as well as the top.
 - (iv) When lateral end fixates used in design, the horizontal moment of internal and horizontal section modules of the end tie shall bear least equal to these horizontal plates of the end tie shall be capable of developing the lateral end moment.

14.6.2. BRIDGE GIRDERS:

- 14.6.2.1. The bridge girders shall be of box construction. [Double plate girders]. Girders shall be sufficiently strong and rigid to withstand the most severe combination of loads that may develop under different working condition. The design of the bridge girder shall be in accordance with the latest edition of IS – 807 taking following additions/ deviations as applicable into account:
- (a) Horizontal forces exerted on the bridge structure due to buffer impact shall be determined at 50% of the rated traveling speed of the fully loaded crane and the characteristics of the buffers used [Freely oscillating loads suspended on the load suspension system shall not be taken into consideration].
 - (b) The force in each member shall be determined for all the loading combinations and the members shall be designed for the maximum force that may arise from any of these combinations of loading.
 - (c) Allowance shall also be made for twisting moment caused by starting and

stopping of LT motor. This shall be considered as equivalent to 250% of the rated full load torque of the motor, to be added, where appropriate to the twisting moments due to other loading.

- (d) Local bending moments to be assumed in the calculation of stresses shall be not less than $WL/6$ at the panel center and $WL/12$ at the panel points where;

W = The total in the member arising from live load and also in the case of vertical loading the weight of the member.

L = The distance between panel points

- (e) For the determination of local stresses in webs, flanges and the at weld seams of throat rivets of rail girder, the individual wheel load shall be considered as dispersed uniformly over a horizontal distance of $2h = 50\text{mm}$, where h is the height of the top of the rail from the point of consideration.
- (f) For plate girders, span to depth ratio shall not exceed 18.
- (g) For plate box girders, full length diaphragms shall be provided at bridge drive supports.
- (h) For box plate girders, in addition to the required full length diaphragms, short diaphragms shall be inserted where required to transmit the trolley wheel load to the web plate and to limit the maximum stress in the trolley rail with safe permissible stress.
- (i) Top flange of the girders shall not be considered as giving supports to the rails, in computing the rail size.
- (j) Trolley rail sections shall not be considered in the design of the bridge girders.
- (k) For box plate girders, all diaphragms must bear against the top flange. The thickness of the diaphragms must be sufficient to resist the trolley wheel load in bearing on the assumption that the wheel load is distributed over a distance equal to width of the rail base plus twice the thickness of the flange plate.
- (l) Girders shall be cambered on amount equal to the deflection caused by dead load plus one half of the live load and the trolley. The bridges shall not deflect more than $1/900$ of span with safe working load on the trolley, with trolley stationed at mid span and excluding deflection due to dead load.
- (m) Box girders shall be so constructed as to eliminate accumulation of water or oil in them. If it so specifies, welded box girders shall be provided with breathing holes to allow for expansion contraction of air due to temperature changes. Special care shall be taken with cranes for outdoor use to eliminate crevices or opening where water may accumulate and cause corrosion.
- (n) Number of splices to make up the requisite lengths for web and flange

materials of the girder shall be more than 2 for girders up to 24 m span and 3 for girders over 24 m span.

- (o) Squaring marks shall be provided on each girder to facilitate erection and squaring of the bridge.

14.6.3. END CARRIAGES:

14.6.3.1. End carriages shall be fabricated from rolled steel sections or plates, or both, welded together to form a box, a solid box except for essential openings which shall be reinforced.

14.6.3.2. End carriages shall be of ample strength to persist all stresses likely to be imposed on them under service conditions, including collision with other cranes or steps. The length of the end carriage shall be such that no other part of the crane is damaged in collision. The end carriages shall be fitted with substantial safety steps to prevent the crane from falling more than 25mm in the event of breakage of a track wheel, bogie, or axle. The safety steps shall not interfere with the removal of wheel. Suitable jacking pads at a height of carriage for jacking up the crane when changing track wheels. Jacking pads shall not interfere with the replacement of track wheel.

14.6.4. TROLLEY FRAME

14.6.4.1. Trolley frame shall be produced in one piece unless there are transport limitations. In the case of splicing of the frame, the design shall be such that one unit of a mechanism mounted on one part of the trolley does not come over the other part. Machined bolts or rivets shall do connection between the two parts of the trolley.

14.6.4.2. Drum bearings and supports for upper sheaves shall be located so as to equalise the load on the trolley wheels as nearly as possible.

14.6.4.3. The trolley frame shall be built up of rolled sections, and plates to form a rigid structure capable of withstanding all stresses that will develop during the working of the crane and shall be arranged to offer maximum accessibility to mechanical and electrical parts placed on it. It shall be designed such that at the highest position of hook there shall be a clear distance of 700mm between the lowest point of trolley obstruction and the highest point of bottom block. Deviations shall be made only with specific approval of the Engineer. The top of the trolley frame shall be plated all over except for openings required for the ropes and flexible cables for bottom block etc., to pass. The openings in the trolley frame shall be such as to keep the ropes or cables at least 125mm away from any part of the trolley frame or equipment to prevent damages for all positions of the bottom blocks. All mechanical and electrical equipment shall be placed above the trolley top plate as far as practicable. For any parts placed below the trolley top plate, access for maintenance, repair and replacement shall be provided. Hand rails shall be provided on all the four sides of the trolley [except in case where protective guard is fitted on the trolley conductor side then hand rails on the three other sides only shall be provided] with openings on the platform side opposite to the trolley conductor side.

14.6.4.4. The trolley shall be fitted with substantial safety steps to prevent the trolley from falling more than 25mm in the event of breakage of a track wheel, bogie or axle. This safety steps shall not interfere with the removal of wheels. The trolley shall be provided with lifting pads for jacking up the trolley in case of wheel removal. The jacking pads shall be at a height of about 300mm from the rail level and shall not interfere with the removal of wheels.

14.6.4.5. **TROLLEY RAIL:** Trolley track rails made of square bars section shall be clamped to the girders with clamping plates spaced not more than 900mm apart with welded alignment blocks between every two clamps such that the distance of a clamp from any adjacent alignment block shall not be more than 450mm. Rails shall be prevented from creeping in the longitudinal direction by rail steps, riveted or welded. Rails shall be made continuous by welding standard lengths. At splice joints rails shall be welded at site and as such, edge preparation of the rails shall be done in the shop. For double web box girders, clamps held by studs welded to cover plates, spacing of clamps and alignment blocks being as stated earlier shall fasten rails.

14.7. MECHANICAL DETAILS:

14.7.1. **DESIGN OF MECHANISMS:** In the design of components on the basis of ultimate strength the value of stress factor used shall be the product of the basic stress factor and the duty factor. The basic stress factor and duty factor shall not be less than given in IS – 3177.

14.7.2. **ROPE DRUMS:** Rope drums shall be fabricated or of cast steel. All rope drums shall be stress relieved. The length of the drum shall be sufficient to accommodate in one layer the length of rope requisite for the specified lift and in addition, not lower than two full dead turns at each anchored end and at least one spare groove at the other end. Each rope end shall be clamped with minimum two clamping wedges with at least two numbers of bolts on each clamping arrangement.

14.7.3. **HOIST ROPES:** Ropes shall be of cross lay 6 x 31 construction of best plough steel having tensile strength of 180 Kg/mm and number of falls should be four maximum. Left hand lay wire ropes shall not be used unless absolutely necessary. The factor of safety of wire ropes shall not be less than 8. Reverse bond in rope shall be avoided as well as possible.

14.7.4. ROPE SHEAVES:

14.7.4.1. All sheaves shall be of cast steel. All sheaves shall be identical; however exception may be made for equalizer sheaves. The equalizer sheave/bar shall be mounted where feasible above the trolley floor and shall be easily accessible and removable from the floor of the trolley. Equalizer sheave/bar shall be arranged to turn and swivel in order to maintain the alignment under all circumstances.

14.7.4.2. All sheaves shall have guards, which fit close to the flange having a clearance not more than 1/4th rope diameter between sheave and inside of guard. Equalizer sheave/bar shall be mounted on rollers bearings/ ball bearings.

14.7.5. **DRIVES:** For long travel motion central drive shall be as per relevant IS specifications. All parts of the long travel drive shall preferably be located above the top platform. No part of the cross travel drive shall be located below the trolley platform. Long travel drive, if located below the top platform, shall be easily accessible for inspection, maintenance and removal from top.

14.7.6. GEARING:

14.7.6.1. Straight and helical spur gearing shall normally be used for all motions. Worm and bevel gears shall not be used without specific permission from GE. First and high-speed reductions shall be through helical gears. All first reduction pinions and also other pinions if feasible shall be of integral with the shafts. All gears shall be of hardened and tempered alloy or carbon steel with machine cut teeth. Gear teeth shall be preferably cut in metric module system. Surface hardening of teeth is not allowable.

14.7.6.2. Gears and pinions of design and size not suitable for foregoing or gears for which suitable wrought steel blacks are not available shall be fabricated of or of cast steel gear of gearbox assembly should be lapped.

14.7.7. **GEAR BOXES:** All gears shall be completely covered or guarded by covers firmly attached to brackets. All gears shall be enclosed in oil tight casings except where not possible. All gear shafts shall be supported on bearings mounted in gear box unless specifically agreed otherwise. In case totally enclosed gear boxes splash or automatic lubrication system shall be used. All fabricated gear boxes shall be stress relieved. Cover shall be split horizontal at each shaft center line and fastened and arranged that the top half can be removed for inspection and repair without disturbing the bottom half. Directly above the most line of teeth, there shall be hand holes with oil tight bolted covers. The gearboxes shall be provided with breather vents, oil level indicator dipsticks and easily accessible drain plug. Radial clearance between the gear box inner surface and the outside diameter of the gears shall be at least $1\frac{1}{4}$ time the depth of the largest gear tooth inside the gear box or 20mm whichever is higher. The facial clearance between the inner surface of the gearbox and the face of the gear of pinion shall be at least 20mm.

14.7.8. **BEARINGS:**

14.7.8.1. Ball and roller anti friction bearings of FAB, EKF, NBC or equivalent make shall be used throughout except where specified otherwise. Rate of life of ball and roller bearings shall be not less than total life in working hours given under. Design of mechanic life of bearings shall be calculated in accordance with manufacturer's recommendations. All bearing housing shall be made of cast wrought steel, bolted to a rigid portion of crane structure by at least 2 bolts. Housings shall be split on the shaft center line to permit removal of the shaft. The underside of the base of each bearing pedestal shall be machined and shall bear upon a machined surface.

14.7.8.2. For bearings etc. lubricating points located at easily accessible position for lubricating with hand grease gun should be provided.

14.7.9. **COUPLING:** Motor shafts shall be connected to gear extension shaft through flexible shock absorbing couplings. For driving hoist drum, geared couplings shall be used between hoists rope drum and hoist gear box output shaft. Solid coupling shall be used for connecting intermediate lengths of long travel and cross travel shafts. Geared or universal coupling shall be used between gear box output shaft and intermediate shaft and end shaft. Between intermediate shaft and end shaft and between end shaft and wheel axle, any other special coupling which can give better and more reliable service may be used after obtaining specific approval of the GE.

14.7.10. **LIFTING HOOKS:** Standard "C" type hook shall be used unless otherwise specified. The hook shall conform to the latest addition of BS 482 or to the relevant IS specification.

14.7.11. **BRAKES:**

14.7.11.1. Electro Hydraulic thrust brake and electromagnetic brake shall be provided for each drive. Brakes shall be mounted on the input pinion shaft of the gear train. The brake shoes shall be hinged type. Brake levers shall be forged or fabricated of or of cast steel. Hinge pins shall be of hardened alloy steel and shall be lubricated. These hinge pins shall be provided with steel bushes at bearing points. Brake drums shall be forged or of cast steel. Drums shall be completely machined and dynamically balanced.

14.7.11.2. Width of the brake drum shall be 5 to 10 mm more than the width of the brake shoes.

14.7.11.3. The hoist brake shall be capable of arresting the rated load while lowering, in a distance not more than $S/120$ where 'S' is the hoisting speed in M/min.

14.7.11.4. Thebrakesforlong&crosstravelmotionsshallbedesignedfromthefollowingconsideration s:

- [a] Braking against traveling shall be capable of arresting the motion within a distance in meters equal to 10% of the speed in m/min when traveling at rated speed with rated load.

14.8. ELECTRICAL DETAILS FOR AC POWERED EOT CRANES:

14.8.1. **SCOPE OF SUPPLY:** The crane electric include power disconnecting switch on the crane bride walkway immediately after the main current collector gear. Protective switch gear, motors, motor control panels, rectifier units, resistors, brakes, limit switches, power and control cable on the crane on trolley lines, socket outlets, lighting distribution panel and lighting fixtures with lamps, joist beam with fastened cable arrangement, pendant push buttons and equipment earthing material.

14.8.2. **CLIMATIC CONDITIONS:** The equipment offered shall be suitably hot tropical and humid climate. However, maximum temperature and 100% humidity shall not occur simultaneously. Ambient temperature is 45° C.

14.8.3. STANDARDS:

14.8.3.1. The equipment shall be selected, assembled and tested as per guide lines provided in the latest edition of IS – 3177 for Class 2 duty cranes and subject to any modification and requirements specified by the GE.

14.8.3.2. The equipment shall also conform to the latest Indian Electricity Rules and Regulations as regards safety requirements. Earthing and other essential provisions specified therein. All equipment shall comply with the statutory requirements of the Government. of India and Government of AP.

14.8.3.3. The equipment shall be designed and selected to facilitate inspection, cleaning, replacement and repair and for use where continuity of operation and safety are first considerations.

14.8.3.4. Since power cables having copper conductors shall only be used for connecting up the electrical equipment on the cranes, the tenderer shall ensure that equipment selected and offered by them shall have ample internal space for easy termination of cable.

14.8.3.5. The robust construction and ample rating margins which experience has shown to be necessary in operation shall be ensured throughout manufacture.

14.8.4. POWERSUPPLYCONDITIONS:

14.8.4.1. The poser shall be available at 415 Volts, 3 Phase, 4 Wire, 50 Hz earthed system. The power and control equipment selected shall be suitable for operation on $\pm 6\%$ variation in the voltage and $\pm 3\%$ variation in supply frequency.

14.8.4.2. Thefollowingvoltageshallbeusedinthecranes.

[i] 415 Volts, 3 phase, 50Hz AC [Earthed system] - For drive motors

[ii] 220 volts DC - Brake coil

[iii] 230 volts, single phase 50Hz, AC- For lighting [Obtained through transformer

secondary 115/0/115 volts with midpoint earthed]

[iv] 110 volts single phase 50Hz AC - For control circuit of floor operated cranes

[v] 110 single phase 50 Hz, AC - For control circuit in general

[vi] 24 volts, single phase, 50 Hz, AC- For hand lamp socket outlets.

14.8.4.3. Depending upon application, the different voltage mentioned above other than 415, 3 phases, 50Hz, AC shall be obtained through individual separate transformers and transformer rectifier units connected to 415 volts AC incoming. Each transformer shall be provided with tapping at $\pm 5\%$ and $\pm 10\%$.

14.8.5. MOTORS:

14.8.5.1. All crane motors shall be totally enclosed fan cooled wound rotor motors and all shall be of slip ring type. However puny motor for micro hoist motion can be provided.

14.8.5.2. All the motors offered shall be suitable for heavy duty reversible crane service having duty cycle rating not less than 40% unless specified otherwise. The supplier shall be responsible for selecting ratings that will meet the class 2 duty with the type of control specified. Ambient correction factors depending upon ambient temperatures specified for each individual crane in the respective clearance diagrams shall be supplied to de-rate the motor.

14.8.6. HORSE POWER:

14.8.6.1. The motor horse power shall be computed as per IS – 3177, service factor for electrical service class II crane shall be 1.3 for long and 1.4 for cross travel motion for selection of motors.

14.8.6.2. The average acceleration shall be such that the performances of cross and long travel motions shall conform to the requirements given in crane clearance diagrams of respective cranes.

[a] **TORQUE:** The pull out torque of the motors at rated voltage and frequency shall be not less than 2.75 times of the nominal torque.

[b] **CLASS OF INSULATION:** All motors shall be class B/F insulated [Class “B” for stators and Class “F” for the rotor] with maximum permissible temperature measured by resistance method not exceeding 1100°C and 1350°C.

[c] **OTHER FEATURES:** The motors shall have continuously rated slip rings. The terminal boxes shall be large enough to accommodate Aluminum conductor cables which may have de-rating factor as low as 0.4 on account of high ambient temperature and grouping factor. In cases where sufficient clearance is not possible in front of terminal box for facilitation maintenance/cable connections terminal box shall be provided on the top of the stator frame.

14.8.7. CRANE CONTROL

14.8.7.1. GENERAL:

[i] All control shall be fully magnetic operated through pendant push button over contactors and time relays. The long and cross travel motion shall be provided with plugging control for which due care shall be taken by the supplier while selecting the drive and control equipment.

- [ii] The control shall be designed [rotor external resistance] to draw the required mechanical horse power from the drive motor, though the motor is to be selected for higher thermal rating [VVVF drives].
- [iii] Hoisting circuit shall be designed for resistance control on the rotor circuit during lifting operation. To control the speed while lowering, counter torque, single phase dynamic braking and super synchronous braking methods shall be employed for controlling the speed during lowering, mechanical load braking shall not be employed.
- [iv] On all motions the circuit shall be so designed that brakes come into operation immediately in the event of tripping of main line contactor. Acceleration of each motion shall be time based through time.

14.8.7.2. HOIST MOTION:

- [i] The brakes for hoist motion shall be released only after, the motors are connected to the supply, but in case of travel motion the brakes shall be released first. Unless travel brakes are energized rotor resistance contractors shall be prevented from closing. If brakes get de-energised due to failure of brake contactor or otherwise full rotor resistance shall be instantly introduced in the motor circuit.
- [ii] With automatic sequence of acceleration, the peak torque shall be limited to about 1.8 times the rated full load torque of the motor.
- [iii] The maximum variation in speed on full load during lowering shall be limited to about 120% of the rated full load hoisting speed.
- [iv] Within the rated capacity, the control shall provide maximum stability of the motion. The maximum lowering speed with about 120% of rated load on the hook shall be limited to prevent the runaway condition of the load.
- [v] The control of the brakes shall ensure that the brakes reset smoothly and arrest the motion to stand still without any appreciable downward drift, or excessive jerks on the hoist mechanism, brought to 'off' position from either direction.
- [vi] Failures of contactors or relays or faults on the controls system shall not create run away condition of the load.

14.8.7.3. LT & CT MOTION:

- [i] In this case brakes shall released before the motors are connected to power supply. On the first point the control shall provide sufficient torque to overcome the static friction and start the motion without jerk or skid on the wheels.
- [ii] Themotionshallstartandacceleratesmoothlywiththeacceleratingpeaklimitedtoabout 180% of the rated terminal of the motor.
- [iii] If a contactor or relay fails to operate in sequence the next step shall be automatically locked out to prevent heavy current kicks or jerks on the system.
- [iv] In case of 4 motors drive, it should be possible to run the bridge with two motors by releasing all the breaks. Motors shall be provided with individual over loaded relays.
- [v] When the motors are selected on the basis of service factor the control shall be

designed to suit the operating conditions of the drive so that skidding of the wheels is prevented and the drive is operated smoothly as per the duty requirements.

14.8.8. PENDENT TYPE CONTROL STATION:

14.8.8.1. The pendent push button station shall have push button for controlling all motions including speed steps. Push buttons shall return to 'off' position through spring return on releasing the same. For each motion there shall be minimum two steps designated fast and slow and also creep speed wherever specified. In addition, there shall be push buttons for main line contactors ON & OFF. OFF push button shall be of mushroom head lockable type so that power and control supply is off when the crane is not in use to prevent inadvertent operation. Facility to prevent inadvertent operation from the floor, while maintenance work is being carried out on the crane shall be provided. Push button shall be provided for alarm as well as lights. Indicating lamps for power 'ON' control ON and corner switch operation shall also be provided on the pendant.

14.8.8.2. The pendant push button control station shall be in IP: 54 enclosures, adequately provided and capable of withstanding rough handling without any damage. Separate flexible cable arrangement consisting of I-beam, cable trolleys junction boxes, cables, etc. shall be provided for the movement of the pendent push button station along crane span.

14.8.8.3. The pendant station shall be suitably supported by means of a chain and it shall be ensured that no strain is caused to the pendant cable and effectively earthed. A minimum of two spare cores shall be provided in the pendant cables.

14.8.9. CONTROL PANELS:

14.8.9.1. All power and auxiliary contactors, individual overload relays, time relays etc., shall be mounted in short steel cubicles with lockable hinged doors. The door hinges shall be such type that during repair works inside the panel, the entire door can be lifted out and placed away enabling better access inside the panel. Each motion shall preferably have its individual panel. All ventilation openings shall have screen protection. Interior of the panel should be dust and vermin proof. Degree of protection of panels shall be IP: 54 as per IS – 2147.

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14.8.9.3. Panels shall be front wired with readily accessible terminal blocks for making connection to external equipment. Panels shall be pre-wired up to the terminal strip.

14.8.9.4. All contactors etc., shall be mounted securely in a vertical arrangement with due consideration to the vibration encountered in the operation of crane. The bottom most row of equipment mounted inside the panel excepting terminal strip shall be at least 350 mm above the panel bottom cover to facilitate inspection and repair.

14.8.9.5. Terminal strip shall be fixed inside the panel preferably in horizontal manner leaving enough space underneath the panel for termination of cables in a convenient manner. A minimum clearance of 250mm shall be provided between the terminal strip and floor of panel to facilitate cabling. Power and control terminals shall be segregated. Power terminal

blocks, shall be separated from each other by means of replaceable insulated spacers. Terminal blocks shall have enough clearance to avoid tracking.

14.8.9.6. All equipment inside the panel shall have permanent identification labels in accordance with circuit diagram as also the power and control terminals. Suitable ferrules shall be provided inside the panels at wire ends. Terminal blocks shall be robust and of such construction as to preclude possibility of cable connections getting loose due to vibration on crane. Sheet steel used for fabrication of panel shall have minimum thickness of 2.0mm. Panels shall be mounted such that bottom of panel is at least 150mm above the floor. Clearance and creep age distance for the control gear shall be 10mm and 12mm respectively as per IS: 4237. Electrical clearance between rupturing parts and enclosures shall be not less than 75mm.

14.8.9.7. All control panels shall be well braced to the crane structure and each panel shall be provided with adequate number of lifting lugs.

14.8.10. **CONTACTORS:** All contactors shall be rated for AC – 23 duty. The minimum size of contactors on the power circuit shall be rated for 30 amps. While computing the rating of the contactors, proper allowance shall be given for higher currents that may be encountered on account of single phase, lowering, plugging and DC injection as per the control scheme chosen. Contactors shall be able to withstand 15 times their rated current for one second without welding of the contactor.

14.8.11. **RESISTERS:**

14.8.11.1. The resisters shall be air cooled, robust, heavy duty, and corrosion resistant punched steel grid type. The resistance boxes shall be mounted in racks that permit independent removal of any selected box so that spacing recommended by the resister manufacturer will be provided. The racks shall be robust in construction to withstand vibration due to crane operation grids and cable connecting arrangement shall be standardized in such a way that connecting points can be shifted to any desired grid at site. Resistance boxes shall be mounted in racks that permit independent removal of any selected box.

14.8.11.2. Notwithstanding ventilation requirements, resistor housing on cranes working in open yards shall be weather proof and all cranes shall be adequately protected with covers to prevent accidental contact.

14.8.11.3. Degree of protection for dusty areas shall be IP:33 and non-dusty areas IP-11.

14.8.11.4. The clearance in air between resistance and earthed metal [enclosure] shall be not less than 100mm to provide proper ventilation of grids. The clearance between resistor banks shall be from underside and terminal arrangement shall be such that cable cores do not get loose due to vibration.

14.8.11.5. The value chosen shall ensure smooth and uniform acceleration and allow for plugging and dynamic braking without ever heating. The resistors shall be rated for minimum 10 minutes duty. Temperature of resistance elements shall not exceed 2500 C at the specified duty when measured by resistance method.

14.8.12. **CIRCUIT PROTECTIVE SWITCHGEAR:** The protective switchgear shall consist of following:

- (i) One triple pole, on load isolator with fuses. The isolator shall be rated to carry at least combined full load currents of the two motions on the crane having largest power [KW].

- a. One number triple pole main line contactor rated to carry and break the combined full load current of two largest motion drives at specified duty. The circuit of the main line contactor shall be designed such that it will prevent it from being closed when;
 - b. Any of the stator or directional contactors of any motion is welded.
 - c. Any emergency corner switch is operated.
 - d. Door or gate switches are actuated.
Gravity limit switch for hoist motion is operated. Emergency stop push button on the pendant is operated.
- (ii) For protection of each drive motor against over-loads adjustable inverse time lag relays with inherent single phase prevention feature [identical to Siemens O/L relay type 3UA 19] shall be provided for each motor. These relays shall be mounted in respective contractor panels and shall be set to trip, the circuit of the motion controlled when current exceeds 200% of the normal value for more than 10 second. The control circuit of individual motions shall have OFF position interlock with respective push button.
 - (iii) Incoming supply to each motion shall be through individual triple pole off load isolators for the purpose of isolation and checking of control functions. These isolators shall be mounted in the respective control panels.
 - (iv) Isolating switches fitted with HRC fuses shall be provided for the following branch circuits:
 - i. Lighting and head lamp socket outlets.
 - ii. Control circuits.

Each control circuit branch to every contactor panel shall be provided with facility for isolation and protection against short circuit and sustained light over loads. Only grip type HRC fuses shall be used on the cranes.

14.8.13. **AUXILIARY SWITCH GEAR:**

- 14.8.13.1. A main metal clad triple pole-isolating switch shall be provided on the long travel bridge. This shall isolate all the circuits except the crane lighting circuit and the circuit of transformer supplying portable lighting socket outlets. This switch shall be without any fuse and off load isolating type.
- 14.8.13.2. The above mentioned main isolating switch shall be rated to carry at least combined full load current of two motions of crane having the largest horse powers and shall be provided with a means of locking the switch operating handle in the 'OFF' position. The switch cover shall be interlocked with the operating handle so that it cannot be removed or opened unless the operating handle is returned to the 'OFF' position. The live contacts inside the switch shall be shielded to prevent accidental contact.

14.8.14. **LIMIT SWITCHES:**

- 14.8.14.1. Limit switches shall be heavy duty type with protective enclosures of IP54 as per IS-2147.
- 14.8.14.2. All hoist motions shall be provided with limit switches to prevent the crane hook from over hoisting and over lowering. Two limit switches shall be provided for proper back

up protection. The first limit switch to act in the event of over hoisting and over lowering shall be of rotary type with selfresetting feature and be incorporated in the control circuit of the respective drive motor and the second one shall be of gravity operated hand resetting type switch connected in the trip circuit of the main line contactor, the second limit switch shall act only to prevent over hoisting limit switch incorporated in the motor control circuit shall be made to act first put in case this limit switch fails to operate, the second limit switch connected in the main line contractor's control circuit shall operate and trip the main line contactor.

14.8.14.3. Any other limit switch, anti-collision, etc., shall be provided if required. Limit switches for long and cross travel motion shall be supplied installed and wired up.

14.8.14.4. **EMERGENCY STOP BUTTON:** A mushroom head type OFF push button shall be provided on pendant station so that the main line contactor can be tripped under any emergency condition by pressing the operating head. Hoist motion shall have two breaks one electric hydraulic thrust type and another electromagnetic type.

14.8.14.5. **BRAKES:**

14.8.14.6. The brakes rating shall be adequate/ ample for the duration and frequency of operation required by the mechanism to prevent impairment of function by overheating. Each motor shall be provided with brakes. All brakes shall be of DC electromagnetic type/electro hydraulic type brakes shall be designed to fail-safe whenever the current interrupted either intentionally or by failure of main supply.

14.8.14.7. Field forcing relay shall be provided for DC brakes only. DC brake circuit shall be switched off on DC circuit for quick operation of brake.

14.8.14.8. Suitable platforms with approach shall be available for repair and maintenance of all major electrical equipment.

14.8.14.9. A minimum clearance of 500 mm shall be provided in front of panels.

14.8.14.10. **LIGHTING:** Lighting shall be provided in the crane where control panels, resistors and transformers shall be installed. Bulk head fitting with dust proof covers shall only be used for the above area four numbers under slung lights of 500 watts and with shock absorbing and anti-swing suspension shall be provided for uniform floor illumination. Screw cap type holders and lamp shall be used for crane lighting. Lighting transformers shall have 50% reserve capacity. Alarm bell shall be provided on each crane with push button for its operation. The push button shall be located on pendant. The lighting distribution board and metal clad switches incorporating fuses in every line of each circuit shall be provided.

14.8.14.11. **SOCKET OUTLETS:** Minimum of four socket outlets for hand lamps shall be provided at long travel Side Bridge and in the area where control panels, resistors and transformers shall be installed. Hand lamps shall operate at 24 Volts AC supply. Industrial type metal clad plug and socket shall be provided. A hand lamp with sufficient length of cable along with a plug shall be provided for each crane.

14.8.14.12. **CABLING:** All wiring for power, control lighting etc., shall be carried out with 1.1 KV grade 3 PVC armoured cables. All power cables shall be minimum 4mm copper or 10mm aluminium and control cables minimum 2.5 mm [cu]. Cable core shall be stranded construction. All flexible cable etc., shall have butyl rubber insulating and PCP/CSP Sheathing. Cable selection and routing on the crane shall form part of the crane design. Selection of cable sizes shall take into account the following factors:

- [a] Ambient de-rating factor
- [b] Group Rating factor
- [c] Intermittent duty factor

Suitable cable trays/trunking firmly secured to crane structure shall be provided with due regard to cable weight and vibrations encountered. Cables shall be routed so that they do not constitute a safety hazard, pose any obstruction to free movement of personnel, and properly laid to present an orderly appearance, conduit and conduit fittings if used on crane for running cables shall be of standard design and shall be supplied with complete accessories / only 50% of the conduit inside space shall be occupied by the cable.

14.8.14.13. **IDENTIFICATION OF CIRCUITS, CABLES ETC.:** Labels of permanent nature shall be provided on supports of all switches, fuses, contactors, relays etc., to facilitate identification of circuits and replacement. All panels, resistors etc., are to be properly marked for each motion. All power control cables, lighting and other cables are to be tagged at both ends as per cable number indicated in the supplier's drawings. All equipment terminals are also to be marked likewise.

14.8.15. **EARTHING:** In case of power supply to the crane through flexible arrangement, the fourth core of the power cable [earthed at isolator in the bay] shall be used for earthing purpose on the crane. The crane shall be made continuous by providing jumpers over riveted or bolted joints and the structure is earthed through the fourth core of fastened cable and earthed lead. All electrical equipment mounted on the crane shall be connected to the crane structure by means of earthing links at least at two points. Flexible cables shall have earth cores serving as earth leads for satisfactory earth connection of equipment.

14.9. Following drawings shall be submitted in six copies to the GE for approval prior to commencement of fabrication. The purchaser shall send his comments within 15 days from receipt of same:-

- [a] Electrical schematic diagrams containing details of components such as make, type rating/ range, settings etc.
- [b] Detailed structural drawings for the capacity of cranes.
- [c] Arrangement and details of pendant station.

14.9.1. All drawings required for approvals shall be submitted in stages within one month of placement of order. The CE shall return the drawings and calculations with comments within 15 days.

14.9.2. If the purchaser returns the drawings and other particulars because they are incomplete or faulty, the tenderer shall have no right to ask for any extension of time.

14.9.3. The following information is to be supplied prior to commissioning of the crane. Six copies of the following manuals/drawings shall be submitted:

- [i] Operating manual. This shall include write up and electrical controls also.
- [ii] Maintenance schedule.
- [iii] Lubrication charts
- [iv] Electrical Schematics
- [v] A consolidated list of electrical equipment indicating make, type, rating, settings etc.
- [vi] External connection diagram
- [vii] Cable routing diagrams showing cross sectional details and clamping/fixing arrangement of cables etc.

[viii] Any other special feature.

14.10. **STATUTORY REGULATIONS:** The tenderer shall follow all statutory regulations of Govt of India and Government of Uttar Pradesh currently in force such as:

[a] Indian Electricity Rules

[b] India Factories Act/Uttar Pradesh Factories Rules

The tenderer without any extra cost shall carry out any modifications on the equipment for meeting these regulations.

14.10.1. **STANDARDS:**

14.10.1.1. The crane shall be designed in accordance with the latest conditions of IS – 3177 for class 2 duty and any other standard referred to therein: and subject to any modification and requirement specified hereinafter.

14.10.1.2. Class of crane mechanism shall correspond to that of the crane unless specified otherwise.

14.10.1.3. Safe access for maintenance and removal of all mechanical and electrical parts must be ensured without any additional scaffolding. All parts requiring replacement or inspection of lubrication shall be easily accessible without the need for dismantling of other equipments or structures. All electrical cables shall be so laid that they are not liable to be damage and can be easily inspected and maintained.

14.10.1.4. All components for cranes of identical capacity and duty shall be interchangeable. Crane of the same capacity and duty shall be identical in all respects unless otherwise required.

14.10.1.5. All machinery or equipment included under this specification must be equipped with safety devices and clearances to comply with recognized standard and purchaser's requirements.

14.10.1.6. For welded construction such as that of bridge girders and carriages, trolley frames, rope drums, gear boxes etc., steel plates upto and including 20mm thickness shall conform to IS : 226 Plates above 20mm thickness shall conform to IS – 2062. Only tested quality steel shall be used.

14.10.1.7. No cast iron part shall be used on the crane except for electrical equipments. Similarly no wood or other combustible material shall be used in any part of the crane.

14.10.1.8. Guards of an a proved design, which will push forward or off the track any object placed across it such as a person's foot or arm, shall be attached to each end of the end carriage.

14.10.1.9. All wheels, coupling, open gears etc. shall be provided with covers opening on strong hinges. These covers shall preferably be made of minimum 3mm thick plates. All heavy covers shall be provided with inspection windows.

(a) All bolts except those with nylon nuts shall be provided with grip lock nuts or spring washers.

- (b) For side alignment of motors strong adjustable screws with lock nuts shall be provided.
- (c) Welded rungs shall be fitted against the foot of all pedestals, gear boxes, etc., except motors. Motors shall be provided with alignment screws for side alignment.
- (d) Fasteners for pedestal block, motors, gear boxes etc., shall be easily removable for the top of platform. Studs or body bound bolts shall not be used as fasteners for mechanical items except for fixing covers.
- (e) All edges or openings shall be provided with two guards toe angles or bent plates wherever required shall be 100mm high minimum.

14.10.1.10. Parts of steel frames carrying machinery shall be provided with doubling plates of adequate thickness welded and machined to true surface.

14.10.1.11. Defects in the material like fractures, cracks, blow holes, laminations, pitting etc., are not allowed. Rectification of any such flaw is permissible only with the approval of the Engineer.

14.11. INSPECTION TESTING & GUARANTEE:

14.11.1. **GENERAL:** The contractor based on the broad outline inspection with purchaser, the detailed procedure for testing, inspection [including the various stages] along with the schedule of time and period of individual activities. In pursuance of General conditions of contract, the inspection and testing procedures and activities shall be governed by the following clauses:-

- [i] In all cases whether at the premises of the contractor / any sub-contractor, the contractor except where otherwise specified, shall provide free of charge, to the purchaser such as labour, materials, tools, consumables, electricity fuel, water, stores, apparatus and instruments as may reasonably be deemed to carry out efficiently such tests/inspection of the materials/items and in accordance with the contract, facilities to purchaser to accomplish such inspection/testing.
- [ii] The contractor shall furnish sufficient documentary evidence that the materials used is in conformity with the specification. Where necessary, manufacturer's test certificate shall be produced and where such test certificate shall be produced and where such test certificate are not available, sample test shall be got conducted in authorized laboratories as directed by purchaser. In case the test facilities are not available in contractor's premises, the contractor shall get the items tested in authorized test samples are drawn and stamped by inspector, the cost for the tests so effected shall be to the account of contractor. Should part of the material/item be manufactured not on contractor's own premises, but on other premises, the contractor shall obtain permission for inspection to inspect and test the work as if the said material /items were being manufactured on the contractor's premises and all such work done in the other premises shall be binding on the contractor.
- [iii] The contractor shall carry out shop assembly of the complete material/items for inspection by purchaser before dispatch.
- [iv] The contractor shall dispatch only the completed units, the equipment in completed assemblies or subassemblies and isolated items shall not be accepted. If the purchaser shall have notified in writing that he is not ready to take delivery, no material/items shall be forwarded until and intimation have been given to the contractor by the purchaser that he is ready to take the delivery.
- [v] If, after the receipt of material / items at site or during or after the subsequent erection / commissioning the inspector finds any loss, defect or damage or in

their opinion, the material/items, is not of the specified quality or otherwise not according to the specification, the purchaser may at his discretion:

- a. Reject the material/item altogether in part and claim damages from contractor, or
- b. Allow the contractor to rectify or replace the entire item or part thereof as may be necessary in place of rejected material /item within a specified time. The contractor shall carry out such rectification or replacement at his own cost or.
- c. Cancel the contract and procure the material / item from other sources and recover the loss from the contractor.

In all such cases, the owner will give a notice to the contractor setting forth, the details of defects/failures found.

14.12. INSPECTION & PERFORMANCE TESTS:

14.12.1. SHOP TEST & INSPECTION:

14.12.1.1. Materials and workmanship shall be subject to test and inspection at any time during regular working hours by the purchaser or his representative. Access shall be available for inspection to all places where work is being done or stock is piled prior to shipment. The supplier shall furnish Mill test reports. Where tests of materials by other are required, the supplier shall arrange for such tests at the written request of the purchaser.

14.12.1.2. Tests at manufacturer's work shall be conducted as specified in IS-3177 and test certificates shall be furnished.

14.12.1.3. The contractor shall submit test certificates for all electrical equipment cables and all parts used in handling gears, gear boxes, rope drums, brake drums, pulley, shafts wheels etc.

14.12.1.4. The contractor shall submit material test certificates for structural steel and mechanical components such as coupling gears, gear boxes, rope drums, brake drums, pulley, shafts wheels etc.

14.12.1.5. While the crane is under manufacture, the purchaser or has the right for interim checkups at the works of the contractor and the sub-contractors and can, if they choose to do so, supervise at all the stages of manufacture.

14.12.1.6. The crane shall be inspected and tested during different stages of its manufacture starting from raw materials till the completion of the crane, by the purchaser. Inspection shall be regarded as a check up and shall be in no way binding on the purchaser.

14.12.1.7. **SHOP ASSEMBLY:** The hoist/crane shall be shop assembled prior to shipment to the extent required to ensure satisfactory field erection. All critical dimension shall be verified, all motions checked and equipment tested in the shop prior to shipping. All sub-assemblies and parts shall be match marked and metal tagged with piece numbers to facilitate field assembly.

14.12.1.8. **SHOP TESTING:** The crane shall be completely assembled including wiring and other fittings and shall be tested for full load and 25% overload conditions in the supplier's shop in the presence of Engineer-in-charge. The bidder shall submit a detailed procedure for testing of hoists at the shop.

14.12.1.9. **TESTS ON ELECTRICAL EQUIPMENT:** The switchgear and motor shall be given tests by the manufacturer according to their respective standards and manufacturer shall provide certified copies of test reports. The switchgear shall be tested after assembly at the factory for operation under simulated service conditions to ensure the accuracy of wiring and functioning of the equipment. The 440 volt circuit breakers and starters shall be given a dielectric test of 2000 volts for the minute between live parts and ground and between

opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one minute between live parts and ground.

14.12.2.

FIELD TESTS:

- [i] These tests shall comprise of the following:-
 - i. The supplier's tests.
 - ii. Acceptancetests
- [ii] After the crane & trolleys are erected all equipment and machinery shall be tested as required by the purchaser. The crane/trolleys shall be run without load and the adjustments shall than be completed.
- [iii] All tests shall be carried out in the presence of the rep of Accepting Officer and any corrections found necessary shall be approved by therep ofAccepting Officer and shall be carried out with minimum of delay.
- [iv] Thecraneaftererectionsshallbetestedasfollows:
 - [a] **DEFLECTION TEST:** The deflection of the bridge girders shall not exceed 1/900 of span with the fully loaded hoist stationed at mid-span and the safe working load at rest. The datum line for measuring the deflection shall be obtained by placing the unloaded hoist on the extreme and of the crane span. The measurement of deflection shall not take on the first application of load. The datum line for the first application of load. The datum line for measuring the deflection should be obtained by placing the unloaded trolley on the extreme end of the crane span.
 - [b] **SPEEDTESTS:**
 - i. All the motions of the crane shall be tested with rated load and the rated speeds shall be attained within the tolerance.
 - ii. All the motions of the crane shall be tested with 25% overload in which case the rated speeds need not be attained but the crane shall show itself capable of dealing with the overload without difficulty.
 - [c] **PERFORMANCE TESTS:** Thecrane shall be tested withrated load for performanceof long travel and cross travel motion to develop the required acceleration.
 - [d] **BRACKETESTS:**
 - i. The hoist brakes shall be capable of breaking the movement under conditions [i] & [ii] of this [speed tests] however the braking path with rated load shall not exceed those given in the relevant IS.
 - ii. The long travel and cross travel brakes shall be capable of arresting the motion with in a distance in meters equal of 10% of the speed in meters/min. and the retardation due to braking shall not exceed thevalues as given in the relevant IS.
 - [e] InsulationandothertestasmentionedinIS:3177shallalsobecarriedout.
 - [f] Load test is to be carried out as per IS specification in presence of user repand Engg-in-Charge for 25%, 50%, 75%, 100% and 110% and both parties have to be signed and submit along with RAR.

- [v] After suppliers tests are completed, an acceptance test shall be carried out by the purchaser's operator in the presence of the purchaser and if accepted, the crane shall be handed over to the purchaser.
- [vi] This test shall include operation and capacity test. Tests will be conducted as specified in IS – 3177. Insulation and other tests applicable to the crane shall be done as per IS – 3177. The date[s] for operation and capacity tests shall be sent by the purchaser and the supplier shall be informed in the tests by a qualified Engineer familiar with erection and commissioning of the crane.

14.13. **NAME PLATE:** Both sides of the crane shall bear one or more plates on which the following shall be inscribed:

- [a] Name of manufacture
[b] Serial Number
[c] Year of manufacture
[d] Safe working load
[e] Span

14.14. **LIST OF MAKES OF VARIOUS MECHANICAL / ELECTRICAL COMPONENTS:**

[i]	Wire rope	Usha Martin / Black Nuts / South India Wire Ropes.
[ii]	Bearings	SKF / FAG / NEG / KOYO / ZKL / NEC / TAMS
[iii]	Gear Box	RADICON / ELCON / CRNAEX / ASIAN / WMI / ACME / NUTECH / SOLID / AUTOMECH.
[iv]	Brakes	EMM / MAXO / STROMKRAFT / SPEED-O-CONTROL / STERLING CONTROL
[V]	Hook	Karachiwala / Servodaya / Herman / Mohatta
[VI]	Motors	Bharat Bijlee / Crompton / Kirloskar / GEC / Siemens / NGEF / Alstom
[VII]	Overload relays	Siemens / L & T / Bhartiya Cutler Hamer
[VIII]	Time Relays	Siemens / L & T / Bhartiya Cutler Hamer
[IX]	Limit Switches	Sterling / Stromkraft / E & P / Speed-O-Control / Siemens / Bhartiya Cutler Hamer / Cutter Hammer / L & T
[X]	Master Controllers	Emm / Sterling / Stromkraft / E & P / Speedo-O-Control / L & T / Siemens
[XI]	Resistors	Emm / Maxo / Stromkraft / Speed-O- Control / Sterling Control
[XII]	Safety Switches	Siemens / L & T / OTIS / Thakoor
[XIII]	DSL-Shrouded Bus Bar Type	Safe Track / Armatic
[XIV]	Pendent	Telemechanic / Bhartiya Cutler Hamer
[XV]	Cables	Gloster / Universal / Polycab / Havells / Nicco / Plaza / Asian Cables / Elektron

14.14.1. The contractor shall submit the Manufacturer's Test certificate for the following equipment:

- [i] Electric motors
[ii] Brake Drum
[iii] Limit Switch

[iv] Wire Rope

14.15. PAINTING

14.15.1. Before dispatch of the crane, the complete components covering structural, mechanical and electrical parts of the crane shall be given a single coat of primer. Mechanical and electrical components shall be given an additional finishing coat of paint. The bright exposed parts of the crane shall be given one coat of rust inhibitor. After erection the complete crane moving parts and electrical components shall be given two coats of approved color paints. The various components of the crane shall be painted in different colours, as per the code of practice.

14.16. PLATFORMS AND LADDERS:

14.16.1. Safe means of access shall be provided for working on the crane. The platforms shall be Min 1000 mm in width to carry out maintenance safely. The platform shall be securely fenced with a double tiered guard railing having a minimum height of 1.1 meters. All the above provision shall be according to clause 19 of IS – 4167.

14.16.2. The tendered rates shall include provision of two ring type ladders 450 mm wide for crane to be fixed at both ends of the bay for access to the crane platform. The ladder shall be fabricated out of MS angle 65x65x6mm for side parts and pipe of 40mm dia for rungs.

14.16.3. One number full length platform of 6mm MS Chequered plate construction on driving end and 2 Nos short service platforms on non driving end shall be provided. Adequate toe guards of 100mm height shall be provided along with full length of platform. The width of the platform shall extend from one side of the girder to extreme end of the end carriage.

14.16.4. 6mm MS chequered plate platform of width of 500mm running along full bay length. GI pipe of 25mm bore shall be fixed on the wall supported by suitable braked at every interval of 1.5 metres at suitable height which shall be used as hand rail while walking on walkway.

14.17. GUARDING

14.17.1. All gear wheels, pinions and chain drives shall be completely encased unless such parts are so situated in relation to the structure of the crane to be as safe as if completely encased.

14.17.2. Effective guards shall be provided for revolving shafts and couplings unless every set screws, bolts or key on any revolving shaft is sunk or shrouded or otherwise effectively guarded.

14.17.3. The sheaves of hook block fitted with two sheaves or less shall be guarded to prevent trapping of hand between sheave and their running rope.

14.17.4. **BUFFERS:** Rubber buffers shall be used for LT and CT motions.

14.17.5. **CATALOGUE:** The tenderer shall furnish the following literature in English:

[a] Along with the tender/quotation: Complete pamphlet operation and installation of the items involved giving technical information of the equipment- 3 sets.

[b] **AFTER ACCEPTANCE OF TENDER:**

- [i] As described in Para [a] above along with manufacturer's instruction books on operation and maintenance of the crane 8 sets.
- [ii] Printed charts for preparation and instructions Dos and DO notes Electric shock treatment chart etc. are to be provided in a display board fixed to wall with suitable arrangement of sizes 1.5 x 1.0m made out of 25 x 25 mm thick teak wood frame with 10mm hard board on one side and glass on other side- 1 No.
- [c] An electric danger board with symbol of skull/bone shall be displayed at the work site.sssss

14.18. **GURANTEE:** The contractor shall guarantee for the following:-

- [a] Quality and strength of materials used.
- [b] Safe electrical mechanical and structural performance in respect of all parts of the installation.
- [c] Satisfactory operation of the the entire Installation during the maintenance period for two years and replacement of parts defective and structural defects at no extra cost to the department.

14.19. **TAKING OVER:** The Installation shall be finally taken over from the contractor after certified by the Accepting Officer or his authorized representative and as per the laid rules and regulations of General Conditions of the Contracts IAFW-2249.

14.20. **TRAINING OF PERSONNEL [MES]:** Responsible for training departmental personnel for running and maintenance of the installation during before the installation is handed over to the department. The lump sum quoted in Schedule "A" shall include all charges thereof.

DATA SHEET

Ser No	Technical Specifications	
1	Type	Electrical Operated Overhead Travelling Crane Double Girder box type with VVVF drive. The crane should have arrangement to release the breaks manually in the power supply / system failure.
	Duty of class of crane	M-5
2	Safe working load	15 Ton as specified in Schedule "A"
3	Span	20 Metres as specified in Schedule "A"
	Height of hook	12.0 m from floor level of corridor
4	Bay length	35.00 Metres
	Location	INDOOR
	Classification	Main Host : M5
		Traverse : M5
		Travel : M5
	Operating Speeds	Main Hoist : 2.0 M/min
		Cross Travel : 7.0 M/Min
		Long Travel : 10.0 M/Min
	Hook	"C" type hook with swiveling antifriction thrust bearing and safety latch.
	Rope Drum	Double Flanged type seamless pipe.

	Sheaves	Forged/RolledSteelmachinedsheaves.
	Motors	Squirrel cage type induction motor for all the motions confirming to IS : 2148 and suitable for group IIA & IIB Gases.TestCertificatesforFlameproofcompatibility issuedby[CMRI]Dhanbadshallbeproduced
	Brakes	AC Hydraulic Thruster breakshall be provided for all the motionsconfirmingtoIS:2148andsuitableforgrouplIA &IIBGases.
	GearBox	Totallyenclosedsplashlubricatedtype
	Couplings	Flexiblecoupling/Rigidcouplings.
	Bearings	Antifrictionbearingszzsealedlubricatedforlonglife
	LimitSwitches	Rotarytypelimitswitchforhoistingandlevertypelimit switchforLongtravelandcrosstravelconfirmingtoIS: 2148andsuitableforgrouplIA&IIB Gases.
	CranePanel	CranepanelshallbeprovidedconfirmingtoIS:2148and suitableforgrouplIA&IIBGases.
	JunctionBox	JunctionboxshallbeprovidedconfirmingtoIS:2148and suitableforgrouplIA&IIBGases.
	Buffers	Springtypemechanical/Rubber
	Bolts&Nuts	Hightensilealloysteel
	Keys	ParallelKey[asperIS-2048]
	Rails	TherailtrackssuitablydesignedasperIS
	Glands	Allglandsshallbemetrichtheaddoublecompressiontype
	DSL system	Festoon type flexible cable mounted on 4 wheel trolley travellingonthebottomflangeofthetrackdulysupported bygalvanizedsteelchainfortakingmechanicaldragload shallbeprovided
	Clearance	0.5 Mtr.
	MovingParts	TheMovingpartsofthecranearetobemadeofbrass. Thediameterandwidthofwheelsaretobekeptmore andtobeeasilyaccessibleforreplacement.
	ControlBoard	TheControlBoardshouldhavecrosstravelalso
	Design	The Crane has to be designed byIIT or Govt EngineeringCollege/University and obtain approval before procurements.
	Pushbuttonunit	Asdirected
5	Capacity	15.0Ton
6	Side Clearance	0.5Metres
7	BLANK	
8	Gantrygirder	DoubleGirderbox type
9	Control	ThroughRadioremotetecontrol
10	Service	Indoor
11	PowerSupply	400to440Volts,3Phase,4Wirewithneutral,ACSupply at50 HZ.
	TypeofGearBoxes	Totallyenclosed,SingleHelical,withDipstick,Drainplug, breathervents,oil,oillevelindicator–Cranedutytype.
	End Clearance	300M
	Typeof Hook	SingleHookTrapezoidal“C”/Standard“C”Type– ConformingtoIS–3875withsafetylatchandswiveling 310–Shanktype.
	End Carriages	1/5ofSpanasperISS,fabricatedofsteelsection/plates withRubberbufferswithsafetysteps,jackingpadsand

		end stopper.
	EmergencySwitch	TobeprovidedonthePendant.
	Maintenanceplatform	MS chequered platform of 6 mm thick plate, two tiredguard railing of 1.1 mtrs/suitable height and of 1000 mm wide [min] along the span of the Crane in driving end with toe guards, with an additional 2 short service platform of 6mmthickanti-skidMSplateonnon-drivingendshallalso be provided.
	Walkwayplatform	Required.
	Ladder	450mmwidemadeofMSangle65X6X6mmwithpipeof40mm diafor rungs.

15. **FLOORING:**

15.1. **GENERAL:**

- 15.1.1. Provision contained in clause 13.25, 13.27, 13.32, 13.39 and 13.40 of MES Schedule Part I are to be adopted for laying floors.
- 15.1.2. Floors shall be laid to levels or to falls as shown on drawings and as directed by Engineer-in-Charge.
- 15.1.3. Floor finish shall be extended over dwarf walls, door openings and other openings.
- 15.1.4. The dividing lines between the floors of different types wherever they so meet between adjoining rooms shall be determined on the basis of the finish visible when the doors are closed and the applicable finish shall accordingly be provided.
- 15.1.5. Floor finish over RCC slabs shall be laid all as specified in clause 13.32.5 of MES Schedule Part-I.
- 15.1.6. Sub floor may not be laid in panels.
- 15.1.7. Floors of types and composition as indicated in the Schedule of finishes and drawings shall be laid as specified in Section 13 of MES Schedule Part I and as directed by Engineer-in-Charge.

- 15.2. **CEMENT:** Cement shall be OPC or Portland Pozzolona Cement (PPC) as stipulated here-in-before for concrete works.

- 15.3. **MOORUM FILLING:** Moorum filling under floors shall be carried out all as specified here-in-after and as directed by GE.

15.4. **CEMENT CONCRETE FLOORS:**

- (a) Cement concrete floors shall be provided over PCC sub-base/ slabs at locations all as shown on drawings and as specified in Schedule of Finishes Drawing. The surface shall be finished even and smooth using extra cement.
- (b) Cement concrete flooring cast-in-situ shall be laid in panels and size of panel shall be as specified in clause 13.23.1 of MES Schedule Part-I.
- (c) Glass dividing strips of 3 mm thick sheet glass shall be provided in cement concrete floors. The width of the glass dividing strips shall be 3 mm less than the thickness of top finished layer of concrete. The top of the strip shall flush with the floor finish. However thickness of the concrete floor finish is more than 50mm, the flooring shall be carried out in alternative panels without using dividing strips.
- (d) The surface shall be cured efficiently by water ponding as directed by Engineer-in-Charge.
- 15.5. **MARBLE STONE FLOORING:** Marble stone flooring wherever shown in the drawings shall be pre polished green marble slabs laid as specified in schedule. The size of the marble slab in flooring shall be minimum 1200 mm x 600 mm. The slabs shall be machine cut and shall be of uniform colour as approved by GE. The thickness of Green marble stone shall

be as specified in drawings. The green marble slab shall be set and jointed in neat cement slurry @ 3 Kg/Sq.m over screed bed as indicated in drawings and pointed in white cement with pigments or coloured cement to match the green marble slab.

- 15.6. **GRANITE SLAB FLOORING/DADO/WALL CLADDING:** The granite slabs shall be of best quality and of colour and size as approved by the GE or as specified in drawings. The thickness of the slabs shall be as specified in drawings with permissible tolerance of +/-3%. The stone shall be hard, durable, sound, tough, and regular in shape, uniform in colour and free from soft veins, cracks, flaws, decay and weathering. The contractor shall get samples of granite slabs approved by the GE for their colour. Every slab shall be machine cut to the required size and shape. Laying and polishing shall be carried out all as specified in clauses 6.20.5 to 6.20.8 of MES Schedule Part-I.
- 15.7. **NON SKID CERAMIC TILE FLOORING:** Provide non skid ceramic tile flooring at locations all as specified in drawings. Non-skid ceramic tiles shall be flat, true to shape, sound and free from flaws and other manufacturing defects. Ceramic tiles shall conform to IS-15622, Grade B-II (a) for Toilets and B-II (b) for other locations for floor tiles and Grade B-III for wall tiles and shall be of first quality. The size of the tiles shall be all as specified in drawings. The shade/pattern/design of the tiles shall be as approved by GE. The tiles shall be set, jointed in neat cement slurry and pointed flush in white cement mixed with pigment to match the colour of tile. The tiles shall be laid as per pattern described by GE. The workmanship shall be all as specified in clause No.13.40.2 of MES Schedule Part-I. The top surface of RCC slab shall be cleaned with hard wire brush and cement slurry @ 1.2 Kg/Sq.m shall be applied before laying the floor.
- 15.8. **VITRIFIED TILE FLOORING:** Vitrified tile flooring shown in drawings shall be carried with premium quality hard, sound, dense, Double Charged and homogenous in texture, free from defects. Mohr hardness shall not be less than 7 and conforming to relevant IS. The tiles are classified under group B1 a of the international Standard for Ceramic Tiles ISO-13006 and European Standard EN: 176. Tiles shall be laid over screed in Cement Mortar as specified in drawing. The shade and the size shall be as specified and as approved by GE. Joints shall be pointed flush using polymer based cementitious tiling joint filler to match the shade of the tile.
- 15.9. **CERAMIC TILE FLOORING:** Ceramic tile flooring shown in drawings shall be carried out with plain, first quality, Grade B II (a) confirm to IS-15622. The shade shall be as approved by users through GE. The tiles shall Set, jointed in neat cement slurry and pointed flush in coloured cement to match, laid over screed as specified in drawings. The tiles shall be laid as per pattern directed by GE. The workmanship shall be all as specified in clause No.13.40.2 of MES Schedule Part I.
- 15.10. **DESIGNER POLISHED CHEQUERED CEMENT CONCRETE TILES:** Pre-cast Designer Chequered PCC tiles in floors with 100% grey cement and pigments shall be provided wherever indicated in drawings. The tiles shall comply the requirement of clause 13.17 of MES Schedule Part-I. Workmanship shall be all as specified in Clause 13.25 & 13.39 of MES SchedulePart-I. Tiles shall be laid over screed bed in cement sand mortar as specified in drawings. Tiles shall be set, jointed and pointed in neat cement slurry of colour to match the tiles. The tiles shall confirm to IS-13801, Specification for Chequered Cement Concrete Tiles except for the wear quality and when tested in the manner specified in clause 11.6 of the same IS. The wear for tiles shall not exceed the following values:
- (a) Average wear: 2mm
 - (b) Wear on individual specimen: 2.5mm
- 15.11. **INTERLOCKING TYPE PAVER BLOCK:**

- 15.11.1. The paver block shall be as mentioned in as shown on drawing, reflective and inter locking type and shall be factory made. The paver block shall be brought from the manufacturer mentioned hereinafter and as approved by the GE. Paver blocks shall be conforming to IS 15658-2006. Shade of coloured tiles wherever specified shall be as directed by the GE. SRI value of paver block shall be ≥ 50 .
- 15.11.2. Material used for preparation of paver block shall be as per clause 4 of IS: 15658-2006.
- 15.11.3. **Water absorption:** The average water absorption shall not more than 6% and for individual samples not more than 7% when tested as per IS 15658.
- 15.11.4. **Markings:** The tiles shall be purchased from an approved manufacturer and shall have the markings as per clause 10 of IS 15658 embossed either on the sides or bottom.
- 15.11.5. **Testing:** The tiles shall be tested for the following under laid requirements as per testing procedure specified in IS 15658. The cost of samples and cost of testing shall be borne by the Contractor.
- (a) Dimensions and tolerance-Table 2 of IS 15658: 2006 shall be referred.
 - (b) Thickness of the wearing layer-Table 2 of IS 15658: 2006 shall be referred.
 - (c) Water absorption-Clause 6.2.4 of IS 15658: 2006 shall be referred.
 - (d) Compressive strength-Clause 6.2.5 of IS 15658: 2006 shall be referred.
 - (e) Abrasion resistance- Clause 6.2.6 IS 15658: 2006 shall be referred.
 - (f) Tensile splitting strength-Clause 6.3.1 of IS 15658: 2006 shall be referred.
 - (g) Flexural strength/Breaking load-Clause 6.3.2 IS 15658: 2006 shall be referred.
- 15.11.6. **Sampling:** The sampling of the blocks for testing shall be done as per clause 8 of IS 15658: 2006 & sampling requirements given in Table 4 of IS 15658-2006. The numbers given there in shall be sampled out of each consignment of blocks supplied at a time, not exceeding 25000 blocks or part thereof.
- 15.11.7. However one set of samples as per Table 4 shall be obtained from the manufacturer from where the blocks are intended to be procured and submitted to the GE for testing and approval. The cost of samples and cost of testing shall be borne by the Contractor.
- 15.12. **SKIRTING AND DADO:**
- 15.12.1. **CEMENT PLASTER SKIRTING:** cement plaster skirting shall be provided all as shown in drawings. Over 10 mm thick rendering in cement mortar (1:3), and shall be of 100mm high. Surface shall be finished even and smooth with steel trowel using extra cement.
- 15.12.2. **NON SKID CERAMIC TILE SKIRTING:** Coloured glazed ceramic tile skirting shall be provided all as shown in drawings. Tiles shall be all as specified here-in-before for non skid ceramic tile flooring. Tiles shall be set and jointed in cement slurry. Joints shall be pointed flush with white cement mixed with pigment to match the color of tile.
- 15.12.3. **VITRIFIED TILE SKIRTING:** Vitrified tiles for skirting shall be of the premium quality hard, sound, dense, Double Charged and homogenous in texture, free from defects, Mohr hardness shall not be less than 7 and conforming to relevant IS. The tiles are classified under group B1a of the international Standard for Ceramic Tiles ISO-13006 and European Standard EN: 176. The thickness of tiles shall be not less than 9-10 mm. and skirting shall be 100 mm high at locations shown in Schedule of finishes drawing over 10 mm thick screed in cement mortar (1:3).

- 15.12.4. **GLAZED CERAMIC TILE DADO/SKIRTING:** Glazed ceramic tiles dado/skirting shall be all as shown drawings. The tile shall be plain, coloured, Type B-III, Grade-I quality and shall conform to IS-15622 and shall be got approved by the GE. The tile shall be set over cement screed/backing coat as stipulated and jointed in neat cement slurry and pointed with white cement mixed with pigment, to match the colour of the tile. The dado thickness projecting from the rendered wall surface shall be flushed using cement mortar 1:3. The top level of the flushed surface shall be finished to a true line as directed. PVC tile beading shall be provided at the edges wherever glazed ceramic tile dado provided all as directed by Engr-in-charge
- 15.13. **KOTA STONE FLOORING:** Kota stone slabs shall be provided all as shown in the drawings. The Kota stone slab shall be machine cut and shall be of uniform colour as approved by GE. The Kota stone slab shall have top exposed face polished before being brought to site. The sample of slab shall be got approved by GE. Kota stone shall be laid all as specified in clause 13.47 of MES Schedule Part – I and as directed by the Engineer-in-charge. The slabs shall be bedded, jointed and pointed with coloured cement to match the colour of tile. The curing, polishing and finishing shall be all as specified in clause 13. 47.4 of MES Schedule Part – I.
- 15.14. **GREEN MARBLE STONE SLABS/CUDDAPAH SLABS/GRANITE STONE SLAB:** Provide mirror polished marble slabs/ Cuddapah slabs/Granite stone slab for kitchen/ pantry/ Glass cupboard platforms etc at locations shown in the drawing and as specified in schedule of finishes drawing. The size of the marble slab/Cuddapah slabs/Granite stone slab shall be in accordance with sizes shown in drawings as a single piece. The slabs shall be machine cut and shall be of uniform colour as approved by GE. The thickness of marble stone/ Cuddapah slabs/Granite stone slab shall be as specified in drawing. The marble slab/ Cuddapah slabs/Granite stone slab shall be set and jointed in neat cement slurry @ 3 Kg/Sq.m over screed bed as indicated otherwise If details of screed bed are missing then it shall be minimum 10 mm screed in CM 1:3 and pointed in white cement with pigments or coloured cement to match the slabs. The grinding & polishing shall be done after laying of slabs to mirror polish (Tin oxide polish).
16. **PLASTERING AND POINTING:**
- 16.1. **MATERIALS:**
- 16.1.1. **CEMENT:** Cement shall be OPC or Portland Pozzolona Cement (PPC) as stipulated here-in-before for concrete works.
- 16.1.2. **SAND:** Sand shall be conformed to the requirements of IS-2116.
- 16.1.3. **WATER:** Water shall be all as stipulated for concrete works.
- 16.2. **PREPARATION OF BACKGROUND FOR APPLICATION OF PLASTER:**
- 16.2.1. All dust and foreign matter on surfaces of masonry and latency on the concrete surfaces shall be removed by watering or brushing as required. In case background contains solvable slats, particularly Sulphate, plastering shall not be done until the efflorescence of the salts is completed.
- 16.2.2. Joints in masonry shall be raked to a depth of 10mm as the work proceeds. Local projections beyond the general wall face shall be trimmed off to avoid variance in thickness of plaster.

- 16.2.3. For smooth surfaces of concrete it shall be roughened by wire brushing or hacking and hammering if surface is hard. All projecting burrs shall be removed. The surfaces shall be scrubbed by wire brushes, Further pock marks 3 mm deep at spacing of 50 mm shall be done.
- 16.2.4. Adequate drying intervals shall be allowed between erection and plastering to bring the surface suitable for suction adjustment. High rate of suction causes plaster weak, porous and friable. The wall surface shall be damped evenly before plastering dry spot shall be moistened. Excess water will lead to failure of bond between plaster and background.
- 16.2.5. Dubbing out and rendering coat shall be same type and mix and dubbing coat shall be executed along with rendering coat.
- 16.2.6. Plastering shall not be done till doorframes are firmly fixed. Provide protection to fittings against splash of plaster, however if any plaster or mortar is noticed, it shall be cleaned off immediately.
- 16.2.7. Screed, 5 cm x 5 cm shall be laid vertically and horizontally not more than 2 m Apart to serve as guide in bringing the work to an even surface.
- 16.2.8. In case of 2 coats plaster work, 1st coat shall be allowed to be materially completed before 2nd coat is applied.
- 16.2.9. The finished work of plastering shall not show more than 4mm projection when checked with straight edge of 2m length placed over it.
- 16.2.10. In one coat plaster the mortar shall be firmly well pressed into the joints and into depressions of masonry walls for obtaining permanent bond and shall be laid little more than the required and the surfaces shall be leveled with wooden float. On concrete walls rendering shall be dashed on roughened surfaces to ensure adequate bond using strong whipping motion at right angle to face of wall.
- 16.2.11. In case of two coat work, before the first coat work is hardened shall be scored to provide key for 2nd coat. The rendering coat shall be kept damp for 2 days.
- 16.3. **CURING**: Each coat of rendering shall be kept damp continuously for 2 days. Moistening shall commence after plaster is sufficiently hardened.
- 16.4. **PLASTERING (INTERNAL AND EXTERNAL)**:
- 16.4.1. All the internal surfaces of walls/concrete shall be rendered all as shown in drawings. All plastered edges shall be rounded off. **The internal surfaces shall be finished even and smooth without using extra cement. However wherever putty finish on plastered surfaces is specified, the plastering shall be finished fair and even.**
- 16.4.2. All external surfaces of walls/concrete shall be rendered in two coats all as shown in drawings. The cement mortar shall be with anti algae waterproofing compound conforming to IS 2645 as per manufacturer's instructions. The surface shall be finished fair and even. External plastering shall be started from 15 cm below ground level/plinth protection wherever applicable.
- 16.4.3. Provide plaster grooves at locations where masonry meets the concrete items such as Beams/Columns. The groove shall be 10mm wide and 5mm deep 'V' type. All grooves shall be finished with using extra cement.

17. SURFACE FINISHES TO BUILDINGS:**17.1. GENERAL:**

- 17.1.1. Preparation of plastered surfaces shall be done by using mechanical sander with internal dust extraction system for clean environment certified by the manufacturer. After preparation of surface, approval shall be obtained from Engineer-in-Charge before applying primer and further treatment/coat. Building wise stage passing register shall be maintained.
- 17.1.2. Finishes i.e. cement based paint, oil bound distemper, acrylic water based interior grade primer, interior acrylic emulsion, acrylic water based exterior grade primer, water based premium acrylic smooth exterior emulsion etc. to surface of walls, ceiling, chajjas, fins, fascias, parapets etc. shall be applied using airless spray technology and capable of operating single spray gun with a suitable hose length. The spray machine should be of reputed manufacturer with pro-guard technology and capability of tracking pressure as well as paint & primer usage. An uniformly finished surface with out patches, roller marks shall be obtained.
- 17.1.3. These equipment shall be certified by approved manufacturer.
- 17.1.4. The accessories for applying the finishes shall be able to spray in hard to reach areas and penetration of finish on the surface so as to achieve uniform application and quality surface finish.

17.2. WALL CARE PUTTY:

- 17.2.1. Wall care putty shall be provided all as shown in drawings. The putty shall be white cement based. White cement based putty shall be of 2mm thick in two layers. The material and preparation of putty shall be all as stipulated in Clause Nos.15.19.1 & 15.19.2 of MES Schedule Part-I. Wall care putty shall be mixed by auto unload multipurpose mixer machine. Putty shall be applied using putty sprayer.
- 17.2.2. **PREPARATION OF SURFACE:** Wall care putty surface shall be prepared by using vacuum based sanding machine for dust free scraping of the walls with in-built vacuum suction system to remove all the dust. Long handle/short handle sander is to be used as required basis. It shall be done till an even and smooth surface is obtained.
- 17.3. **WHITE (LIME) WASHING:** White wash shall be provided all as shown in drawings. Lime used for white washing shall be freshly burnt fat lime (Class 'C') white in colour, conforming to IS-712. Skirting and dado are not to be white washed.
- 17.4. **OIL EMULSION DISTEMPER:** Oil Emulsion/Acrylic Washable Distemper shall be provided all as shown in drawings. Distemper, oil emulsion shall conform to IS-428.

17.5. EXTERNAL WEATHER PROOF PAINT:**17.5.1. MATERIALS:**

- (a) Paint shall be weather proof Acrylic emulsion, exterior grade (100% acrylic) premium quality. Paint shall be procured from any of the makes listed hereinafter. Shade of the paint shall be as approved by GE. Primer shall be water based acrylic suitable for exteriors as per manufacturer's instructions. Primer shall be of same make as of paint. The paint and primer shall be brought in manufacturer's sealed containers only by the contractor duly marked with batch number from the manufacturer.
- (b) The contractor shall produce manufacturers test certificate along with purchase voucher in original for the paint and primer brought to site before claiming payment for the same. Purchase voucher of paint and primer shall contain the complete description of material, batch No., net weight, test certification No., quantity in each package, No. of packages etc., The quantity of material brought at site indicating No. of packages, quantity in each package, batch No., purchase voucher number, test certification number, date of manufacturing, date of expiry etc., shall be entered

in MB as "Not to be Abstracted" and shall be signed by the JE, Engineer-in-Charge, GE and contractor.

(c) Each container of paint and primer shall bear the following particulars:

- (i) Manufacturer's trade mark.
- (ii) Reference to Indian Standard to which they comply.
- (iii) Name of product.
- (iv) Net weight.
- (v) Date of manufacturing.
- (vi) Batch No.
- (vii) Storage requirement.
- (viii) Storage life.
- (ix) Date of expiry.

(d) Each lot of paint and primer shall be checked by Engineer-in-Charge and approved by him after verifying from invoices, package, batch No. and test certificate. Materials shall be incorporated in the work only after written approval from Engineer-in-Charge.

17.5.2. **PRIMING COAT:**After preparing the surface as approved by Engineer-in-Charge, one coat of exterior water based acrylic primer as approved by manufacturer, thinned with water in 1:1 ratio shall be applied with brush as per manufacturer's instructions and as directed by Engineer-in-Charge.

Notes:

1. The shade shall be as approved by GE. The finish of Acrylic emulsion weather paint shall be smooth matt finish.
2. The paint shall be as per Manufacturer's original colour as available or shade card. No mix of tint shall be made into original shade.

17.5.3. **GUARANTEE:**

- (a) The contractor shall obtain a written guarantee for effectiveness of paint against fading out, peeling off, cracking, dust/algae accumulation etc. for **5 (Five) years** from the certified date of completion of entire work from the manufacturer and submit the same to GE before completion of work.
- (b) Should the GE at any time during construction or reconstruction or prior to the expiry of the Guarantee period, finds defective performance of the paint, the contractor shall, on demand in writing from the GE specifying the locations complained of, notwithstanding that the same may have been inadvertently passed/certified and paid for, under take to carryout such treatment as may be necessary forthwith to rectify the defects to the full satisfaction of GE. In the event of his failure to do so, within the specified period to be specified by the GE in his demand aforesaid, the GE may undertake such defective work at the risk and expense of the contractor. The liability of the contractor under this condition shall not extend beyond the period of five years from the certified date of completion, unless the GE had previously given notice to the contractor to rectify the defects.
- (c) **3% of the cost of the weather proof painting** as decided by the GE shall be retained from the final bill amount towards **Guarantee for Acrylic Emulsion paint** which will be released after satisfactory expiry of **05 (five) years Guarantee period**. If contractor fails to rectify the defects noticed in the treatment or found in the

material the aforesaid amount so retained shall be utilized for rectification of defects and contractor shall have no claim whatsoever on this account. The contractor may submit Bank guarantee Bond or Fixed Deposit Receipt from any Nationalised Bank pledged in favour of **GARRISON ENGINEER** for the said sum valid for the period of 05 (five) years from the date of completion of work in which event no further amount will be recovered from the final bill on this account. Defect liability period under condition 46 under General Conditions of Contracts IAFW-2249 shall be deemed to be amended to the extent mentioned above for Acrylic emulsion paint.

17.5.4. SCAFFOLDING:

- (a) The exterior painting work shall be carried out by using scaffolding. No zoola is permitted for the work under any circumstances. Suitable scaffolds shall be provided for workmen.
- (b) Scaffolding or staging more than 3.5 Metres above the ground or floor, swung or suspended from any over head support or erected with stationary support shall have a guard rail properly attached, braced and otherwise secured at least 1 Metre high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
- (c) Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1 Metre.
- (d) Safe means of access shall be provided to all working platforms and other working places.
- (e) The rates quoted are deemed to include the above provision of scaffolding and no extra will be payable to contractor on this account. The scaffoldings shall be removed only after obtaining clearance of Engineer-in-Charge after considering the quality of the work undertaken on completion of the painting.

17.5.5. SAFETY PRECAUTIONS:

- (a) Contractor shall provide all safety precautions for the labour engaged for this work. All the labours shall be provided with safety belts, helmets, Nose screens etc and the contractor shall adhere to all safety precautions as per Labour Welfare Act.
- (b) It is also advised, contractor to have insurance cover for his workmen working at heights against any eventuality from any reputed insurance agencies. Department will not be responsible for any untoward incident happening due to lack of safety precautions taken by contractor.

17.5.6. STAGE PASSING: The work shall be executed in a workman like manner and to the entire satisfaction of the GE. Contractor shall obtain the approval of GE stage wise as indicated below. The contractor shall give due notice in writing with sufficient time in advance to the Engineer-in-Charge and the GE, when each stage is about to be completed. The contractor shall start the work of subsequent stage only after obtaining written approval of the GE for previous stage. In default of such notice being received from the contractor, if he commences the work of subsequent stage without approval of the GE, then the GE shall have all the rights reserved to reject the work and ask the contractor to demolish the said

portion executed. The contractor shall have no claim on this account or otherwise. The decision of the GE in this regard shall be final and binding.

STAGES:

- (a) Extent of area to be painted.
- (b) Sample of painting work (Area to be decided by GE)
- (c) After preparation of surface and before applying priming coat.
- (d) After applying priming coat.
- (e) After applying first coat of Acrylic emulsion paint.
- (f) After applying second coat of Acrylic emulsion paint.

18. GLAZING:

- 18.1. Glazing shall be with plain sheet glass or frosted glass as indicated on drawings and as specified. Sheet glass shall be of ordinary glazing quality conforming to the requirement of IS-1761. The thickness of glazing shall be as indicated in drawings and shall be 5mm incase not shown in drawings. In case of bath & WC rooms the glass shall be frosted on one side. Glass shall be fixed to wooden windows and ventilators using teak wood beading with putty all as specified in MES Schedule Part-I.

19. PAINTING:**19.1. GENERAL:**

- 19.1.1. The synthetic enamel paint shall be of 1st quality as approved by GE.
- 19.1.2. The contractor shall inform the GE, within three weeks of the acceptance of the tender, the brand names of the manufacturer of paint proposed to be used in the works and submit samples thereof and obtain prior written approval of the GE before their use in the work.
- 19.1.3. Paint for priming coat, under coat and finishing coat will be of the same manufacturer.
- 19.1.4. Tint of paint, if not mentioned in drawings/schedule of finishes will be approved by the GE.
- 19.1.5. Contractor shall execute painting under the guidance of the Engineer-in-Charge and marked as such before commencement of painting work. Each coat of paint shall be passed by the Engineer-in-Charge before the next coat is applied.
- 19.1.6. If the undercoat of paint is not executed within six months after applying the priming coat of paint, the priming coat shall be redone by the contractor at no extra cost to the Government.
- 19.1.7. Surfaces which become inaccessible for painting after execution shall be painted before progressing the execution further.
- 19.1.8. Primer for wood surfaces shall be pink primer and for that of steel surfaces shall be zinc chrome primer. Colour and shade for under coat and finishing coat shall be decided by Garrison Engineer.
- 19.1.9. **PREPARATION OF SURFACES:** Preparation of surfaces for all locations except gantry girders shall be all as specified in MES Schedule Part-I. The steel surfaces of gantry girder shall be prepared by sand blasting. The prepared surface shall be got passed by the GE before applying paint, gantry girders shall be painted with primer and under coat before erection. Painting shall be carried out by spray painting.

19.2. WORKMANSHIP:

19.2.1. All wood work required to be painted shall be smoothened, sized and knotted and then applied with priming coat. Stopping and filling (filler coat) shall be done after priming coat and surfaces rubbed down to a level and smooth surface and thereafter under coat and finishing coat applied, all as specified in clause 17.6 of MES Schedule Part-I.

19.2.2. The steel surfaces which are required to be painted shall be given two coats of paint, priming coat and undercoat after fabrication but before assembly and erection and finishing coat after assembly and erection.

19.2.3. Reinforcement bars, tinned or galvanized iron surfaces and steel-work embedded in concrete/plaster shall however not to be painted.

19.3. **CLEANING:** Before commencement of plastering/painting work, all doors/windows/ventilators, Balcony railings etc shall be covered properly for protecting from the drips of paint/primer while painting, to the entire satisfaction of Engineer-in-Charge. Covering shall be done with tarpaulin or ply wood. After completion, the surrounding area, glass panes, flooring shall be cleaned and all the paint marks on it shall be removed.

19.4. **TARRING:** Prepare and apply two coats of tar to the hold fasts, backs of wooden frame in contact with brick work/plaster etc. Hold fast shall be given two coats of tar and sanded.

20. PLUMBING:**20.1. GENERAL:**

20.1.1. Plumbing work shall be carried out all as specified in Paras 18.13 to 18.27A of MES Schedule Part I.

20.1.2. The work of plumbing shall include for all materials and labour for all items of plumbing all as mentioned below including connections and joints with and including necessary specials such as bends, tees, etc.:

- (a) UPVC/SWR (ring) soil pipes from water closets taken up to first manhole.
- (b) UPVC waste pipes from UPVC Nahani traps shall be taken up to gully trap.
- (c) UPVC waste pipe up to UPVC Nahani trap and UPVC waste pipe from Nahani trap to Nahani trap.
- (d) UPVC Nahani traps
- (e) SWG gully traps
- (f) Specials in UPVC lines and those in vertical stack with oval access doors.
- (g) The working pressure of UPVC pipes and fittings shall not be less than 4 Kg per Sq.cm.
- (h) Gully traps including necessary waste pipe in between gully traps and nahani trap/floor trap.
- (j) Drain pipes from gully trap to first manhole outside the building area and connection thereto.

- (k) Excavation and earth work up to first manhole (excluding the manhole).
- (l) Separate soil waste pipe shall be taken to gully trap and first manhole from bath/WHB and WC/Urinals. The nahani trap and floor trap shall be of long body.

Notes:

- 1. Soil and waste pipes beyond the above limit shall be measured and paid separately as ordered by GE.
- 2. Wherever change in direction of waste pipe is necessitated in floors Nahani traps shall be provided at these places.

20.1.3. All soil pipes and fittings shall be 150mm dia UPVC pipes inside the building to take sewage from water closets to main vertical stack and including vertical stack pipe up to 3.0 mts. from outer face of external wall including connecting to first man hole (excluding manhole). Man holes to be constructed inside shaft of any building as shown in drawing shall be considered integral part of the building and cost is included in the lump sum. Waste pipes and fittings between UPVC Nahani trap to vertical stack pipe up to gully trap shall be UPVC pipe 75 mm bore. Vent pipe shall be of UPVC 150mm dia. and provided with slotted cone cap vent cowl of UPVC at top. The top unsupported portion of such pipe shall be secured with stack clamps fixed to parapet or other part of structure.

20.1.4. Plumbing work shall be carried out as specified in section 18.13 to 18.23 of MES Schedule part I and the Contractor shall employ licensed plumber.

20.1.5. Cast iron brackets shall be fixed on walls with wooden plugs (built in walls) or plugged to walls, Size of PCC blocks shall be 100mmx100mmx75mm and shall be in PCC (1:3:6) type C1 using 20mm graded stone aggregate.

20.1.6. Detailed line plan in respect of plumbing work shall be prepared by the contractor and got approved by the Engineer-in-Charge before commencement of work.

20.2. SOIL, WASTE AND VENT PIPES:

20.2.1. All soil pipes, waste pipes, vent pipes and fittings including WC connections shall be of UPVC conforming to IS : 4985 as specified in clause 18.2.7 A of SSR Part-I.

20.2.2. All the pipes and fittings shall have ISI certification mark.

20.3. **JOINTING:** Jointing shall be carried out as specified in clause 18.52 and 18.67.7A of SSR Part I.

20.4. FIXING OF PIPES TO WALLS:

20.4.1. Fixing of pipes to walls/floors shall be carried out as per manufacturer's instructions.

20.4.2. Pipes embedded in floor between Nahani trap to Nahani trap and from Nahani trap to external waste pipe stack shall be in one piece.

20.4.3. Accessories such as bends, branch pieces (single/double) etc shall be provided as required and/or as shown on drawings. All accessories, except those below GL shall have oval access doors (standard pattern) to enable access to each straight section in the pipes. Access doors to fittings shall be provided with 3mm rubber insertion packing and secured with set screws to make them air and water tight.

20.5. **FLOOR TRAPS/NAHANI TRAPS:** Nahani traps (NT) (marked as "FT"/"NT" in drawing) shall be of 110mm dia. UPVC with hinged grating and 75mm bore outlet conforming to IS including setting in PCC (1:3:6) type C1 and jointing with waste pipe as specified herein before. Floor shall be sunk at locations other than sunken floors to accommodate Nahani traps and packed with plain cement concrete (1:2:4) type Bo. The grating for Nahani trap shall be fixed in the recess made to the floor at locations of Nahani trap.

20.6. **GULLY TRAPS:**

20.6.1. The gully traps shall be salt glazed stone ware grade 'A' complying with the requirement of IS-651 of 1980.

20.6.2. Gully traps shall be square mouthed, 150mm x 150mm size set in PCC (1:3:6) type C1.

20.6.3. Cast iron grating shall be 150mm x 150mm and coated with bituminous paint and fixed as directed by the Engineer-in-Charge.

20.7. **TESTING:** All soil/waste pipes including fittings shall be tested as per manufacturer's instructions on completion of work and all as specified in clause 18.79 of MES Schedule Part I to the entire satisfaction of the Engineer-in-Charge. Joints found leaking/sweating or defective shall be remade to GE's satisfaction.

21. **SANITARY APPLIANCES:**

21.1. Sanitary appliances shall be of vitreous China 1st quality and shall conform to IS-2556. The appliances shall be of high grade and shall be coated on all exposed surfaces with impervious white vitreous glaze. The glaze shall be uniform free from craze and appliance shall bear ISI mark. The contractor shall employ licensed plumbers in work.

21.2. Water closets etc shall be vitreous china first quality white glazed and shall conform to relevant part of IS-2556 (Vitreous china sanitary appliances) and shall be ISI marked or of superior quality and finish. Tolerance in the size of fittings as given in IS shall be permissible. Also refer to clause 18.32 of MES Schedule Part I.

21.3. **URINAL:** Provide white glazed fire clay stall urinal and its screens. Stall urinal shall be half stall urinal and shall conform to IS 2526 (Part- 6) 1995 and all as specified in clause 18.32.7.2 of MES Schedule Part I. Screens shall be white glazed fine clay 1200 mm high and 15 mm thick (overall) and projecting 500 mm after suitable embedment in the wall shall be provided as directed by the Engineer-in-Charge. The end screen shall be suitably fixed as directed by the Engineer-in-Charge. The range shall have 15 cm deep standard pattern tread plates of fire clay. The inside surface of the stall and its screens shall be regular and smooth throughout to ensure efficient flushing. Provide galvanized iron flush pipe with CP stop valve, 32 mm dia chromium plated waste coupling with chromium plated bottle trap 32 mm size with 190 mm long wall connection pipe, concealed GI waste pipe from bottle trap to nahani trap with necessary specials and fittings as directed by Engineer-in-Charge. Necessary slope in PCC platform shall be provided as directed.

21.4. **FLUSHING CISTERN:**

21.4.1. Provide PVC flushing cistern low level 10 liters capacity shall be of slim and double flush type. The cistern shall be fitted with suitable handle/chain/rope for smooth and convenient operation in case of water closets. The flush pipe shall be of polyethylene pipe LDPE with pressure rating of 6 Kgf/Sq.cm. Flush pipe connecting flushing cistern to water closet shall be fixed on wall using GI clips and screws all as directed by the Engineer-in-Charge.

21.4.2. Connections to inlet of flushing cistern shall be done with readymade low density polythene pipe for cold water services (conforming to IS-3076) comprising 16mm bore and 450mm long polythene pipe having brass union at both ends. One end to be screwed to inlet of flushing cistern and the other end to GI pipe/stop cock. The weight of 16mm dia (outer dia) 450mm long pipe shall be not less than 47 grams. (The weight worked out from the density of polythene pipe for cold water service). The weight of pair of brass unions shall not be less than 40 grams.

21.5. **WATER CLOSET (EUROPEAN TYPE/ANGLO INDIAN TYPE):**Water closet European type/ Anglo Indian type (floor mounting type) wherever shown on drawing shall comprise as under:

- (a) Water closet European type/ Anglo Indian type (floor mounting type) fixed to wall with suitable 'P' trap. The water closet shall be screwed to wooden plugs embedded into floor.
- (b) Seat and cover shall be of thermo plastic material conforming to IS 2548 (Pt II) plastic closed pattern, flat bottom, hinged with chromium plated brass hinges, rubber buffers of suitable size and conforming to IS.
- (c) PVC (HDPE) low level cistern 10 litres capacity as specified.
- (d) Flush pipe.

21.6. **BLANK**

21.7. **WASH HAND BASIN:**

21.7.1. Wash hand basin shall be provided at the locations all as shown in drawings and the same shall be of slim/thin and rim type

21.7.2. Wash hand basin shall include the following:

- (a) Vitreous china wash hand basin complete with brass chromium plated waste out let screwed with necessary coupling connection.
- (b) one brass chromium plated pillar cock 15mm dia
- (c) A pair of painted cast iron brackets fixed on and including teak wood plugs embedded in walls.
- (d) Brass chromium plated chain and rubber plug.
- (e) Ready made low density polythene pipe for cold water services conforming to IS-3076 comprising 16mm dia (outer dia) and 450mm long polythene pipe having brass union at both ends, one end to be screwed to inlet of pillar cock and the other end to the GI pipe/stop cock. The polythene shall not weigh less than 47 grams (the weight worked out from the density and dimension given in IS-3076 for low density polythene pipes for cold water services). The weight of pair of brass unions shall not be less than 40 grams.
- (f) Stainless Steel Bottle trap shall be provided to WHB.

22. **MISCELLANEOUS ITEMS:**

22.1. **CRUMPLE JOINTS:** Crumple shall be provided all as shown in drawings and as per codal provisions. The top surface of RCC over crumple joint shall be provided with water proofing treatment as specified for RCC roof.

- 22.2. **STEPS:** Steps shall be provided as per functional requirements. Steps shall be constructed in brick masonry in CM 1:4. All exposed brick masonry surface up to 150 mm below ground level shall be plastered in CM 1:4, 10 mm thick, finished even and smooth, without using extra cement.
- 22.3. **SPOUT PIPE:** UPVC spout pipes and specials/accessories shall be provided all as show in drawings and same shall be UPVC pipe of 75mm dia shall conform to IS-13592 (Type A).
- 22.4. **RAMPS:** Provide ramps with chequered finished on top PCC at top and toe wall at location shown on drawings and as indicated and specified in schedule of finishes. Dwarf wall shall be of random rubble masonry. Cement plaster to external/exposed surfaces of dwarf wall up to 15 Cm below GL, earth filling, hard core shall be all as specified herein before.
- 22.5. **DAMP PROOF COURSE:**
- 22.5.1. Damp proof course shall consists of 50mm thick PCC type A0 (1:1½:3) using 12.5mm size graded stone aggregate), mixed with water proofing compound 2% by weight of cement or as per manufacturer's and laid as specified in Para 5.42.1 and 5.42.2 of MES Schedule Part I. Water proofing compound for damp proof course shall be as per IS-2645 (1975).
- 22.5.2. Damp proof course shall also be provided under door/openings (below floor by giving a vertical drop). Floor finish shall be extended in door openings.
- 22.6. **GREEN MARBLE CILL:** 20 mm thick Pre polished Green marble slab in single piece as specified shall be length of window and bearing of length as specified in drawings on either side of opening. The outside edge of window cill should be beveled. At inner side window cill 20 mm thick polished green marble stone over 20 mm thick green marble stone fixed with leak proof polyurethane adhesive as shown in drawings. If the length of the window is more than 1500mm in length cill may be in 2 or more pieces with each piece not less than 1500mm. The Cills for GRC jalli and Aluminium fixed glazing shall also be carried out as stipulated above. Cill shall have slope to external side for easy drain out of water.
- 22.7. **STAINLESS STEEL RAILING:** Railing of stainless steel shall be provided as per functional requirements. The vertical pipes and hand rail shall be of stainless steel, standard quality of grade SS-304, polish finish of wall thickness 1.6 mm and of size as shown on drawings. SS tubes shall be welded at the turnings and junctions. All the welded portions shall be completely grinded and brought to bright and smooth finish. Anchor fastening bolts shall be provided with grouting so as to achieve full strength of railing. The final finish of the railing shall be bright and smooth.
- 22.8. **STAINLESS STEEL SINK WITH DRAINING BOARD (DOUBLE SINK & DRAINING BOARD)**
- 22.9. Stainless steel sink with draining board in kitchen shall be provided as per functional requirements. Sink with draining board (combined) shall be of over all size 1550 x 510 (61" x 20") or nearest size. The size of bowl shall be 510x405mm and 200mm depth. Sink with draining board shall be manufactured from Salem stainless steel sheets grade A1 SI-305. The thickness of the sheet shall be 1 mm. The sink with draining board shall be of any one of the makes mentioned in list of makes. The surface of the sink and draining board shall be plastic coated to make it safe and scratch free installation. The sink with draining board shall be first got approved by GE before placing order. The sink shall be provided with brass chromium plated connecting union and plug. The waste pipe shall be of HDPE pipe and shall be extended upto top of nahani trap. Sink and draining board shall be supported

on 25x25x6mm angle iron brackets 500mm long with split end embedded in PCC block of size 250x250x150mm in 1:3:6 type C2.

22.10. **COOKING PLARTFORM/WORKING PLATFORM/PREPARATION**

PLATFORM/PLATFORM: Provide 18 to 20 mm thick Baroda Green marblestone slab over RCC slab at locations shown in the drawing. Marble stone slab shall be in one piece and edges shall be moulded and shall be set over 15 mm thick screed in cement mortar 1:4 over RCC slab. 20 mm dia hole shall be provided in the RCC slab while casting and in marble stone for the purpose of gas pipe connection.

22.11. **CUPBOARDS:** Wardrobe/cup boards shall be provided as shown in drawings. Chowkats and frame of shutters of wooden doors shall be made of 1st class Hard wood. The panel insert for panelled door shutters shall be 19mm thick pre-laminated/ veneered particle-board or marine particle board in one piece and shall conform to IS-3097 all as shown in drawings. Shelves shall be made of cuddapah stone as shown on drawing. Provide stainless steel builders hardware as shown in the drawing. Shutter shall be fixed with the help of stainless steel piano hinges. All woodwork shall be treated with french polish. The internal plastered surfaces of cupboard/ wardrobe shall be treated with the room finishes as specified in schedule of finish. All fittings and fixtures shall be all as shown in drawings.

22.12. **GLASS FIBER REINFORCED CONCRETE JALLI:** Provide perforated wall panel system (Glass fiber reinforced concrete) with frame at locations shown on drawings and as specified. Panels shall be 30 mm thick to be executed by the specialist agency and makes as approved by GE.

22.13. **RCC SHELVES:** RCC shelves shall be provided as per functional requirements. The surfaces of RCC shelves, shall be finished with 5 mm thick plaster in CM (1:3) finished fair and even without using extra cement and treated with finish given for walls of respective rooms. Platform below shelves shall be with PCC (1:2:4) type B1, finished to match the flooring of the room.

22.14. **DRAPERY RODS:** Provide drapery rods with brackets and finials, at locations indicated on drawings. The drapery rod shall be of stainless steel as shown in drawing No.CEVZ/2022/TD-25. Fancy type Brackets for drapery rods shall be fixed to the wall using rawl plugs and powder coated screws of appropriate size. Make of Drapery rods shall be Marvel/Vista Lavolor/Mac Decor

22.15. **DRYING CLOTHES ARRANGEMENTS:** The arrangements for drying clothes shall be made using stainless steel hooks embedded in to the wall and galvanized union straining screw all as shown in drawing. The wires shall be provided as shown in drawings. Wires shall be of PVC coated for and anti rusting.

22.16. **OVERHEADSHOWER:** Overhead Shower shall be provided all as shown in drawings.

22.17. **CALCIUM SILICATE FALSE CEILING:**

22.17.1. Provide Calcium silicate false ceiling at the location shown on drawing. The size of ceiling board shall be shown on drawing. The construction details of ceiling grid shall be all as per TD. The intermediate channels, ceiling sections, perimeter channel shall be made of Aluminu Grid all as per manufacturer's instructions. The ceiling board shall be fixed to bottom the grid with screws. The joint of ceiling board shall be filled with suitable ceiling compound over 48mm fiber tape to achieve seamless joints. The exposed surfaces of ceiling shall be finished with two coats of acrylic washable distemper of approved colour over a coat of primer over a coat of wall care putty all as directed by GE.

Note: Only calcium silicate false ceiling area will be measured form wall to wall. No

deduction shall be made for exposed frames/opening (cut outs) having area less than 0.30 Sq.m. the calcium silicate ceiling tiles shall have NRC value of 0.50 (Minimum), light reflection >85%, non combustible as per B S 476 part 4, 100% humidity resistance and also having thermal conductivity <0.043 W/MK.

22.18. STAIR CASES:

22.18.1. Provide RCC staircases all as shown in drawings.

22.18.2. Stair case shall be provided with green marble stone slab. Treads of steps & landing of stair case shall be provided with green marble stone 18 to 20mm thick machine cut in one piece set over 15mm thick CM (1:4) and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing/grinding and polishing. Risers shall be provided with green marble stone 18 to 20mm thick machine cut in one piece set over 10 mm thick CM (1:4). Soffit of RCC stair case shall be treated with 3 coats of white wash all as specified hereinbefore. Treads shall be bull Nosed.

22.19. **RAIN WATER PIPE:** Provide UPVC Rain water pipes and specials/accessories all as shown on drawings. UPVC pipe shall conform to IS-13592 (Type A). Each pipe shall be clearly and indelibly marked with the following information at internals not more than 3 metres.

(a) Manufacturers name or trade mark

(b) Nominal outside dia. of pipe

22.19.1. Rubber rings shall conform to IS-5382. Jointing of UPVC pipe shall be carried out all as specified in clause 18.52 of MES Schedule Part-I. The pipes and fittings shall be fitted over RCC column/wall all as per manufacturer's instructions using UPVC clamps. CI dome type grating/GI flat type grating of suitable size shall be provided. The size of rain water pipe where not indicated in drawings shall be 150mm dia.

22.20. **MIRROR:** Mirror shall be provided all as shown in drawings. Mirror shall be of selected quality glass of 6.0 mm thick with edges bevelled. It shall be free from all flaws, specks or bubbles. The glass shall be uniformly silver plated on the back, free from silvering defects. The silver shall have a uniform protective coating of red lead paint. Mirror shall be any one of the makes mentioned hereinafter. Mirror shall have 6 mm thick plywood backing of BWR grade with commercial face veneers. Mirror shall be fixed to wooden plugs embedded in wall.

22.21. **HEALTH FAUCET:** Health faucet shall be provided all as shown in drawings. The faucet shall be with chromium plated brass body (Push type) with wall hook and 1 m long SS braided rubber hose pipe with self-cleaning nozzles, ultra shine with 0.3 to 0.5 micron Chromium plating.

22.22. **PEG SETS:** Provide standard machine made pegs of Stainless steel of size shown on drawing and at locations shown on drawing.

22.23. **STAINLESS STEEL TOWEL RAIL:** Stainless steel towel rail shall be provided all as shown in drawings. Towel rail shall be of 19/20mm dia stainless steel tube of wall thickness 1.5mm. Brackets shall be fixed to wooden plugs embedded in wall.

22.24. **SOAP TRAY:** Soap tray shall be provided all as shown in drawings and shall be of stainless steel as per functional requirements.

- 22.25. **HOLD FAST:** Provision of hold fasts to chowkats of doors/windows/ventilators and cupboards, etc all as per details shown on drawings and as specified. These shall be embedded with PCC (1:2:4) type B1 using 20 mm graded aggregate in the wall/mix of concrete as per the columns.
- 22.26. **STAINLESS STEEL WIRE MESH:** Provide stainless steel wire mesh for mosquito proofing irrespective what is indicated on the drawings. The stainless steel wire mesh shall be of stainless steel wire cloth, 0.40mm nominal dia. of wire and average width of aperture 1.40mm fixed with stainless steel wire staples. The mesh shall be fixed to shutters/frames using second class hard wood beading, wrought faces, fixed with screws.
- 22.27. **FAN HOOKS WITH BOXES:** Wherever fan hooks/fan points have been shown, MS boxes with fan hooks shall be provided as per detail shown on drawings. Exposed faces shall be given two coats of white paint over a coat of red oxide primer. However, fan hooks without boxes shall be provided in roof slab. Fan hook boxes shall be covered with 3 mm thick plastic laminated sheet of required colour.
- 22.28. **EXPANSION FASTENERS:** Where the frames of doors, windows, cupboards are to be fixed to reinforced concrete jambs, these shall be fixed with Expansion Fasteners of adequate wherever expansion fasteners are being used hold fasts/lugs need not be used.
- 22.29. **MS GRILLS:** Provide fabricated MS Grills to windows wherever shown on drawings. MS grills shall be fabricated with MS bars/flat to required size all as per the details shown on drawings. MS Grills shall be fixed to chowkats with suitable GI screws all as directed. All the surfaces of grills shall be treated with paints as specified hereinafter for steel surfaces.
- 22.30. **MS GUARD BARS:** MS guard bars shall be provided to ventilators wherever shown on drawings. The surfaces of guard bars shall be treated with paints as specified.
- 22.31. **RCC JALLI:** Provide RCC jalli at the locations and as per the details shown on drawings. Faces of RCC Jalli shall have fair and even surfaces. The finish given to adjoining wall surfaces shall be provided to RCC Jalli. The RCC Jalli shall be set and jointed in cement mortar (1:4).
- 22.32. **BLANK**
- 22.33. **RCC CHAJJAS/ FINS**
- a) RCC chajjas with fins shall be provided as per details shown on drawings. Thickness of the finished fin after application of rendering in CM (1:3) on both sides shall be 80mm unless otherwise shown on drawings.
 - b) RCC chajjas (whether cast integral with the lintel or Precast embedded in the wall) shall be provided with a coved fillet of radius 80mm in PCC (1:2:4) type B-0, mixed with integral water proofing compound, preferably casted on green concrete.
 - c) The top surface of chajjas / fins and the coved fillet shall be finished with 10mm thick cement plaster in CM 1:3 with mixture of approved water proofing compound as per manufacturer's instructions while the concrete is yet green viz. just after the initial setting has taken place.
- 22.34. **BLANK**
- 22.35. **COLLAPSIBLE STEEL GATES:**
- 22.35.1. Collapsible steel gates shall be of approved design and make and top hung. These shall be with single or double leaves as indicated.

22.35.2. Rolled steel channels for vertical supports, flats for crossing, and tee and flats for top and bottom runnel' shall be mild steel conforming to IS 2062-2006. Roller wheels shall be of grey iron casting generally conforming to grade FG 150 of IS 210-1993 and shall be capable of taking the weight of the gate. Rivets used shall not be less than 6mm and shall be of snap headed type. Other fittings such as folding stoppers, fixing hold fasts, locking cleats, brass handles on both sides and cast iron rollers shall be of approved design and size.

22.35.3. The dimensions and other particulars shall generally be as under, unless otherwise indicated. The dimensions given are normally for a collapsible gate of maximum height of 3m.

(a) MS Channel = Hot rolled medium channel 18x9x3mm.

(b) Flats for crossings = 18x5 mm.

(c) Tee and flats for top and bottom runners with a minimum web of 40x12mm and flange of 40x6mm.

(d) The distance from centre to centre of channel pickets = 10 cm.

22.35.4. The bottom and top runners are fabricated separately with necessary holding fixtures for burying in the ground or fixing in the lintel respectively. The gates shall be provided with locking arrangement so that locking with padlock can be done.

22.35.5. Collapsible gates may be fixed under the lintels or fixed on outside/inside of the wall as indicated. Gates shall be fixed moveable on top and bottom channels with swinging arrangements on either side. Single leaf collapsible gate can be with single panel collapsible atright or left end. Fixing of collapsible gates shall be carried out in a workman like manner, the gate shall open and close smoothly and easily, the bottom runnel' shall be sunk level with floor. The gate shall be cleaned of all rust and mill scales etc. The wheel shall be fitted with ball bearing for width of opening more than 1.5m.

22.36. **GRILL DOOR:** Grill door shall be provided as per size as shown on drawing. The door shall be painted with two coats of synthetic enamel paint over a coat of red oxide zinc chrome primer.

22.37. **HDPE WATER TANK:**

22.37.1. Rotational moulded polyethylene water storage tanks shall be double layered ISI marked. The inlet connection shall be provided with a plunger type ball valve of brass of the dia of inlet pipe with polythene float valve 40 mm bore. GI Over flow pipe and wash out pipe of size 25 mm bore shall be provided from roof top to ground level with perforated PVC mosquito cover screwed to the pipe, Tanks shall be seated over 100 mm thick (Minimum) PCC 1:2:4 type B1 (using 20 mm graded stone aggregate) platform of adequate size all as directed by the Engineer-in-Charge.

22.37.2. **BLANK**

22.38. **RCC OVER HEAD TANKS (FIRE FIGHTING TANK & DOMESTIC WATER TANK):**

22.38.1. RCC over head tanks shall be provided all as per details shown in drawings with following specifications:

(a) RCC M-30 (Design Mix) mixed with Algi proof integral water proofing compound confirming to IS: 2645 as per Manufacturers instructions.

(b) Water proofing plaster shall be carried out as per described in drawings.

- (c) Inlet, Outlet, Washout and overflow pipes, valves shall be provided as per the drawings and as directed. Construction joint shall be provided as per standard engineering practice all as directed by the Engineer-in-Charge.
- (d) Testing of RCC over Head Tank for water tightness shall be done in accordance with IS-3370. The Over Head Tank shall be filled with water very slowly upto half the depth and allowed to remain for a period of 7 days. Thereafter water shall be filled to the full rated capacity and shall be allowed to remain for a further period of 7 days. The structure should not show any sign of leakage or sweating during this period. The drop in water level during during 24 hours after the Over Head Tank is filled to full capacity shall not exceed 115mm. Any leakage or sweating noticed shall be rectified and complete water tightness shall be achieved by the contractor to the entire satisfaction of Engineer-in-Charge. Water required for testing the Over Head Tank shall be arranged by the contractor at his own expenses.
- (e) The Over Head Tank after completion/Testing and till handed over to the department shall be filled with water and shall not be kept dry under any circumstances by the contractor.
- (f) Rest of the specifications shall be all as shown/described in the drawings and as specified here-in-before.
- (g) The plastering 10mm thick in CM 1:3 mixed with water proofing compound shall be provided over slab. Necessary records of tests shall be maintained duly signed by the Engineer-in-Charge and representative of the Contractor and shall be countersigned by the GE.
- (h) RCC Water Tanks shall be provided all as shown in drawing. The Lumpsum quoted shall deemed to include cost of ladders, water level indicator, railings, rungs, aluminium mosquito proofing wire mesh, inlet / outlet / wash out /overflow pipes, cast iron fittings, cast iron sluice valves of pressure rating PN 1.6, lightning conductor, aviation light..

22.39. **STRUCTURAL GLAZING**

22.39.1. Structural glazing shall be provided at locations as shown on drawings. 6 mm thick toughened glass reflective type shall be used in structural glazing. Main frame work of vertical and horizontals made out of specially designed extruded colour powder coated aluminium sections anchored to RCC / MS elements with structurally adequate MS brackets (hot dip galvanized to min.125 micron thick) using SS 316 grade anchor fasteners.

22.40. **MAGIC EYE:**

22.40.1. Provide magic eye in the door at the location and to the size shown on drawing. It shall be provided with big length outside good quality viewer lens.

22.41. **RCC CILL:** RCC cill shall be provided all as shown in drawings. Cill shall have 75 mm bearing on either side of opening. Cill shall have slope to external side for easy drain out of water.

22.42. **MS RUNGS:** Rungs shown on the drawings shall be of MS bars bent to shape and fixed as shown in drawings. Exposed faces of rungs shall be painted with two coats of synthetic enamel paint over a coat of primer all as specified herein before.

22.43. **MSRAILINGS:** MS Railing shall be provided as per details shown on drawings. The MS pipes shall be medium grade.Exposed faces of rungs shall be painted with two coats of synthetic enamel paint over a coat of primer all as specified herein before.

22.44. **BUILT-IN-CUPBOARDS:** Built-in-cupboard at locations shown in the drawings shall be provided. Built-in-Cupboards shall be provided all as shown in drawing No.CEDD-87-TD-22.

23. **WASH HAND BASIN ON GRANITE SLAB COUNTER WITH MIRROR:**

23.1. Oval Shaped Ceramic Wash hand Basin to be provided at places as shown on drawings. It shall be of size 560mm x 410mm [or nearest size] oval shaped below counter basin. The basin shall be provided with a granite slab counter. The diameter of the opening in the counter slab over the basin shall be 10mm less than the diameter of the said basin. The counter slab shall be of 18 to 20 mm thick polished black granite stone slab in one piece. All exposed edges of the counter slab shall be grinded with portable power driven grinder to smoothness and rounded finished and to be polished for shining. The pillar tap shall be fixed on the counter slab or as directed by Engineer-in-Charge.

23.2. Provide mirror of full width of counter and to height all as shown on drawing. Mirror shall be of selected quality glass of 6 mm thick with edges beveled. It shall be free from all flaws, specks or bubbles. The glass shall be uniformly silver plated on the back, free from silvering defects. The silver shall have a uniform protective coating of red lead paint. Mirror shall be any one of the makes specified hereinafter. Mirror shall have 6 mm thick plywood backing of BWR grade with commercial face veneers. Mirror shall be fixed to wooden plug embedded in wall.

24. **PILE FOUNDATION AND PILE CAPS:**

24.1. **GENERAL:**

24.1.1. The Piles to be provided under the scope of subject work shall be BORED CAST-IN-SITU CONCRETE piles constructed in accordance with IS-2911 Part-I Section 2.

24.1.2. The boring shall be done by using HYDRAULIC ROTARY TYPE RIG OF MINIMUM CAPACITY 135KN and bore hole shall be stabilized with direct mud circulation method using bentonite.

24.1.3. Before commencement of piling work, the contractor shall intimate the GE regarding the same in writing.

24.1.4. The disposal of spoil shall be done outside MD land, without any extra cost to the department.

24.1.5. Methods like chiseling Energy Concept or Pile Penetration Ratio shall be used to arrive at pile termination depth, in consultation with GE.

24.1.6. Workmanship i.e. Control of Piling Installation, Use of Drilling Mud, Cleaning of Borehole, Tremie Concreting, Defective Pile and recording of data etc., of piles shall be all as stipulated in Clause 8 of IS 2911 (Part-1/ Sec 2).

24.2. **GUIDE RING:**

24.2.1. The steel guide ring of internal diameter equal to the diameter of the pile plus a clearance of a minimum of 25mm and a maximum of 50mm shall be provided to facilitate the smooth drilling of bore hole. The wall of the guide ring shall be absolutely vertical and shall be concentric with the pile centre. The guide ring shall be at least one meter deep. The necessary steel required for this shall be arranged by the contractor.

24.3. BENTONITE SLURRY:

24.3.1. A fresh water mixed with Bentonite slurry (Sodium Montmorillonite Slurry) shall be used for supporting the sides of the bore. The properties of Bentonite shall be maintained as given below:

- (a) The liquid limit of bentonite when tested in accordance with IS-2720 (Part 5) shall be 400 percent or more.
- (b) The density of freshly prepared bentonite shall be 1.034 to 1.10 Grams/ml whereas density of slurry mixed with deleterious compound in borehole shall be taken as 1.25 Grams / ml.
- (c) The Marsh Cone viscosity when tested by Marsh Cone shall be between 30 to 60 seconds.
- (d) The differential free swell shall be more than 540 percent.
- (e) The PH value shall be between 9 to 11.5.

24.3.2. Routine field tests of slurry viscosity using marsh funnel shall be carried out and this slurry reclassified. The contractor shall ensure to keep the slurry level in the bore as high and constant as possible to avoid damaging surges, produced by the action of cluses, loss of slurry in soil and other causes. The slurry has a tendency to loose viscosity, get settled and increase the density resulting in insufficient and establishing properties. The contractor shall ensure filtration and a high immediate yield value of slurry.

24.3.3. Bentonite constant of 16 Kg/Cu.m. gives sufficient thick slurry and shall be maintained throughout the boring operation. Base exchanged Bentonite concentration shall be maintained between 4 to 7 by weight.

24.3.4. After penetration of clay strata and on entry more permeable strata the artesian water head present at site shall be suitable countered by use of increased slurry head and density.

24.3.5. The said content in the Bentonite powder shall not be more than seven percent (7%). Testing of the slurry at the base of the trench shall be carried out by special samplers or by using samples obtained viz. the submersible pumps. Sand content shall be measured by screening the slurry on a 200 mesh sieves (Micron) deep. Sampling shall be carried out every time before placement of the reinforcement cage. Reuse of the slurry in a second and subsequent bore shall be permitted only after carrying out the necessary Marsh funnel, PH Value and Density tests. Generally, the slurry immediately above the rising concrete shall be diverted to disposal pits rather than treating the same. Additives up to a limit of 0.5% by weight of the slurry are permitted. The contractor shall ensure adoption of suitable bentonite clay mixer, lump breakers, fillers and centrifugal pumps for circulation etc. He shall ensure a clean layout using proper capacity mixing tanks, re-circulation tanks, disposal pits, circulation trenches and pipe lines, suitable lined tanks shall be used to avoid break down due to side wall collapses. While drawing out the used and stored slurry, the slurry from the top only shall be drawn and the pits cleared to remove the settled solids.

24.4. REINFORCEMENT FOR PILES:

24.4.1. The drilled bore hole shall be thoroughly cleaned before positioning of reinforcement cage.

24.4.2. The grade of TMT bars shall be all stipulated in BOQ/drawings and shall be as specified here-in-after.

24.4.3. The reinforcement shall be properly tied and fixed to prevent any displacement and distortion while concreting is in progress. Clear cover shall be as shown on drawings to reinforcement including binders/helical. The reinforcement of piles shall be extended to the length shown on drawings as dowel bars from cut off level.

24.4.4. **REINFORCEMENT BAR BENDING SCHEDULE:** The contractor shall submit to the GE for scrutiny and approval, detailed reinforcement bar bending schedule, four weeks in advance of due date of commencement of any particular item of concrete work, while working out the reinforcement bar bending schedule the contractor shall ascertain from the Garrison Engineer the length of bars likely to be made available and this schedule shall be soon made keeping the wastage/off cuts of bars to bare minimum without hampering technical requirement. The fabrication of reinforcement of concrete works shall be commenced only after bar-bending schedule is approved in writing by the Garrison Engineer/Engineer-in-Charge.

24.5. **CONCRETING FOR PILES:**

24.5.1. The grade of concrete shall be all stipulated in BOQ/drawings.

24.5.2. The slump of concrete for piles shall be 150 mm to 180 mm. All other aspects in respect of concrete shall be all as specified here-in-after.

24.5.3. The bottom of the bore holes shall be cleaned off all the spoils and sediments before placing concrete so that the bases of piles shall be free from loose materials, concreting of bore holes shall commence as soon as possible after cleaning. A bore hole which is not cased be left un-concreted for more than 2 hours. It shall be cleaned thoroughly before placing concrete. Concreting under water shall preferably be done in one operation. Adequate standby plant shall be catered for this purpose.

24.5.4. Concrete shall be preferably placed by a tremie pipe. ½ Kg of granulated vermiculite shall be used in tremie pipe before pouring initial concrete to ensure that concrete does not get mixed with slurry. The tremie pipe shall extend up to the bottom of the bore hole at the start and may be withdrawn in section as level of the concrete rises in the bore hole at the start, but its discharge end shall at all times be embedded in the concrete to a minimum depth of one metre. Placing of concrete shall be continuous and the tremie pipe shall be held concentric in the hole.

24.5.5. Concrete in piles shall be cast to piling platform level to permit overflow of concrete for visual inspection. Concrete may be placed up to the original ground level as directed by the Engineer-in-Charge or to a minimum height of one metre above cut off level to permit removal of all laitance and weak concrete before capping.

24.5.6. In the case of concreting inside casing which is subsequently withdrawn the concrete shall be placed in sufficient quantity to ensure that during withdrawal of casing a sufficient head of concrete is maintained to prevent the inflow of soil and water. Sufficient care shall also be exercised in extracting the casing such that the freshly placed concrete is not lifted up-along with casing in which case, the entire concrete including the reinforcement shall be taken off, the pile shall be thoroughly of casing pile: Extraction of casing shall be done in such a way that no necking or shearing of the concrete in the shaft takes places. During the extraction of the casing, slump of concrete shall be observed and when required, additional quantity of concrete shall be placed up to the original ground level as directed by the Engineer-in-Charge so that the pile is formed up at least 100 cm above the cut off level.

24.5.7. Payment for concrete in piles will be made from founding level to cutoff level only, based on quantity theoretically arrived by multiplying cross sectional area of pile and length of pile

between cutoff level and founding level. The contractor shall have no claim whatsoever on this account. Chipping out piles up to cut off level including disposal of spoil to out side MD land shall be deemed to be included in the quoted lumpsum.

24.6. CONTROL OF ALIGNMENT:

24.6.1. Piles shall be installed as accurately as possible according to the design and drawings vertically. Greater care should be exercised in respect of installation of single piles or piles in two pile groups.

24.6.2. As a guide, an angular deviation of 1.5 percent in alignment for vertical piles should not be exceeded. Piles should not deviate more than 75mm or D/6 whichever is less (75mm or D/10 whichever is more in case of piles having diameter more than 600 mm) from their designed positions at the working level. In the case of single pile under a column the positional deviation should not be more than 50mm or D/6 whichever is less (10mm in case of piles having diameter more than 600mm). In case of piles deviating beyond these limits and to such an extent that the resulting eccentricity can not be taken care of by redesign of the pile cap or pile ties, the piles shall be replaced or supplemented by additional piles.

24.7. FINISH OF PILES AND REPLACEMENT OF DEFECTIVE PILES:

24.7.1. Concrete in piles shall be cast to piling platform level to permit overflow of concrete for visual inspection. Concrete may be placed up to the level as directed by Engineer-in-Charge i.e to a minimum height of one metre above cutoff level or MGL whichever is higher, to permit removal of all laitance and weak concrete before capping. However, no payment is allowed for the laitance concrete which is to be chipped off.

24.7.2. The piles that are found defective shall be pulled out or left in places as directed by the Garrison Engineer without affecting the performance of the adjacent piles. As a result of redesign all additional work required to compensate for the defective piles, whether pulled out or left in position will be provided by the contractor at his own expenses as directed by the Garrison Engineer. Payment for the defective pile will not be made. However, payment for provision of new piles as per re-design will be made.

24.8. TESTING OF PILES:

24.8.1. Testing of piles shall be carried out using the Kentledge method conforming to relevant IS all as directed by the Engineer-in-Charge and the GE.

24.8.2. Integrity test shall be carried out on all piles for the evaluation of pile quality and integrity at no extra cost to the Department.

24.8.3. The initial and routine load test of piles shall be carried out all as specified in Appendix 'A' to IS-2911 (Part-IV) on pile (s) to be selected/approved by the Garrison Engineer. Initial load test and routine load test will be carried out in numbers stipulated in BOQ/Structural drgs. GE shall intimate the CWE before commencing the load tests at site and CWE shall detail a representative to inspect the load tests. The load test results shall be approved by CWE. Load test shall be carried out for compression as well as lateral load.

24.8.4. Necessary arrangements such as loads, set of dial gauges and all other appliances /equipments shall be provided at site by the contractor and the quoted rates for test(s) shall be deemed to include for all the aforesaid provisions.

25. ROADS:

25.1. Contractor's representative and the Engineer-in-Charge shall jointly record measurements of stocked metal in measurement book to check that the required quantities have been

brought for works as stipulated in clause 20.A.1.3 of MES Schedule Part-II. The measurement of stacks are not subject to any deductions.

25.2. **BITUMEN:** Bitumen shall be paving bitumen of Grade VG-10 for teck coat and VG-30 for other as per IS-73, Specification of Paving Bitumen and shall be Contractor's supply and shall be procured by the contractor directly from HPCL/IOCL/BPCL. Contractor shall make his own arrangements to store the same. The contractor shall produce paid vouchers and test certificates for bitumen used in the work immediately on receipt of materials. Contractor shall make his own arrangements to store the bitumen. After the bitumen has been brought to site, independent tests shall also be carried out by the GE, to ascertain the quality of the bitumen. Testing of bitumen shall be in accordance with IS-73. For sampling the numbers of containers to be selected from the lot of bitumen depend upon size of the lot and shall be in accordance with Table-III of IS-73. Number of tests and types of tests to be carried out shall be as per relevant IS. In case the bitumen is not of requisite standard as verified by the GE through independent testing as mentioned herein before, the Contractor shall remove the total consignment from the site at his own cost after written rejection order of the consignment by the GE despite manufacturer's test certificate. The cost of test shall be borne by the Contractor irrespective of the results of tests.

25.3. **FORMATION SURFACES:** Before laying soling the formation shall be prepared all as specified in MES Schedule Part I clause 20.A.21.2 and rolled by 8/10 capacity power roller.

25.4. **BLOCK LEVELS:**

25.4.1. Before commencement of roadwork, the block levels of the area (after clearing the shrubs and vegetation etc) shall be taken jointly by the contractor and Engineer-in-Charge. Block levels shall be taken at 3 meter intervals.

25.4.2. Drawing showing the block levels on the basis of the levels taken as mentioned above shall be prepared and signed by both parties in token of their acceptance. Formation levels to which the cutting/filling is required to be carried out shall then be marked on these drawings and cutting/filling shall be carried out strictly according to these signed drawings.

25.4.3. Levels of the finished formation (after consolidation) shall be taken to ensure that the correct levels as indicated in the aforesaid drawings have been, in fact achieved. A certificate to this effect shall be endorsed by the Engineer-in-Charge in the works passing register.

25.5. **GRANULAR SUBBASE:**

25.5.1. **SCOPE:** This work shall consist of laying and compacting well graded material on prepared sub grade in accordance with the requirements of these specifications. The material shall be laid in one or more layers as subbase or lower subbase and upper subbase (termed as subbase hereinafter) as necessary according to lines, grades and cross sections.

25.5.2. **MATERIAL:**

(a) The material to be used for the work shall be natural sand, crushed gravel, crushed stone, crushed slag, or combination thereof depending upon the grading required. Use of materials like brick metal, Kankar and crushed concrete shall be permitted in the lower subbase. The material shall be free from organic or other deleterious constituents and shall conform to the grading given in Table-1 and physical requirements given in Table-2. The grading to be adopted for a project shall be as specified in items of Schedule A and the material to be used for the work shall be of grading-V. The construction operation of GSB shall be carried out as described in clause 401.3 of MORTH specification.

(b) If the water absorption of the aggregates determined as per IS : 2386 (Part-3) is

greater than 2 percent, the aggregates shall be tested for Wet Aggregate Impact Value (AIV) (IS-5640). Soft aggregates like kankar, brick ballast and laterite shall also be tested for Wet AIV (IS-5640).

TABLE-1: GRADING FOR GRANULAR SUB BASE MATERIALS

IS Sieve Designation	Percent by Weight passing the IS Sieve
	Grading V
75.0mm	100
53.0mm	80-100
26.5mm	55-90
9.50mm	35-65
4.75mm	25-50
2.36mm	10-20
0.85mm	2-10
0.425mm	0-5
0.075mm	-

TABLE-2: PHYSICAL REQUIREMENTS FOR MATERIALS FOR GRANULAR SUB BASE

Aggregate Impact Value (AIV)	IS-2386 IS-5640	(Part-4)	or	40 Maximum
Liquid Limit	IS-2720	(Part-5)		Maximum 25
Plasticity Index	IS-2720	(Part-5)		Maximum 6
CBR at 98% dry density (at IS-2720-Part-8)	IS-2720	(Part-5)		Minimum 30 unless otherwise specified in the Contract

25.5.3. **CONSTRUCTION OPERATIONS:**

- (a) **PREPARATION OF SUB GRADE:** Immediately prior to the laying sub base, the sub grade already finished as applicable shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water, if necessary and rolled with two passes of 80 -100 kN smooth wheeled roller.
- (b) **SPREADING AND COMPACTING:**
 - (i) The subbase material of the grading specified in the Contract and water shall be mixed mechanically by a suitable mixer equipped with provision for controlled addition of water and mechanical mixing so, as to ensure homogenous and uniform mix. The required water content shall be determined in accordance with IS-2720 (Part-8). The mix shall be spread on the prepared sub grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for maintaining the required slope and grade during the operation, or other means as approved by Engr-in-Charge.
 - (ii) Moisture content of the mix shall be checked in accordance with IS-2720 (Part-2) and suitably adjusted so that, at the time of compaction, it is from 1 to 2 percent below the optimum moisture content.

- (iii) Immediately after spreading the mix, rolling shall be done by an approved roller. If the thickness of the compacted layer does not exceed 100mm, a smooth wheeled roller of 80 to 100 kN weight may be used. For a compacted single layer up to 200mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 kN static weight capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional cross fall or on super elevation. For carriageway having cross fall on both sides, rolling shall commence at the edges and progress towards the crown.
- (iv) Each pass of the roller shall uniformly overlap not less than one third of the track made in the preceding pass. During rolling, the grade and cross fall (camber) shall be checked and any high spots or depressions which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 km per hour.
- (v) Rolling shall be continued till the density achieved as stipulated for the material determined as per IS-2720 (Part-8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

25.5.4. **SURFACE FINISH AND QUALITY CONTROL OF WORK:** The surface finish of construction shall conform to the requirements of Clause 902 of MORTH. Control on the quality of materials and works shall be exercised by the Engr-in-Charge in accordance with section 900 of MORTH.

25.5.5. **ARRANGEMENTS FOR TRAFFIC:** During the period of construction, arrangements for the traffic shall be provided and maintained in accordance with Clause 112 of MORTH.

25.6. **WET MIX MACADAM:**

25.6.1. **WEATHER AND SEASONAL LIMITATIONS:** The work of laying of wet mix macadam shall not be done during rain.

25.6.2. **MATERIALS:**

(a) **COARSE AGGREGATE:**

- (i) Coarse Aggregate shall consist of crushed rock, crushed gravel or other hard materials. They shall be clean, hard, and durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter.

Notes:

1. Where crushed gravel is proposed for use as aggregate, not less than 90% by weight of the crushed material retained on 4.75 mm sieve shall have at least two fractured faces.
2. The aggregates shall satisfy the physical requirements & grading requirements as indicated hereinafter & shall be procured in bulk only after obtaining sample approved.

- (ii) **PHYSICAL REQUIREMENTS:** The coarse aggregate shall satisfy the following physical requirements:

Test	Percentage Max
Flakiness Index- IS 2386 Part-I	15
Impact Value-IS 2386 Part-IV	30
Los Angles Abrasion Value	40

(b) FINE AGGREGATE:

- (i) The fine aggregate shall consist of crushed or naturally occurring material and be fraction passing 2.36 mm sieve and retained on 75 micron sieve consisting of crushed screening, natural sand or mixture of both. It shall be clean, hard, durable uncoated and dry, free from injurious, soft or flaky pieces and organic or deleterious substance.
- (c) The combined grading of coarse/fine aggregate shall conform to following:

IS SIEVE SIZE	PERCENTAGE PASSING
53.0 mm	100
45.0 mm	95-100
22.40 mm	60-80
11.20 mm	40-60
4.75 mm	25-40
2.36 mm	15-30
600 Micron	8-22
75 Micron	0-8

Note: The material passing 425micron (0.425 mm) sieve, when tested according to IS: 2720 (Part 5), shall have liquid limit and plasticity index not more than 25 and 6 per cent respectively.

25.6.3. PREPARATION OF BASE:

- (i) The surface of the sub grade to receive the WMM course shall be prepared to the specified lines, grades, camber, slopes and cross-falls and made free of dust and other extraneous matter. Any ruts or soft yielding places shall be corrected in and approved manner using the specified materials & compacting it in place to the requirements of relevant specifications and as per direction of the Engineer-in-Charge to achieve firm surface, if necessary sprinkling of water shall be carried out.
- (ii) Provision of Lateral Confinement of Aggregates Before starting with wet-mixmacadam construction, if so directed by the Engineer-in-Charge, necessary arrangements should be made for the lateral confinement of wet mix. This shall be done by laying material adjoining shoulders along with that of wet-mix layer. The sequence of operation shall be such that the construction of the shoulder is done in layers each matching the thickness of the adjoining pavement layer. Only after a layer of pavement and corresponding layers at shoulder have been laid and compacted, the construction of the next layer of pavement and shoulder shall be taken up.

25.6.4. **MIXING:** Aggregates as per required grading for wet-mix macadam shall be mixed with the requisite quantity of water in a batch mixing plant of suitable capacity having provision of controlled addition of water and forced/positive mixing arrangements as approved by the

GE. Optimum moisture for mixing shall be determined in accordance with IS: 2720 (Part-8), after replacing the aggregate fraction, retained on 19 mm sieve with material of 4.75 mm to 19mm size. However, the OMC (Optimum Moisture Content) and required number of passes to achieve the desired density may be determined at site during proof rolling using the roller selected for compaction. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not vary by more than ± 1 percent.

25.6.5. SPREADING OF MIX:

- (i) Immediately after mixing, the mix material shall be transported to site and spread uniformly and evenly upon the prepared sub-base/base in required quantities. Hauling of the mix over a freshly completed stretch is not permitted. The mix shall be spread with the help of WMM mechanical sensor Paver. In no case should mix be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted. The aggregates mix should be spread to proper profile by using paver having hydraulic control suitable for initial adjustment and maintaining the same to achieve the specified slope and grade.
- (ii) The surface of the layer as spread shall be carefully checked with templates and all high or low spots remedied by removing or adding wet mix aggregate as may be required. The layer thickness may be checked by depth blocks during construction. No segregation of coarse and fine particles shall be allowed. The aggregates mix, as spread should be of uniform gradation with no pockets of fine materials.

25.6.6. COMPACTION:

- (i) After the mix has been laid to the required thickness, grade and cross-fall (camber), the layer should be uniformly compacted to the full width by rolling with a three-wheeled power roller of 8 to 10 tonnes capacity and with a vibratory roller of the approved type and capacity. The speed of roller shall not exceed 5 Km/hour. The rolling shall commence from the lower edges with the roller running forward and backward until the edges have been firmly compacted. The roller should then progress gradually towards the center parallel to the center line of the pavement, uniformly over-lapping each preceding rear wheel track by at least one third width of the wheel, until the entire surface has been rolled up to the centre line.
- (ii) Rolling should not be carried out when the sub grade is soft or yielding or when it causes a wave-like motion in the sub-base/base course or sub-grade. If irregularities develop during rolling which exceed 12mm when tested with a 3 metre straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface on forming to the desired grade and cross fall. In no case should the use of unmixed material be permitted to make up the depressions.
- (iii) Rolling should be continued till the stipulated density achieved is as determined by the method outlined in IS: 2720 (Part-VIII). After completing, the finished surface shall present a well-closed appearance, free from movement under compaction equipment or any compaction marks, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and re-compacted to the satisfaction of the Engineer-in-Charge.
- (iv) Longitudinal joints and edges shall be constructed true to the delineating line parallel to centre line of pavement. All longitudinal and transverse joint shall be cut vertical to the full thickness of the previously laid mix before laying the fresh mix.

25.6.7. **SETTING AND DRYING:** After final compaction of wet-mixed macadam course, the pavement shall be allowed to dry for 24 hours before overlaying with any bituminous layer.

25.6.8. **OPENING TO TRAFFIC:** No vehicular traffic except construction vehicles shall be allowed on the finished wet-mix macadam surface till the subsequent bituminous course is laid. In exceptional cases, construction traffic may be allowed with approval of the Engineer-in-Charge for short durations once the course is completely dry provided vehicles move over the full width avoiding any rutting or uneven compaction. The contractor will take all precautionary measures to prevent any damage to the finished surface till next layer is laid over it.

25.6.9. **SURFACE FINISH AND QUALITY CONTROL OF WORK:**

- (i) The surface level of a wet mix layer laid as base course shall have a tolerance of not more than +10mm from the designed longitudinal and cross profile. For checking compliance with this, surface levels shall be taken on grid of points placed 6.25 metre longitudinally and 3.5m transversely. For any 10 constructive measurements taken longitudinally or transversely, not more than one measurement shall be permitted to exceed the above tolerances, thus one measurement being not in excess of 5mm above the permitted tolerance.
- (ii) The longitudinal profile shall also be checked by a 3 metre straight-edge at the middle of each traffic lane along a line parallel to the centre line of pavement. The maximum allowable difference between the pavement surface and underside of a 3 metre straight edge shall be 8mm.

25.6.10. **QUALITY CONTROL:**

- (a) The frequency of the quality control tests shall be as under -.

Sl. No.	Test	Frequency (minimum)
(i)	Grading	One test per 100 Cum
(ii)	Atterberg Limits of portion of aggregates passing 425 micron sieve	One test per 100 Cum.
(iii)	Moisture Content prior to compaction	One test per 250 Cum
(iv)	Density of compacted layer	One test per 500 Sqm.
(v)	Aggregate Impact Value or Los Angeles Abrasion value	One test per 200 Cum
(v)	Flakiness and Elongation Index	One test per 200 Cum

- (b) The materials supplied and the works carried out by the contractor shall conform to the relevant technical specifications and as approved by the Garrison Engineer.
- (c) For ensuring the requisite quality of construction, the materials and works shall be subjected to quality control tests, as described above. The testing frequencies set forth are the desirable minimum and the Engineer-in-Charge shall have the full authority to carry out tests as frequently as he may deem necessary to satisfy himself that the materials and works comply with the appropriate specifications.
- (d) 3 Test procedures for the various quality control tests are indicated in the respective section IS codes. However, where no specific testing procedure is mentioned, the tests shall be carried out as per IRC: 109.

25.6.11. **RECTIFICATION OF SURFACE IRREGULARITY:** Where the surface irregularity of the layer as laid down exceeds the permissible tolerances or where the course is otherwise

defective due to sub-grade soil getting mixed with the aggregates, the full thickness of the layer shall be scarified over the affected area, re-shaped with added premix material or removed and replaced with fresh premix material as applicable and re-compacted in accordance with the specifications mentioned above. The area treated in the aforesaid manner shall not be less than 5m long and 2m wide. In no case shall depressions be filled up with unmixed and ungraded material or fines.

25.7. **SEMI DENSE ASPHALTIC CONCRETE (SDAC):**

25.7.1. **MATERIALS:**

- (a) The dense asphaltic concrete shall consist of coarse aggregate, fine aggregate and filler in suitable proportions and mixed with sufficient binder. The combined grading of fine/coarse aggregates shall conform to the following:

Is Sieve (mm)	Cumulative % by weight of total aggregate passing
19	100
13.2	90-100
9.5	70-90
4.75	35-51
2.36	24-39
1.18	15-30
0.6	15-30
0.3	-
0.15	0-19
0.075	3-8

Note: The combined grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.

- (b) Coarse aggregate shall be crushed material retained on IS 2.36mm sieve and shall be crushed stone and shall consist of angular fragments clear, tough and durable rock, free from disintegrated pieces and organics or other deleterious matters and adherent coatings. The aggregates shall not contain more than 6 percent by weight of flat/longed pieces (Flat piece is one having ratio of "width/thickness" of more than 4, elongated piece is where the ratio "length/width" is more than 4). The aggregates shall preferably be hydrophobic and of low porosity. If hydrophaneous aggregates are to be used, which in normal circumstances shall be avoided, bitumen shall be treated with anti stripping agents of appropriate quality in suitable doses.
- (c) The aggregates shall satisfy the following physical requirements:

Property	Test	Specification
Cleanliness (Dust)	Grain Size Analysis (IS-2386 Part-I)	Max 5% Passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index (Combined) (IS-2386 Part-I)	Max 30%
Strength	*Los Angeles Abrasion Value (IS-2386 Part-IV)	Max 30%
	*Aggregate Impact Value (IS-2386 Part-IV)	Max 24%
Polishing	Polished Stone Value (BS:812 Part- 114)	Max 24%
Durability	Soundness (IS:2386 Part-V)	

	Sodium Sulphate	Max 12%
	Magnesium Sulphate	Max 18%
Water Absorption	Water absorption (IS-2386 Part-III)	Max 2%
Water Sensitivity	Retained Tensile Strength (AASHTO T 283)	Min 80%
Stripping	Coating & Stripping of Bitumen Aggregate (Mixtures) (IS-6241)	Minimum retained coating 95%

Notes:

1. *Aggregate may satisfy requirements of either of these two tests.
 2. Water sensitivity test is only required for the minimum retained coating in the stripping test is less than 95%.
 3. If minimum retained coating is less than 95% and it is required to use anti-stripping agent, the same shall be provided as per manufacturer's instructions or as advised by testing lab as per approved job mix formula.
- (d) Fine aggregates shall be the fraction passing IS 2.36 mm sieve and retained on 75 micron sieve, consisting of natural river sand conforming to IS-383. It shall be clean, hard durable, dry and free from ingenious soft or flaky pieces and organic or other deleterious substances.
- (e) Filler shall consist of Ordinary Portland Cement (43 grade) as approved by the GE. The filler shall be graded within the limits indicated in Table below.

IS Sieve (mm)	Cumulative per cent passing by weight of total aggregate
0.6	100
0.3	95-100
0.075	85-100

25.7.2. **DESIGN CRITERIA FOR SDAC:** Semi dense asphaltic concrete mixes should be properly designed so as to satisfy certain criteria needed to assure adequate stability and durability. The mix design shall be done by Marshall Method of mix design (ASMD 1559-1979). The mix as designed and laid should satisfy the requirements as given under:

Criteria	Specified Value
	Semi Dense Asphaltic Concrete
(a) Number of compaction blow each end of Marshall specimen	75
(b) Marshall stability in KGs	1200 (Min)
(c) Flow value (mm)	2-4
(d) Percentage air void mix (to prevent bleeding)	3-5
(e) Percentage air voids filled with Bitumen (VFB)	65-78
(f) Loss of stability on immersion in wear at 60 C (ASTMD 1075)	-
(g) Binder content % by weight of total mix.	As per design mix

(h) Percentage voids in mineral aggregates (VMA)	See table below
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25.7.3. MINIMUM PERCENT OF VOIDS IN MINERAL AGGREGATES:

Nominal maximum particle size*	Minimum VMA, Percent related to mix Design air voids, percent**		
	3.0	4.0	5.0
9.5	14.0	15.0	16.0
12.5	13.0	14.0	15.0
19.0	12.0	13.0	14.0
25.0	11.0	12.0	13.0
37.5	10.0	11.0	12.0

* The nominal maximum particle size is one size large than the first sieve to retain more than the 10.

** Interpolate maximum voids in the mineral aggregate (VMA) for design air voids values between those listed.

25.7.4. JOB-MIX FORMULA FOR SDAC:

- (a) Job mix formula shall be got designed in any of the Institutions given below:
 - (i) CRRI, New Delhi
 - (ii) SEMT Wing, CME Pune.
 - (iii) IIT Chennai/Roorkee/Delhi
 - (iv) Any Govt. Approved Lab.
- (b) The proportions of coarse aggregates, fine aggregates and mineral filler shall be indicated as percentage by weight of total aggregate including mineral filler. Contractor shall submit these mix proportions to Garrison Engineer for approval on meeting the specifications mentioned hereinbefore.
- (c) The tenderer shall submit their job mix formula to the Garrison Engineer within 30 days of the acceptance of contract also giving the details as mentioned in the preceding clauses for approval of the Job-Mix formula for actual use. A re-verification of mix proportion is essential for every change in source of aggregates and bitumen and by obtaining fresh job mix formula and mix design.
- (d) Material, quality, workmanship, mix design criteria for semi dense asphaltic concrete shall be all as described in clause 20.B.2 of MES Schedule Part-I. Anti stripping agent shall be added to the aggregate to reduce the stripping time of aggregate all as per manufacturer's instructions without any extra cost to the Government. The binder shall be paving bitumen.
- (e) Preparation of mix, laying, spreading, compaction and control for semi dense asphaltic concrete shall be done all as specified in clause 20.B.4 of MES Schedule Part-I.
- (f) The design mix for semi dense asphaltic concrete shall be carried out from any approved Regional Laboratory/Government Approved Lab/Engineering/ Polytechnic College. The mix designation shall be all as specified in table under clause 20 B 2

MES Schedule Part-I. The cost of transportation of material and testing charges shall be borne by the contractor.

(g) PLANT TRIALS-PERMISSIBLE VARIATION IN JOB MIX FORMULA:

- (i) Once the laboratory job mix formula is approved the contractor shall carry out plant trials at the mixer to establish that the plant can be set up to produce a uniform mix conforming to the approved job mix formula. The permissible variations of the individual percentages of the various ingredients in the actual mix from the job mix formula to be used shall be within the limits as specified in table below.

Description	Permissible variation
	SDAC
Aggregate passing 19mm sieve or larger	+8%
Aggregate passing 13.2mm, 9.5 mm	+ 7%
Aggregate passing 4.75 mm	+ 6%
Aggregate passing 2.36mm, 1.18 mm, 0.6 mm	+ 5%
Aggregate passing 0.3mm, 0.15 mm	+ 4%
Aggregate Passing 0.075mm	+ 2%
Mixing temperature	+10°C

- (ii) Once the plant trials have demonstrated the capability of the plant, and the trials are approved, the laying operation may commence. GE may order additional testing of the product to establish the reliability and consistency of the plant. No claim whatsoever on this account will be admissible.

25.7.5. MIXING AND TRANSPORTATION OF MIX:

- (a) The temperature of binder at the time of mixing shall be in the range of 165°C to 170°C and of the aggregates in the range of 153°C to 163°C, provided also that at no time, the difference in temperature between the aggregates and binder shall exceed 14°C. The mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particles of the mineral aggregates are coated uniformly and temperature of mix shall not exceed 160°C.
- (b) Hot mix plant shall be used for mixing of aggregate and the binder. The binder shall be heated to the specified temperature. The aggregate shall be suitably warmed or heated before loading into hot mix plant. The correct quantity of each size of aggregate shall be fed into mixer with specified quantity of each size of aggregate shall be fed into mixer with specified quantity of binder. Each batch shall be mixed to ensure thorough coating.
- (c) The mix shall be transported from the mixing plant to the point of use in suitable tipper vehicles specified here in after. The vehicles employed for transport shall be clean and be covered using suitable covers in transit to ensure that the temperature of mix does not fall below 120 degrees Celsius at the time of laying.

25.7.6. SPREADING OF THE MIX: Spreading of asphaltic concrete shall be done by means of self-propelled mechanical Paver with a provision of electronic sensing device for automatic levelling and profile control within the specified tolerances and internal heating arrangement for the screed.

25.7.7. **ROLLING AND COMPACTION:** The rolling and compaction process for SDAC asphaltic concrete (shall be in four stages as described here in after. The initial or breakdown rolling shall be done with 8 to 10 tone Tandem Vibratory Roller use on static mode. Intermediate rolling shall be with a smooth sheet pneumatic roller of 15 to 30 ton capacity having tyre pressure of 7 Kg/Sq.cm. There after the compaction will be carried with the help of Tandem roller with vibratory mode till compaction levels are achieved. Final compaction and surface finish shall be achieved with the help of pneumatic tyred roller.

25.7.8. **PLANTS/MACHINERY TO BE USED:**

(a) **HOT MIX PLANT:** Computerized Hot mix plant of adequate capacity and capable of producing a proper and uniform quality mix shall be used for preparation of the mix. The plant shall be drum mix type, electrically controlled and computerized monitored continuous mix type. The plant shall have coordinated set of essential units capable of producing uniform mix as per the job mix formula such as:

- (i) Cold aggregate feed system for providing blended aggregate in correct proportions. At least 3 bin system shall be deployed.
- (ii) The rotating drum shall be fitted with suitable burners capable of heating the aggregates to the required temperature without any visible unborn fuel or carbon residue on the aggregates.
- (iii) (The three-bin aggregate feed system shall have variable speed belt conveyors, (load cells or other suitable devices) for regulating the accurate proportioning of aggregates into an even flow automatically from a central control bin.
- (iv) Bitumen control unit of the system shall be capable of measuring/metering and spraying required quantity of bitumen at specified temperature with synchronization of bitumen and aggregates feed.
- (v) Filler system suitable to receive bagged or bulk supply of filler material and its incorporation in the mix in correct quantity which could be controlled from central control unit.
- (vi) Dust control unit shall be part of the plant.
- (vii) Suitable auxiliary bitumen boiler of adequate capacity with self-heating arrangement and temperature control device.

(b) **PAVER FINISHER:** Paver finisher shall have the following essential features:

- (i) Loading hoppers and suitable distributing mechanism.
- (ii) Hydrostatic drive/Control for all drives
- (iii) Hydraulically extendable screed for appropriate width requirement
- (iv) The screed shall have tamping and vibrating arrangement for initial compaction tutelage as it is spread without rutting or spoiling the surface. It shall have adjustable amplitude and infinitely variable frequency.
- (v) Necessary control mechanism so as to ensure that the finished surface is free om surface blemishes.

Note: The work shall be carried out by means of mechanical paver. However, wherever widening of road less than 2.0m, same shall be allowed manually.

- (c) **SPRAYING FOR TACK COAT:** Tipper mounted with storage douser for bitumen with heating arrangement and having nozzle fixed at end with suitable pumping arrangement to spray the heated bitumen. The system should have a built-in arrangement to control the speed of the vehicle to give exact/desired quantity of bitumen to be sprayed.
- (d) **TIPPERS:** Tippers deployed for transportation of asphaltic concrete should be directly able to discharge into the paver hopper and shall have suitable hydraulic control for operating the system. The minimum carrying capacity of Tipper shall be 6 Ton.
- (e) **TANDEM VIBRATORY ROLLER:** Tandem Vibratory roller shall have both modes of compaction i.e. static mode as well as vibratory mode. It is desirable to use the static mode for the initial rolling and then resort to vibratory rolling and final finishing to be done by static rolling. The machine shall have auto water spraying system.
- (f) **PNEUMATIC TYRE ROLLER:**
- (i) Final rolling shall be carried out by pneumatic tyre roller. The roller shall have pneumatic tyres placed in such a way that area traversed is suitably covered by the combination of front/rear wheels. The empty weight may be put to the tune of 10 tons and it shall be possible to increase this load to about 21 tons, with ballast or other material for compaction purposes. This machine shall have auto water spray system.
- (ii) The contractor shall remove all loose material/wooden twigs or any other material from resurfaced portion of the road after completion of work.

25.7.9. **QUALITY CONTROL TESTS:**

(a) **CONTROL TESTS ON FLEXIBLE PAVEMENT:**

Sl. No.	Type of Construction	Test	Frequency (Minimum)
1	Semi Dense Bituminous Concrete/Bituminous Concrete	(i) Quality of binder	Number of samples per lot and test as per IS-73, IS-217 and IS-8887 as applicable.
		(ii) Aggregates impact value/Loss Angles Abrasion Value	One test per 200 Cu.m of aggregate One test per 50 Cu.m of aggregate
		(iii) Flakiness Index & Elongation Index	
		(iv) Striping Value	Initially one set of three representative specimens for each source of supply. Subsequently when the warranted by changes in the quality of aggregate.
		(v) Water Absorption of Aggregates (vi) Soundness (Magnesium and Sodium Sulphate)	-do- Initially one determination by each method for each of supply, ten as warranted by change in the quality of

			aggregates.
		(vii) Sand equivalent test	As required
		(viii) Plasticity Index	As required
		(ix) Polished Stone Value	As required, for Semi Dense Bituminous Concrete/Bituminous Concrete
		(x) Percentage of fractured faces	When Gravel is used, one test per 50 Cu.m of aggregates
		(xi) Mix grading	One set of tests on individual constituents and mixed aggregates from the dryer for each 400 tones of mix subject to a minimum of two tests per plant per day.
		(xii) Stability of mix	For each 400 tones of mix produced, a set of 3 Marshall specimen to be prepared and tested for suitability, flow value, density and void content subject to minimum of two sets being tested per plant per day
		(xiii) Water sensitivity mix (Retained tensile Strength)	Initially one set of three representative specimens for each source of supply. Subsequently when the warranted by changes in the quality of aggregate (if required)
		(xiv) Swell test on the mix	As required for the Bituminous Concrete
		(xv) Control of temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling	At regular close intervals
		(xvi) Control of binder content and grading of mix	One test for each 400 tonnes of mix subject to a minimum two tests per day per plant.
		(xvii) Rate of spread of mixed materials	Regular control through checks on weight of mixed materials and layer thickness
		(xviii) Density of compacted layer	One test per 250 Sq.m area
	Binder	(i) Softening Point	Initially on submission there after daily if site blended, weekly if pre-blended
		(ii) Penetration at 25°C and 4°C	-do-
		(iii) Elastic recovery	-do-
		(iv) Ductility	-do-
		(v) Flash Point	-do-
		(vi) Frass Breaking	Initially on submission
		(vii) Viscosity at 150°C	-do-
		(viii) Thin film oven test, penetration, softening	-do-

		pint, elastic recovery of residue, loss on heating.	
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(b) **PERMISSIBLE TOLERANCES FOR SDAC:** The permissible variation in binder content with reference to Schedule 'A' shall be within the following limits:

(i) Binder content : $\pm 0.3\%$

(c) When the road is opened to traffic, it should be ensured that a minimum density of 95% is achieved.

25.7.10. **FINISHED SURFACE PAVEMENT UNIFORMITY (APPLICABLE FOR SDAC):**

The finished pavement shall be of uniform thickness and thickness shall not vary more than 3mm from that specified. The surface tolerance of any paving course shall be such as not to exceed 3mm when tested transversely. The uniformity of finished and compacted surface shall be checked with Profilometer/road unevenness recorder. Any layer with deviation beyond this limit shall be corrected and or removed and replaced by contractor at his own expense. The rectification in such cases shall be carried out with fresh materials and compacted to specifications.

25.7.11. **OPENING TO TRAFFIC:** Traffic may be allowed immediately after completion of the final rolling when the mix has cooled down to the ambient temperature.

25.7.12. **USE OF ROAD:** During the progress of work on road the contractor has to provide suitable temporary screen barricades preferably of galvanization sheets duly painted on back side of intersections of road to avoid any untoward accident.

25.7.13. **COMMUNICATION FACILITIES:** Efficient communication facility for executives and contractor's representative shall made available by the contractor regarding site control, safety precautions, quality control to ensure smooth execution of work.

25.7.14. **MATERIALS AND TESTING:**

(a) A percentage/selected checks as decided by the GE/Accepting Officer, shall be got done independently in the Zonal/Government approved lab and the expenditure for these tests shall be borne by the Contractor.

(b) Type of tests on various materials indicated in MES Schedule Part-I. In case as per relevant IS, if any additional tests are also required to be carried out, the same shall be carried out by the contractor without any extra cost to the Govt.

(c) If the contractor does not carryout any of the tests as specified or for any less number of tests carried out, recovery to that effect shall be made and the recovery rate shall be as decided by Accepting Officer. In case the contractor is unable to carryout certain tests due to break down of testing equipments/non availabilities of testing equipments, the required tests shall be got carried out in Govt. Lab/College as approved by GE and cost of such shall be borne by the contractor.

25.8. **BITUMINOUS MACADAM:**

25.8.1. **PREPARATION OF THE SURFACE:** The surface shall be dry and cleaned of all dust and foreign matter with wire brushes. Any depressions or pot holes shall be properly made up and thoroughly compacted.

25.8.2. APPLICATION OF TACK COAT:

25.8.2.1. The binder shall be heated to its appropriate temperature and applied uniformly over the prepared surface with the help of either self propelled or towed pressure sprayer with self heating arrangement and spraying nozzles, a system capable of spraying bitumen at specified rates and temperatures so as to provide a uniform & even spread of bitumen. The tack coat shall be applied just immediately before spreading the mix. The rate of tack coat shall be as stipulated. The temperatures of application of binder shall be between 165°C to 180 °C.

25.8.3. PREPARATION OF MIX:

- (i) **WEATHER AND SEASONAL LIMITATIONS:** Bitumen macadam shall not be laid during rainy weather or when the surface is damp or wet or when the temperature is less than 16°C under shade.
- (ii) **PLANT:** Hot mix plant of not less than 100 ton/hour output (or as indicated) and capable of producing a proper and uniform quality mix shall be used for preparation of the mix. For small quantity continuous drum mixing plant may be used with approval of GE. The plant shall have coordinated set of essential units capable of producing uniform mix as per the Job Mix formula such as:
 - (a) Cold aggregate feed system for providing blended aggregates in correct proportions. At least 4 bin system shall be deployed.
 - (b) The rotating drum shall be fitted with suitable burners capable of heating the aggregates to the required temperature without any visible un burnt fuel or carbon residue on the aggregate.
 - (c) The dryer part shall be fitted with thermometric instruments so as to indicate/automatically record the temperature of heated aggregates before mixing with the binder.
 - (d) The three bin aggregates feed system shall have variable speed belt conveyors, (Load cells or other suitable devices) for regulating the accurate proportioning of aggregates into an even flow automatically from a central control cabin.
 - (e) Bitumen control unit of the system shall be capable of measuring/ metering and spraying required quantity of bitumen at specified temperature with synchronization of bitumen and aggregates feed.
 - (f) Filler system suitable to receive bagged or bulk supply of filler material and its incorporation in the mix in correct quantity, which could be controlled from central control unit.
 - (g) Dust control unit shall be part of the plant.
 - (h) Suitable auxiliary bitumen boiler of adequate capacity with self-heating arrangement and temperature control device.

25.8.4. TEMPERATURE:

25.8.4.1. The temperature of the binder at the time of mixing shall be in the range of 150°C-177°C and shall be so maintained without overheating of the binder. The temperatures of the aggregates shall be in the range of 155° C-163° C. At no time, however, shall the

difference in temperature between the aggregates and the binder shall exceed 14° C. It shall be ensured that bitumen or aggregates are not over heated.

- 25.8.4.2. The hot combined aggregates and bitumen shall be measured separately and as accurately as practicable, to the proportions in which they are to be mixed. Mixing shall be done thoroughly at least for 30 seconds or more after the addition of the binder, as required so that a homogenous mixture is obtained in which all the particles are uniformly coated.

25.8.5. TRANSPORTING MIXED MATERIALS:

- 25.8.5.1. The mixed materials shall be transported from mixing plant to the site in clean vehicles. Every precaution shall be taken to avoid segregation and to ensure that they do not become contaminated with dust or foreign matter. In order to maintain satisfactory temperature of materials in transit, particularly in cold weather, and to prevent undue loss of heat, adequate precautions shall be taken to ensure that the materials are properly protected/covered during transportation. Hauling over freshly laid material will not be permitted.
- 25.8.5.2. The temperature of the mix in every transporting vehicle shall be checked immediately prior to discharge into the spreader. If the temperature of any batch is below the laying temperature specified the mix shall be rejected and shall be removed from site immediately.

25.8.6. LAYING:

- 25.8.6.1. The mix transported from the hot mix plant to the site shall be laid by means of a self-propelled mechanical paver finisher with electronic sensor and hydraulic controls with suitable screed capable of laying, spreading, tamping and finishing the mix true to the specified width and profile without causing segregation, dragging, bringing, irregularities or other surface defects. The paver shall be capable of being operated at a speed consistent with the character of the mix and the thickness of the course being laid, so as to produce a surface having a uniform density and surface texture. Where not operated on side forms the paver-finisher shall employ equalizing runners, evener arms or other devices to adjust the profiles and confine the edges of the courses to true lines. The temperature of the mix at the time of laying shall be in the range of 120°C to 160°C. The sequence of laying shall be decided by the Engineer-in-Charge preferably starting from edge towards the centre line of the pavement.
- 25.8.6.2. Only in confined spaces and areas when the paver finisher can not operate, handspreading may be permitted by the Engineer-in-Charge. Sub-base areas will meet the specified compaction standards and layer thickness. Generally hand spreading is prohibited unless specifically authorized by the Engineer-in-Charge.

25.8.7. JOINTS IN BITUMINOUS MACADAM:

- 25.8.7.1. **GENERAL:** All joints shall present the same texture, density and smoothness as other sections of the layer. Special care shall be given to joints of sections laid at different time, to ensure a proper bond and a smooth surface between the old and new sections.
- 25.8.7.2. **LONGITUDINAL JOINTS:** Longitudinal joints and edges shall be constructed true to the delineating line parallel to the centre line of pavement. The longitudinal joints shall be truly vertical in straight lines which are continuous for the full length of the pavement, or in smooth curves around bends. Joints in successive asphaltic concrete layers above shall be staggered by 500mm from those underlying layers. The exposed vertical edges of the longitudinal lane joints shall be carefully cut back and trimmed to a dense vertical face in the compacted lane, or for a minimum of one and a half times the layer thickness,

whichever is greater. All debris/loose material arising from this operation shall be removed from the pavement and the underlying surface cleaned. The exposed joints face shall then be cleaned and painted with hot bitumen immediately before the laying of the adjacent lane.

25.8.7.3. TRANSVERSE JOINTS:

- (i) They shall be formed at right angles to the longitudinal joints, and be truly vertical. Transverse joints shall be staggered from each other and in the layers above at least 500mm. The end of day's operations the roller shall pass over the unprotected end of the freshly laid mix.
- (ii) The exposed vertical edges of the transverse joints shall be cut back and trimmed to firm material or for a distance of not less than 1-1/2 times the thickness of layer or up to meeting a dense material of full thickness, whichever is greater. All debris/loose material arising from this operation shall be removed from the pavement and the underlying surface cleaned. The exposed joints shall then be cleaned and painted with hot bitumen immediately before resumption of the laying operation.

25.8.7.4. The longitudinal and transverse joint shall be overlapped by a minimum 50 cm in each additional successive layers to ensure that no weak joint is formed either longitudinally or transversely along the pavement crest thickness.

25.8.8. ROLLING:

25.8.8.1. After spreading of the mix, consolidation shall be done by an approved power driven roller or rollers weighing not less than 8 to 10 tonnes each, and vibratory road roller of adequate capacity. Rolling shall start as soon as possible after the material has been spread. Rolling shall start longitudinally at the sides and proceed towards the centre of the pavement, overlapping on each successive strip by at least one half the width of the rear wheel. End stop channel boards may have to be used if the middle portion of the runway is taken first. Alternate trips of the roller shall be of slightly different lengths.

25.8.8.2. The speed of the roller shall not exceed 5 KM per hour and shall at all points be slow enough to avoid displacement of the mixture and, displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall at once be corrected by the use of rakes and addition of fresh mixture where required.

25.8.8.3. When the roller has passed over the whole area once, any high spots or depressions which become apparent shall be corrected by removing or adding fresh material. Rolling shall then proceed continuously with at least 10 passes of the roller till no further compaction is possible. To prevent adhesion of the mixture to the wheels of the roller, the wheel shall be kept damp with water, but excess of water shall not be permitted. In no case shall fuel lubricating oil be used for this purpose. Rolling operations shall be completed in every respect before the temperature of the mix falls below 80°C.

25.8.9. PAVEMENT EDGES:

25.8.9.1. Pavement shall be laid to correct width and alignment. To achieve straight and vertical edges, the contractor shall cut back the edges to correct width and alignment by removing extra mix spread. Nothing extra shall be paid on this account.

25.8.10. QUALITY CONTROL:

25.8.10.1. The following quality control tests shall be carried out at frequencies specified against each:

Sl. No.	Test	Test Method	Frequency
1.	Flakiness Index and Elongation Index	IS:2386 (Part-1)	Before approval of the quarry and at every subsequent change in the source of supply and one test for every 50 Cum of aggregate.
2.	Impact Value	IS:2386 (Part-4)	-do-
3.	Los Angeles Abrasion Value	IS:2386 (Part 4)	-do-
4.	Stripping Value	IS:6241	Initially one set of 3 representative specimens for each source of supply. Subsequently when warranted by changes in the quality of aggregates
5.	Water-absorption of aggregates	IS:2386 (Part-3)	-do-
6.	Grading of aggregate	IS:2386 (Part-1)	Two tests per day per plant both on the individual constituents and mixed aggregates from the dryer.
7.	Temperature of aggregate at mixing	-	At regular close intervals
8.	Temperature of binder at mixing	-	-do-
9.	Temperature of mix at laying	-	-do-
10.	Temperature of mix at rolling	-	-do-
11.	Soundness (Magnesium and Sodium Sulphate)		Initially, one determination by each method for each source supply, then as warranted by change in the quality of the aggregates.
12.	Marshal Stability, flow, air voids and density		At regular close intervals to ensure uniform strength of the pavement

25.8.10.2. Minimum one test (3 moulds/tests) shall be conducted for every 100 m Ton of mix for Marshal Stability and Flow Value. Field density of Bituminous layer shall be checked for every 100 sq. meters. The field density shall not vary + 2% of the laboratory density.

25.8.11. **BITUMEN CONTENT & BITUMINOUS GRADING:**

25.8.11.1. The bitumen content of the mix shall be tested periodically and as directed by the GE using centrifugal extraction method or such method approved by the GE. The test shall generally be carried out in accordance with established practices and as directed by the GE. Whenever, there is a deviation in the resultant bitumen content from approved job-mix formula values, it shall be reported to the GE immediately and necessary correction made at the Job-mix plant as directed. The permissible tolerance of bituminous content & gradation shall be as under:

(a)	Aggregate passing 4.75 mm	± 7%
(b)	Aggregate passing 4.75 mm sieve and	± 5%

	retained on 2.36 mm sieve	
(c)	Aggregate passing 75 micron sieve	± 2%
(d)	Bitumen	± 0.5%

- 25.8.11.2. **FIELD DENSITY DETERMINATION BY SAND REPLACEMENT METHOD:** The metallic tray of the field density unit is kept on a level spot of the surface and a hole, 10cm in dia is cut to the entire thickness of the layer. All materials removed from the hole are carefully collected and weighed. A known weight of dry standard sand, passing 75 micron IS sieve and retained on 300 micron I.S. sieve is taken in sand pouring cylinder. The cylinder is kept directly over the hole and the shutter of the cylinder is released without any jerk and closed when the hole is filled with the sand. The quantity of the residual sand in the cylinder is weighed and the quantity of filling the cone of the cylinder is determined.

The in-situ density of the layer is calculated as follows:

$$\text{Density} = \frac{A}{\frac{W - (W_1 + W_2)}{d}} \text{--gm. per c.c.}$$

Where,

A = Weight of the materials removed from the hole.

W = Initial weight of sand taken in the cylinder.

W₁ = Weight of the sand filling the cone of the cylinder.

W₂ = Weight of the sand remaining in the cylinder.

d = Bulk density, gm per cc of sand.

- 25.8.12. **ACCEPTANCE CRITERIA OF FIELD DENSITY:**

- (i) The optimum density for the Bitumen Macadam on consolidation shall be taken as the density achieved in Marshall mould after compaction in laboratory with 75 blows on each end of the spectrum. The field density determined as per Clause 20.B.3.11.1 in no case shall be less than 98 % of this optimum lab density.
- (ii) When the field density works out to be less than 98 % of optimum density achieved in Marshall mould in the laboratory, the surface shall be further consolidated till the required field density is achieved. If this is not found possible, the work represented by the sample shall be dismantled and redone by the contractor at his own cost.

- 25.8.13. **CONTROL ON LAID THICKNESS & RECTIFICATION:**

- 25.8.13.1. The surface accuracy shall be checked immediately after rolling. The surface when tested with 3 metre straight edge placed anywhere in any direction, there shall be no gap greater than 6 mm between the bottom of edge & surface anywhere. Surface irregularities falling outside shall be rectified by removing to full depth the affected areas which shall not be less than 10 Sqm and relaying with fresh materials. In no case shall depressions be filled up with screenings of binding material.

- 25.9. **PAINTING ROAD MARKING:**

- 25.9.1. **MATERIAL:**

- 25.9.1.1. Special road marking paint of brand and manufacturer shall be used. The paint shall conform to IS-164. Ready mixed paint as received from the manufacturer shall be used without adding any admixture. During work, if the consistency of the paint gets thick, thinning shall be done by use of thinner of the specified brand of paint, recommended by the manufacturer.

25.9.2. PREPARATION OF SURFACE AND APPLICATION:

25.9.2.1. Surface shall be thoroughly cleaned and dusted. All the dirt, scales, oil etc shall be thoroughly removed before painting is started. The painting shall be applied evenly and smoothly by means of crossing and laying off. Each coat shall be allowed to dry out thoroughly before the next coat is applied. No left over paint shall be put back into the stock tins. No hair marks from the brush or clogging of paint puddles shall be left on the work. Trial patches of paint shall be laid at intervals to check if drying is satisfactory.

26. AREA DRAINAGE:

26.1. Area drainage work shall be carried out all as directed at site by the Engineer-in-Charge.

26.2. Materials such as coarse aggregate, fine aggregate, stone for RR masonry, shall be all as specified hereinbefore.

27. SEWAGE DISPOSAL:

27.1. For materials such as coarse aggregate, fine aggregate, cement, stones, steel for reinforcement etc refer the respective clauses as specified hereinbefore.

27.2. PCC bed and haunching to drain pipes shall be provided all as specified in para 18.68 of MES Schedule Part I.

27.3. RR masonry shall be provided all as specified hereinbefore.

27.4. CONCRETE PIPES:

27.4.1. Reinforced concrete pipes for drains and culverts shall be non-pressure type, class NP2 or class NP3, as indicated; and shall conform to IS 458-2003, Specification for concrete pipes with or without reinforcement. Bends, junctions and specials shall be of cast iron and of suitable size,

27.4.2. The ends of concrete pipes shall be suitable for butt end joints, The butt ends shall be prepared for collar joint with grooves, The pipe joints shall be capable of withstanding the same pressure as the pipe.

27.4.3. Concrete pipes shall be straight and free from cracks excepting craze cracks, The ends of pipes shall be square with their longitudinal axis so that when placed in a straight line in the trench, no opening between ends in contact shall exceed 3 mm in pipes upto 600mm diameter and 6 mm in pipes greater than 600 mm in diameter, The outside and inside surfaces of the pipes shall be smooth dense and hard and shall not be coated with cement wash or other preparation. The pipe shall be free from defects resulting from imperfect grading of the aggregate, missing or moulding. Pipe shall be free from local dents or bulges greater than 3 mm in depth and extending over a length in any direction greater than twice the thickness of barrel.

27.4.4. **BED CONCRETE/HAUNCHING:** Concrete foundations to the pipes, hunching the pipes shall be provided as required. The thickness of concrete bed below the barrel of the pipe shall not be less than 10cm for pipes up-to 150 mm and not less than 15 cm for pipes 150mm and over in dia. Bedding shall extend laterally at least 15cm beyond either side at the barrel of the pipe. Haunching of pipes shall be carried out all as specified in clause 18.68.4 of MES Schedule Part I.

27.4.5. **LAYING AND JOINTING OF PIPES:** The pipes shall be laid on concrete bed as specified in clause 18.69 of MES Schedule Part I. Jointing of salt glazed stone ware pipes shall be carried out as specified in clause 18.70 and 18.70.1 of MES Schedule Part I.

27.4.6. **TEST FOR PIPES:** The pipes shall be tested for water test all as specified in clause 18.79 of MES Schedule Part-I.

27.5. MAN HOLES:

27.5.1. Manholes shall be built as given in clause 18.78 of MES Schedule Part I and shall be tested for water test all as specified in clause 18.79.8 of MES Sch Part I.

27.5.2. STEEL FIBRE REINFORCED CONCRETE (SFRC) COVER SLABS:

27.5.2.1. SFRC cover slabs shall be provided all as required at site and as directed by the Engineer-in-Charge and shall be conforming to IS 12592-2002. All the covers and frames shall be sound and free from cracks and other defects.

27.5.2.2. Cement and aggregate required for the concrete and steel reinforcement shall be all as specified in the relevant clauses of these Particular Specifications..

27.5.2.3. **STEEL FIBRES:** The diameter/equivalent diameter of steel fibres where used, shall not be greater than 0.75 mm. The aspect ratio of the fibres (ratio of the length of the fibre to its diameter/equivalent diameter) shall be in the range of 50 to 80. The minimum volume of fibres shall be 0.5 percent of the volume of concrete.

27.5.2.4. Sampling and testing shall be done all as prescribed in the relevant IS and all as specified and as directed by the Engineer-in-Charge and as approved by the GE.

27.6. MS RUNGS/STEEL RUNGS:

27.6.1. The rungs shall conform to IS: 5455-1969. The step shall be clean, well cast and they shall be free from air and sand holes, cold shuts and warpings which are likely to impair the utility of castings.

27.6.2. The portion of the step which projects from the wall of the manhole shall have a raised chequered design to provide an adequate non-slip grip. Any ribs, chequering, battering or other projection for thick purpose shall be raised above the general plane of top surface of step and shall be placed particularly along the edges of treads. It is considered that in this position the most protection given as against slip.

27.6.3. Rungs shall be provided in all manholes over 0.8m in depth and shall preferably be of cast iron and suitable dimensions (see IS : 5455-1969*). May be 300 mm apart horizontally as well as vertically and shall project a minimum of 100mm beyond the finished surface of the manhole wall. The top rung shall be 450 mm below the manhole cover and the lowest not more than 300 mm above the benching. Footrests shall be painted with coal tar, the portion embedded in masonry or cement concrete block being painted with thick cement slurry before fixing.

28. INTERNAL WATER SUPPLY:**28.1. GENERAL:**

28.1.1. The scope of work is for providing distribution pipe leading to water tanks and down services from water tank to various sanitary fittings, all as specified and as directed by the Engineer-in-Charge.

28.1.2. Particular specifications given hereinafter are brief and are only to particularise, amend and emphasise the specifications given in MES Schedule, Which are not repeated.

28.1.3. In addition to IS mentioned in the MES Schedule, IS-1172, Basic requirement of water supply, drainage and sanction (second revision) and IS-2065, Code of practice for water supply in buildings shall also be applicable and supersede the provisions of MES Schedules in case of any discrepancy.

28.2. MATERIALS:

28.2.1. All fittings, accessories and other items to be incorporated in the work shall strictly as per current/latest IS (even if not mentioned hereinafter) and shall invariably bear the ISI certification mark. In case ISI marked items are not available in the country, these shall be arranged to the best quality as approved by GE.

28.2.2. The test certificates for items to be incorporated shall be procured by the contractor from a standard laboratory as approved by GE. In addition, samples (as per IS provision) shall be tested in any approved laboratory by GE. However the cost shall be borne by the contractor.

28.2.3. All manufactured articles required for incorporation in the work shall be brought to site in the manufacturer's original packing with the seal intact. Incorporation shall be done only when approved by the Engineer-in-Charge.

28.2.4. The samples of all items shall be supplied by the contractor to GE for approval within one month from the date of issue of work order. The contractor shall proceed with the work only after the samples are approved by the GE. Approved samples shall be labeled as such are signed both by GE and contractor. One set of approved samples shall be kept in custody of GE till the work is completed and the other at the site of work. The contractor and the executive will ensure that the materials used in the work are identical with the approved samples.

28.2.5. Concealed pipe work shall be embedded into chases formed/cut into walls/floors. After fixing of pipes gaps/voids in chases shall be filled with cement concrete (1:3:6) type C-1 or in cement sand mortar (1:3) as specified hereinbefore and neatly finished as per surrounding surfaces. Cost of cutting chasing in fly ash brick walls shall be included in Lumpsum cost of building.

28.3. **MILD STEEL GALVANISED TUBES AND FITTINGS:** Water tubing and fittings shall be of galvanised medium grade and shall conform to IS-1239 (Part-I). Laying, jointing and fixing of pipes shall be carried out all as specified in clauses 18.50 and 18.51 of MES Schedule Part-I. The Contractor shall use proper bends, elbows, tees etc. at turning corners. Bending of pipes is not permitted except where the pipe has to follow the contour masonry/ brick work or where a fitting cannot be inserted. The bends shall be gradual and firm with the written permission of the Engineer-in-Charge. Pipes and fittings shall be of make as approved by the GE. Contractor shall provide screwed plugs to all open ends of pipe on completion of day's work. Contractor shall provide screwed plugs to all open ends of pipe on completion of days work.

28.4. **CPVC PIPES:** CPVC Pipes shall conform to IS 15778. CPVC pipes & fittings upto 50 mm bore shall be SDR 11. CPVC pipes and fittings above 50 mm bore shall be SDR 17. All pipe and fittings of CPVC shall be UV stable, leak proof, tough, rigid and suitable for internal and external water supply. The storage and installation of CPVC pipes shall be all as stipulated in Annexure 'E' of IS 15778.

28.5. **BIB TAPS AND STOP VALVES:** Bib taps and stop valves shall be ISI marked and of approved make. Minimum finished mass of bib tap and stop valves shall be all as specified in relevant clause of MES Schedule Part-I (Specifications).

28.6. **PILLAR TAPS:** Pillar taps shall be ISI marked and of approved make. Minimum finished mass of pillar tap shall be all as specified in relevant of MES Schedule Part-I.

28.7. **GATE VALVE:** Gate Valve shall be ISI marked and all as specified in relevant of MES Schedule Part-I.

28.8. **GATE VALVES/NON-RETURN VALVE/SLUICE VALVE:** These shall be of size and specification as given in respective item of Schedule "A", ISI marked and of approved make.

28.9. **RECORD DRAWINGS:** Three copies of line plan of complete work indicating the line of pipes, size, positions of fittings etc., shall be submitted by the contractor to the Engineer-in-Charge on completion of work.

28.10. **WORKMANSHIP:**

28.10.1. Skilled artisans and qualified supervisors shall be employed by the contractor.

28.10.2. Water tubing shall run on the external face of wall as far as possible. Pipes shall be taken into rooms in such a way that minimum length of pipe is required to be embedded in walls/floors/fixed to internal walls.

28.10.3. Laying and fixing of GI Pipe shall be done as specified in MES Schedule. GI tube sleeve shall be provided wherever the piping is passing through walls, floors, slabs etc.,

28.10.4. After fixing pipes to walls or embedding in floors/walls and tested, the disturbed surfaces of walls and floor shall be made good to match with surrounding surfaces.

28.10.5. Proper bends/elbows/tees, etc shall be used at turnings/corners/junctions, etc. Bending of pipes shall not be permitted except where the Engineer-in-Charge decides that it is inescapable and in such case the bend shall be gradual.

28.10.6. Water tubing shall be bitumen coated where the pipes are concealed or buried.

28.10.7. Pipes shall not run diagonally. The galvanizing of clamps nuts and bolts shall be as per relevant IS.

28.10.8. Unions shall be provided at appropriate places as directed by Engineer-in-Charge to the extent necessary to facilitate repairs or alterations to piping without taking out long length of pipes. However, they should be invariably provided for the intake and supply pipes of overhead tanks.

28.10.9. Screwed plugs shall be provided to all open ends of pipes on completion of work.

28.10.10. Work shall be executed by licensed plumbers. The contractor shall produce the license of the plumber for verification of Engineer-in-Charge.

28.11. **WATER: USE OF LOW FLOW FIXTURES AND SYSTEMS:**

28.11.1. The plumbing fixtures with the following flow rates and flush rates shall be installed in bathrooms and kitchens:

Fixture Type	Maximum Flow Rate/ Consumption
Water Closets (Full Flush)	2.7 LPF
Lavatory Faucets/Taps	3 LPM
Showerhead/Handheld Spray	3 LPM

Urinals	1.2 LPF
Kitchen Faucets	3 LPM

29. INTERNAL ELECTRIC SUPPLY:**29.1. GENERAL:**

29.1.1. The specifications and general rules/conditions laid in MES Schedule Part-I and Part-II including errata and amendments as applicable.

29.1.2. The following specifications for internal electrification are supplementary to these given in MES Schedule and shall be read in conjunction with them. These specifications will take precedence over the specifications in MES Schedule where at variance.

29.1.3. All electrical works shall be executed as specified in MES Schedule.

29.1.4. All electrical fittings and wiring runs must be clear off doors, windows and openings.

29.2. CLASS OF WORK:

29.2.1. The work shall be carried out in strict compliance with the provisions contained the latest edition of the Indian Electricity Rules IEE Regulations and IS-732 (Code of practice for electrical wiring and fittings in buildings) as applicable to these works except where such regulations and rules are modified by the specifications. It shall be of high standard and approved constructions used in modern electrical work and shall be suitable in every respect for the type of voltage specified and shall be to the satisfaction of the Engineer-in-Charge.

29.2.2. All electrical works shall be executed properly by skilled licensed electricians under the supervision of suitably qualified electrical supervisor. The contractor on demand by Engineer-in-Charge shall produce such evidence of qualifications of his workmen, supervisors either at the commencement or thereafter during contract period.

29.2.3. The run of ERW conduits shall be marked on the walls and soffits of roof/floor/slabs for wiring. Approval of the Engineer-in-Charge shall be obtained in writing before fixing plugs, conduits, cables and fittings, etc.

29.2.4. Looping in system of wiring shall invariably be used throughout the installations.

29.2.5. Wiring shall be done strictly in accordance with IE Rules and IS Specifications, layout shall be strictly in conformity with modern Engineering practice.

29.2.6. The phase identification should clearly be provided at the main incoming switch.

29.2.7. The name of functions of each distribution board shall be clearly and neatly painted on the distribution boards. The metallic covering or supports of all medium/pressure apparatus and conductors shall be bonded together where possible and have two separate and distinct Earth connections.

29.2.8. After fixing to walls disturbed surfaces like cutting/leaving/forming holes in walls and floors shall be made good to match with the surrounding surfaces.

29.2.9. Suitable lintels as required in brick construction for mounting sheet steel terminal boxes, etc shall be catered as ordered by GE.

29.2.10. Marking of apparatus shall conform to clause No. 19.106 of Sec-19 of MES Schedule Part-I.

29.3. **MATERIALS AND SAMPLES:** Approved samples shall be labeled as such and signed both by the contractor and the GE. These shall be in the custody of Engineer-in-Charge till final completion of the work. The materials shall be brought to site by the contractor in the makers wrapper and shall not be installed unless approved by the Engineer-in-Charge. The contractor shall ensure that the materials used in the work are identical with approved samples and are uniform throughout.

29.4. **SCREWS, NAILS, ETC.:** All screws used in the work shall be brass nettle fold or sun brand. Cover of MS boxes be fixed with brass screws.

29.5. **TYPE OF WIRING:** Type of wiring shall be all as directed by Engineer-in-Charge.

29.6. **SUB MAIN WIRING:** Sub main wiring shall be directed by Engineer-in-Charge.

29.7. **POSITION OF MAIN SWITCH BOARD:**

29.7.1. The main switch board for buildings shall be conveniently and suitably provided as shown on drawings/as directed by Engineer-in-Charge.

29.7.2. All modular GI boxes for mounting switches, sockets, regulators etc. shall be fixed flush with the finished surface of the wall. ISI marked modular switches, sockets, fan regulators etc. shall be mounted on modular GI sheet with earth terminal including modular white cover fixed on modular GI sheet flush box with a frame for mounting the above items.

Note: Size of the box may vary depending up on the number of switches, sockets, fan regulators etc. not necessarily providing an individual box for each item. Required number of modular GI boxes shall be provided in required number and sizes in each room as per the site requirement and as directed by the Engineer-in-Charge.

29.8. **CABLES:** All cables except flexible cable to be used in the work shall conform to IS-694-1977. All cables used in the work shall have ISI marking. The cables shall be approved by the GE.

29.9. **MS BOX FABRICATED STEEL BOX:** MS box for housing, switches etc. shall be fabricated out of 1.2 mm thick MS sheet and made all as directed by Engineer-in-Charge and shall be fixed sunk into walls with plugs and screws. The size of the box shall be suitable for No. of modules used.

Note: Box size may vary depending upon number of switches, sockets, regulators, etc to be provided. It is not necessary to provide individual box with individual switches and control. Number of MS boxes and size to be provided in each room/ place shall be decided by the Engineer-in-Charge.

29.10. **SWITCHES, SWITCH SOCKET OUTLET:**

29.10.1. The switches shall be best quality and approved conforming to the requirement laid down in IS-3254. Switches shall be of 6 Amps. Piano type switches shall be connected to phase and not to the neutral wire.

29.10.2. All the switches/switch socket outlet shall bear ISI mark.

29.11. CONDUIT:

29.11.1. Conduits of rigid non metallic PVC heavy grade shall conform to IS-9537 and accessories conform to IS-3419. Conduits where specified shall be concealed in walls/slabs and fixed as specified in clause 19.132 of MES Schedule Part-I. Conduits shall be approved by GE.

29.11.2. Metallic Conduits shall be ERW steel galvanised conduit conforming to IS-3601. Conduits shall be approved by GE. Conduits where specified shall be fixed as specified in clause 19.125 to 19.131 of MES Schedule Part I. Conduits shall be approved by GE.

29.12. **PLUGS:** In ceiling/columns/stonewalls provide patent "Rawl plug" (such as "MELTREK" rawl plug or "Phil plug"). These shall be of adequate size. Wooden plug shall be provided in other places as approved by Engineer-in-Charge.

29.13. **GENERAL:** All the fittings and accessories shall be uniform throughout suitable in every way for the supply to which they are connected. Details of materials and workmanship unless otherwise specified shall be as per MES Schedule and relevant IS specifications.

29.14. MCCBs, MCBs AND MCB DB:

29.14.1. MCCBs, MCBs shall be approved by GE:

29.14.2. Sufficient length of cables shall be kept inside control boards for connections between MCBs, MCB, DB sub main wiring shall be measured upto the top of board only. The unit rate of distribution boards shall include for the above provisions.

29.14.3. All cable terminals inside main switches/main control board/Isolators/bus bar Chamber/MCB DB, etc shall be provided with suitable lugs for connection/inter connections.

- (a) The sheet steel MCB distribution boards shall be provided with electrolytic quality copper bus bar for phase neutral.
- (b) Powder coated factory made enclosure fabricated out of 1.6 mm thick CRCA steel sheet.
- (c) Detachable conduit entry plate shall be provided for both top and bottom with knock outs.
- (d) All the miniature circuit breakers (MCBs) shall comply with IS-25A25A225A-19725A -(C curve 10 KA)
- (e) The MCBs shall be designed for operated on hammer trip principle for effectively limiting the fault current within shortest period.
- (f) The MCBs inside DBs shall be direct rail mounted.

29.14.4. All MCB DBs MCBs on panel board shall be provided with suitable compression lugs/glands for various cables.

29.14.5. All the item provided in the works shall be IS marked. If IS mark is not available in India the same shall be procured from the best available in market with prior approval of GE. No sub standard item shall be allowed.

29.15. EARTHING:

- 29.15.1. Earthing shall be strictly in conformity with MES Schedule Part-I as per Electrical Plate No.2/Plate No.3 for pipe earthing/plate earthing respectively and work shall be executed in the presence of MES representative.
- 29.15.2. Excavation for earth pit shall be in any type of soil. Excavation shall be passed by the Engineer-in-Charge before refilling. The surplus soil if any shall be removed to a distance not exceeding 50 Mtrs and the site kept clean and tidy.
- 29.15.3. All metal works associated with wiring system (other than current carrying parts) including cables, sockets steel conduit and boxes shall be earthed through earth continuity conductor as required under Indian Electricity Rules. Earth terminals for switch socket outlets and fans/regulators shall be connected to the earth continuity conductors.
- 29.16. **THE MAXIMUM CONTINUITY RESISTANCE:** The maximum continuity resistance from any point in the installation including the earth continuity conductor and earth pipe shall not exceed one ohm.
- 29.17. **PORCELAIN CONNECTORS 2/3 WAY:** These shall be of best indigenous make suitable for AC single phase 230 volts 5 amps and approved by the GE before incorporation in the work. The terminal screws shall be brass and well shrouded in the porcelain fittings. The connectors shall be concealed in the porcelain fittings. The connectors shall be concealed porcelain connectors $\frac{2}{3}$ way shall be used invariably.
- 29.18. **RECORD DRAWINGS:** On completion of the wiring of the building the contractor shall submit three copies of the line plans of buildings (Scale 1:100) indicating actual position of all fittings and actual runs of all main and sub circuits and such other information which the Engineer-in-Charge require. Phase and neutral wires shall be shown in red and black colour respectively.
- 29.19. **ELECTRICAL TESTS:**
- 29.19.1. On completion of wiring the following tests shall be carried out :-
- (a) Insulation test
 - (b) Testing of earth continuity and earth resistance.
 - (c) Polarity test
- 29.19.2. The test result shall be recorded and signed by Engineer-in-Charge and the contractor and to be submitted to the department in triplicate.
- 29.19.3. The contractor shall submit CMRI test certificate to conform relevant IS provisions, for flame proof fitting supplied under the contract. Fittings shall be allowed for incorporation in the work only on production of the above certificate.
- 29.20. **GUARANTEE FOR LED LIGHT FITTINGS:**
- 29.20.1. Contractor shall furnish a written guarantee to GE for a period of 70 Months from the certified date of completion of the entire work for effective functioning and continuous rated lumen output of LED Light Fittings on Non-Judicial Stamp Paper of Rs. 100.00. If the LED light fittings become non functional or in case of any defect found in the light fitting or rated lumen is not produced during aforesaid Guarantee Period, the contractor shall carry out the necessary repairs / rectification / replace the necessary spares including LED bulbs to the entire satisfaction of Garrison Engineer at his own cost in the following cases:

- [a] Manufacturing Defects
 - [b] Failure due to mechanical and electrical impact
 - [c] Drop in Lumen [or Lux at 1m] below 90% of claimed values of Lumen [or Lux at 1m] of the LED Luminaire
- 29.20.2. An amount calculated @ 2% of the value of LED Light Fittings at contract rates enhanced by 25% and rounded off to next hundred rupees [Subject to a minimum of Rs. 5,000.00] shall be retained out of the contractor's bill as Security Deposit against the Guarantee for effective functioning and continuous glowing of LED Light Fittings for 70 Months. This Security Deposit shall be released after successful expiry of the 70 Months guarantee period from the certified date of completion of the entire work by GE, provided always that the contractor shall first have been paid the Final Bill and have rendered "No Demand Certificate [IAFA –451]". Alternatively, the contractor may furnish Fixed Deposit Receipt in lieu of Security Deposit from a Schedule Bank in favour of GE for the above said Guarantee Period.
- 29.20.3. Should the GE at any time during the Guarantee period, find defective performance of the LED Light Fittings, the contractor shall, on demand in writing from the GE specifying the location complained of notwithstanding that the same may have been inadvertently passed / certified and paid for, undertake to carry out such repairs / rectification / replacement of spares including LED bulbs as may be necessary forthwith to rectify the defects to the full satisfaction of GE and render complaint, free from any type of defects. In the event of his failure to do so, within the period as specified by the GE in his aforesaid demand, the GE may undertake such defective work through other agency at the risk and cost of the contractor in all respects. The liability of the contractor under this condition shall not extend beyond the period of 70 Months from the certified date of completion, unless the GE had previously given notice to the contractor to rectify the defects. Condition – 46 of General Conditions of Contracts [IAFW – 2249] shall be deemed to be amended to the extent mentioned above.
30. **EXTERNAL WATER SUPPLY:**
- 30.1. **GENERAL:**
- 30.1.1. The work under this Schedule comprises of taking branch connection by cutting, the existing cast iron pipeline, laying cast iron pipes and specials, PP-R pipe including fittings.
- 30.1.2. Layout of pipelines shown in drawing is tentative and any change in layout would not entail the contractor for payment. Layout of pipelines including specials and fittings shall be marked on ground by the contractor for approval of Engineer-in-Charge. Actual work shall be carried out only after approval by the Engineer-in-Charge. The contractor shall be advised to produce the materials only after approval of layout.
- 30.1.3. The work shall be executed by a licensed plumber. The contractor shall provide the license of the plumber for verification on demand by Engineer-in-Charge.
- 30.2. **MATERIALS:** All fittings, accessories and other items shall strictly conform to current/ latest IS and shall invariably bear ISI certification mark. Material shall be incorporated in work only when approved by GE/Engineer-in-Charge.
- 30.3. **MILD STEEL GALVANISED TUBES AND FITTINGS:** Water tubing and fittings shall be of galvanised medium grade and shall conform to IS-1239 (Part-I). Laying, jointing and fixing of pipes shall be carried out all as specified in clauses 18.50 and 18.51 of MES Schedule Part-I. The Contractor shall use proper bends, elbows, tees etc. at turning corners. Bending of pipes is not permitted except where the pipe has to follow the contour masonry/brick work or where a fitting cannot be inserted. The bends shall be gradual and firm with the written

permission of the Engineer-in-Charge. Pipes and fittings shall be of make as approved by the GE. Contractor shall provide screwed plugs to all open ends of pipe on completion of day's work. Contractor shall provide screwed plugs to all open ends of pipe on completion of days work.

30.4. **GATE VALVES/NON-RETURN VALVE/SLUICE VALVE:** These shall be of size and specification as given in respective item of Schedule "A", ISI marked and of approved make.

30.5. **DI PIPES AND PIPE FITTINGS/SPECIALS:** Centrifugally Cast (spun) Ductile Iron Pressure Pipes shall be IS-8329 marked of class K-7/K-9 and suitable for Spigot and Socketed CI/Ductile Iron Fittings with Push on Joints. The pipes shall be in standard lengths of 4m, 5m, 5.5m & 6m. The pipes and fittings shall withstand the hydrostatic test pressure after installation, without showing leakage, sweating or defects of any kind as laid down in IS. Internal surface of Pipes and Fittings such as bends (any type, radius and angle), tapers any type (straight, bent, increasing/decreasing or double socket, etc.), tee pieces (single branch 'Y' junction, double branch, etc.), cross (all flanged), collars, duck foot bends, caps and plugs etc shall be cement mortar lining with epoxy seal coat and external surface shall be zinc coating (minimum 130 Grams per square metre) with bituminous finish layer (minimum thickness 70 micron). Ductile iron Pipes shall be laid, jointed and tested all as per IS-12288, Code of practice for use and laying of DI pipes and as specified in MES Schedule Part-I. All DI pipe fittings/special shall be IS-9523 marked. Thickness of fittings shall be as per class K-12, PN-10.

30.6. **CI PIPES AND FITTINGS:**

30.6.1. Pipes and fittings of over head tank shall be of cast iron. Inlet, outlet, wash out and over flow pipes shall be of cast iron flanged pipe 150 mm dia Class "LA". Pipes and fittings passing through the walls and slabs shall be embedded in concrete and shall be of double flanged type and provided with normal puddle flanges of 12mm thick. Puddle flanges shall be provided where pipes are being embedded in the concrete slabs of the overhead tank. The cost of these puddle flanges is also deemed to be included in the lump sum amount quoted by the tenderer. Inlet, outlet, wash out and overflow pipes shall be provided up to PCC drain and further pipe connection shall be measured and paid for separately. Openings shall be provided as shown on drawings and during execution of the work. No opening shall be provided after the concrete has set. The contractor shall make the surface good and leak proof after providing the pipes and fittings in slabs / wall to the satisfaction of the Engineer-in-Charge.

31. **EXTERNAL ELECTRIFICATION:**

31.1. **GENERAL:**

31.1.1. The work under this schedule comprises of provision of underground cables etc.

31.1.2. The entire equipment shall be from standard manufacturers with high class workmanship and finishes as mentioned hereinafter. The tenderer shall state while submitting his tender, the name of the manufacturer(s) whose equipment he would be offering for incorporation in the work.

31.1.3. The contractor shall be responsible for supplying, erecting, installing, testing, commissioning of all the equipment as directed by the Engineer-in-Charge.

31.1.4. The installation of electric equipment shall be carried out by an authorised Engineer, competent to undertake such work, within the rules and regulations applicable to the Andhra Pradesh State Electricity Board.

31.2. **APPLICABILITY OF RULES, REGULATIONS AND CODE OF PRACTICE:**

31.2.1. The entire electrical installation under this contract shall comply with requirements of Indian Electricity Rules, acts and other regulations such as those made under factories and Fire Insurance Act, as may be applicable from time to time.

31.2.2. Generally power is supplied to MES by Andhra Pradesh State Electricity Board and therefore all plants, equipment and electrical work shall comply with relevant rules of that authority also. It will be the responsibility of the contractor to ascertain from Andhra Pradesh State Electricity Board rules and regulations applicable for these installations and to ensure their compliance in this work. The installation under this contract shall be executed as per the latest Indian Standard Codes of Practice.

31.3. **CIVIL ENGINEERING WORKS:** Cost of all civil Engineering works required for installation of various electrical equipment shall be included by the tenderer in the Lumpsum quoted.

31.4. **PAINTING AND PROTECTION:**

31.4.1. Each item of equipment shall be painted or protected as detailed hereinafter. Entire surface of structural steel work shall be thoroughly scrapped to remove rust, dust etc and wire brushed. One coat of zinc chrome primer shall be applied before erection. After erection at site the structural steel work shall be painted with a under coat followed by finishing coat. Damage to paint in respect of factory painted equipment shall be made good by applying same tint and type of paint.

31.4.2. After erection at site and before being connected to the power supply, all items of electrical equipment and all circuits shall be fully tested to prove correct connection, insulation resistance, continuity, effective earthing etc. Any defects pointed out /noticed shall be rectified immediately by repairing or replacing defective part of equipment. All instruments and appliances, other materials etc. required for carrying out the tests shall be provided by the contractor. The entire electrical installation shall be tested before commissioning by electrical inspector deputed by the Accepting Officer.

31.4.3. If owing to storage or other causes, the electrical insulation resistance has deteriorated, the equipment shall be thoroughly dried out and replaced or other steps taken to restore proper insulation resistance before connecting it to the power supply.

31.4.4. After connecting the power supply, the whole of the insulation shall be tested to demonstrate its ability to operate satisfactorily.

31.4.5. The result of all such tests shall be recorded and signed by the contractor and the Engineer-in-Charge. The installation shall be deemed to be completed only after satisfactory completion of all the tests. Approval by the GE for materials, workmanship etc will not relieve the contractor from his obligations to comply with all the requirements of the contract.

31.5. **OPERATION OF EQUIPMENT OF CONTRACTOR:** The contractor shall be responsible for all operations necessary for the adjustment, testing and final trials of the equipments and system until it has been taken over by the department. During the complete period of erection and testing, the contractor shall be fully responsible for the preservation, care and

maintenance of the equipment and he shall provide all materials and stores etc. necessary for these operations until the work is taken over.

- 31.6. **EXCAVATION AND EARTH WORK FOR CABLE:** The trenches for cable shall be upto a depth of 75cms for LT cable and 90cm for HT cables and width as per IS-1255 with allowances for horizontal inter axial more than required excess spacing as specified in succeeding clauses and bottom of trenches shall be formed to level and gradients all as specified in MES Schedule. In case excavation is done more than those required, the excess shall be made good by cement concrete (1:7:12) with 20mm graded aggregate. All surplus spoil shall be disposed off to a distance not exceeding 50metres as directed by the Engineer-in-Charge.
- 31.7. **HT/LT CABLES:** HT/LT underground cables shall conform to relevant IS Specifications suitable for 11000/1100 volt grade electric supply with aluminium conductors. The cable shall be laid and jointed as specified in clauses 19.74 to 19.91 & 19.93 to 19.96 of MES Schedule Part-I (Specifications). While laying underground cables under paths, roads etc, exact depth at which the cable are to be laid shall be directed by Engineer-in-Charge. Cables shall not be bent to small radius while laying in trenches/ducts. The minimum safe bending radius shall be taken as 12 times the diameter of the cable. Cable gland shall be made of brass and conforming to relevant IS specifications.
- 31.8. **TESTING OF CABLES:** Testing of cables shall be carried out as detailed in clauses No 19.93 and 19.94 of MES Schedule Part-I (Specifications). The cable record shall be maintained all as per clause 19.95 of MES Schedule Part-I (Specifications).
- 31.9. **MCCB:**MCCBs shall be suitable for operation on triple pole AC 415 Volts 50 cycles of different interrupting capacity as required.
- 31.10. **CONNECTING:** The cables shall be connected to the terminals of switches etc through suitable type aluminium lugs as required site.
- 31.11. **UNDERGROUND CABLE ROUTE INDICATOR:** Underground cable route indicator shall be provided at every 50 Metres interval throughout the length of the route, and at every bend/change in direction of the route. The indicator shall be made out of cast iron piece not less than 6 mm thick supported by 25x6 mm flat iron piece. The unit rate quoted for cable shall deemed to include the cost of cable route indicator.
- 31.12. **TESTING OF CABLES BEFORE COMMISSIONING:**Testing of cables as specified in relevant IS shall be carried out in all cables in presence of the Engineer-in-Charge after laying and jointing and the results shall be recorded.
- 31.13. **GI PIPE:** GI tubing shall be IS marked IS-1239 and shall be all as specified in clause 125A.4 of MES schedule part I. The fittings provided by the contractor shall bear ISI mark. GI pipes shall be any one of the makes mentioned hereinafter.
- 31.14. **GUARANTEE FOR LED LIGHT FITTINGS:**
- 31.14.1. The Guarantee for LED light fittings shall be all as stipulated here-in-before in internal electric supply.
- 31.15. **LT PANEL:**
- 31.15.1. **GENERAL:** Design, manufacture, testing, supply, install and commission cubical type, sheet steel enclosures, free standing floor mounting, Outdoor type or Indoor type LT Panel as per specifications given below and confirming to IS-375. The Contractor shall

submit drawings for panel boards with complete details for acceptance before starting manufacture of LT panels. LT panel shall be from any of the CPRI approved manufacturer.

- 31.15.2. **SYSTEM:** The LT panel shall be suitable for operation on Three Phase, 4 Wire, 415 Volts, 50 Hz, Neutral earthed and short circuit fault level not less than 10 KA at 415 Volts and shall be suitable to withstand a Fault level of 50 KA (RMS) for one second. Rated normal voltage shall be 415 Volts.
- 31.15.3. **STANDARD:** The design, manufacture and testing of the various LT panel covered by this specification shall comply with latest edition of the relevant Indian Standard and Indian Electricity Acts.
- 31.15.4. **CONSTRUCTION:** Mainframe of LT Cubical Panel/Switchboard including Doors and Covers shall be fabricated with minimum 3.15 mm thick CRCA Sheet for Outdoor type and 2mm thick CRCA Sheet for Indoor type. CRCA Sheet shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kinds in sheet shall be seam welded. All welding slag grounded off and welding pit wiped smooth with plumber metal. All panel and covers shall be properly fitted and square with frames and holes in the panel correctly positioned. Fixing screws shall be fixed in position with shank nuts. Self threading screws shall not be used in construction of panel/ switchboard. Panel/ switchboard shall be totally enclosed design conforming to Protection Class IP-54 for Outdoor type and IP-43 for Indoor type as per IS-2143. Soft compressible Neoprene gasket shall be used between all metal joints, doors and covers to prevent ingress of dust and moisture. A horizontal wire way with screwed cover shall be provided at the top to take inter connecting control wiring between different vertical sections. Separate and adequate size compartment shall be provided for accommodating instruments, indicating lamps, control contactors, control fuses and for outlet from each switches etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of circuit breaker bus bar connection. The panel/switch board shall be designed for natural cooling. A cover plate at the top of the vertical section will be provided with a ventilating hood. External aperture of ventilating way is covered with a perforated sheet having holes less than 1.00mm dia. Danger boards shall be provided to all the LT panel boards as per IS specification. The holes provided for incoming and outgoing cables in the panel shall be covered with sliding cover to provide short circuit hazards due to lizards/insects etc.
- 31.15.5. **INSTRUMENT ACCOMMODATION:** Separate and adequate compartments shall be provided for accommodating instruments indicating lamps and control fuses etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of circuit breaker, bus bar and connections. Every MCCB shall be provided with ampere meter of suitable rating. Voltmeter shall be provided only on incoming switch of each panel.
- 31.15.6. **CIRCUIT COMPARTMENTS:** Each switch fuse unit shall be housed in a separate compartment and shall be enclosed on all sides. Sheet steel hinged lockable door shall be duly interlocked with switch as mentioned in IS-8623 in "ON" position.
- 31.15.7. **BUSBAR:**
- 31.15.7.1. Busbars shall be either of copper or aluminium of rated capacity. Cross section of Busbars shall preferably be rectangular and for each phase and neutral shall be same and shall be extendable on either side. Copper busbars shall be made of high conductivity 99.9% pure copper of ETP Grade. Aluminium busbars shall be made of 63401 WP Grade Aluminium Alloy. All the busbars shall have full round edges and shall be suitably braced with non-hygroscopic SMC supports of 660 Volts Grade. The rating of bus bar is for a maximum total operating temperature of 110°C at an ambient of 40°C (at full load current).

- 31.15.7.2. All the Busbars shall be fully air insulated and shall be colour coded in Red, Yellow, Blue and Black colours as per the standard practices using heat shrinkable PVC Sleeves for easy identification of individual phases and neutral. The inter connection shall be sleeved with PVC insulated tapes and colour coded. The bus bars shall be supported on suitable insulator, supports at short intervals to withstand the forces arising from short circuit on the system. Automatically operated safety shutters to screen in the live parts when breaker is withdrawn from the cubicle shall be provided in case of ACBs.
- 31.15.7.3. Horizontal bus bar shall be run at the top or at the bottom of the panel in a separate chamber and the chamber shall be adequately ventilated.
- 31.15.7.4. Vertical bus bar feeding the breaker shall be provided in each cubicle. Connections between bus bars and circuit breakers terminals shall be through aluminium strips/ copper strips of proper size to carry full rated current and insulated with sleeves. Copper strips shall be used where called for.
- 31.15.8. **PAINTING:** Every panel/ switch board shall be painted with two coats of epoxy powder paint over a coat of primer after undergoing a rigorous metal treatment process involving alkaline degreasing, de-scaling in dilute sulphuric acid or any other acid and phosphate. Paint shade will be 631 of IS-5.
- 31.15.9. **TERMINALS:** The incoming and outgoing cable will enter the panel from top or from sides. However, it can be taken from bottom, if situation warrants. Outgoing terminals of breaker and neutral link shall be brought to a terminal block suitably located at the rear side of the panel. A separate cable compartment can be provided for incoming and outgoing cables. Adequate space should be provided at the terminal point to give proper bend to cable before connection and at entry point cable inside the panel shall be properly clamped on sidewall at the rear. There should be sufficient space at the rear to avoid bunching of cables. Each cable should be able to come out without affecting other cable in case of replacement/breakdown. All cables shall enter into the Panel/Distribution Board/Switch Fuse Unit with double compression brass glands. Cost of gland is deemed to be included in the quoted cost of cable. An adopter box by extending the input and output terminals of the switchgear shall be provided where there is difficulty in terminating No. of runs of cables and the cost of the same is deemed to be inclusive in the cost of panel.
- 31.15.10. **SIZE OF CONTROL CABLES:** Cross sectional area of control cable shall be minimum 1.50 Sq.mm of copper with the insulation level of 660 V conforming to IS-694.
- 31.15.11. **TEST:** Prototype of all panel supplied as per above specification should have been tested and approved previously by CPRI. Tenderer should submit the dimensional drawings of prototype LT panels tested along with test results. All routine and type test result should conform to IS-8623.
- 31.15.12. **RUBBER MATS:** The rubber mats shall be 15 mm thick. These shall be solid rubber insulating material to be laid before the panels. Rubber mat shall be made from compound vulcanised rubber free from filler insertions and fibre materials. The upper surface shall have ribbed pattern. The lower surface shall be finished in cloth imprint. Mats shall be free from plasters, pinhole, embedded foreign matters and the other physical defects. It shall be ISI marked. The rate quoted against LT panel is deemed to be including rubber mats as required.
- 31.15.13. **DANGER NOTICE PLATES:** Danger notice plate shall be provided on all electrical equipment like LT switchgear, bus duct etc. The danger notice plate shall conform to IS-2551: 1963. 250 X 200 mm size danger notice plate for 11 KV and 433/380 volts

respectively shall be provided as directed by Engineer-in-Charge. The plates shall be made from 1.6mm thick MS sheet, vitreous enamel white. The letter, figures and conversional skull and bones in signal red colour shall be fixed either with 25 X 3 mm MS clamps or rivet/nut bolts.

31.16. EARTHING:

31.16.1. Earthing shall be provided of the types as mentioned in Schedule "A" and shall be executed as per IS-3043 and clause 19.137 to 19.146 of MES Schedule Part-I. The overall earth resistance of the earthing system (electrode) shall not exceed one ohm. Earthing shall be done in a manner that the inner edges of earth pit is at least 2 metre from the foundation (extreme outside end) of building/poles etc and the minimum distance between any two earth electrodes shall be regulated as per IS-3043. All pipes used in earthing shall be of medium grade.

31.16.2. RCC Cover for earth pit shall be 50 mm thick, mix of concrete for cover shall be (1:2:4) type B-1 using 20 mm graded crushed stone aggregate and reinforced with 6 Nos, 8 mm dia TMT bars in both ways. Handle shall be of 8 mm dia high strength deformed TMT steel bars and shall be fixed in such as way that the gap between cover and handle is at least 150 mm. Cover shall be placed on MS frame made with 40 X 40 X 6 mm Angle Iron embedded in concrete.

31.16.3. Concrete chamber shall be PCC, 1:2:4, Type B-1 using 20 mm graded stone aggregate. All internal surfaces of the chamber shall be given 15 mm thick plaster in cement mortar (1:4). Funnel in chamber shall be made out of MS with 20 mm bore, medium grade GI Watering pipe. It shall be leak proof and provided with wire gauge duly soldered.

31.16.4. Charcoal dust and salt filling shall be done in layers as shown in electrical plate. Surplus soil shall be disposed off and site left clean and tidy on completion.

31.16.5. For checking the efficiency of earthing, the following test shall be carried out, preferably during the summer months:

- (a) The earth resistance of each electrode is measured.
- (b) The earth resistance of earthing grid is measured.
- (c) All electrodes are connected to the grid and the earth resistance of the entire earthing system is measured.

31.16.6. It shall be ensured that as per NEC-1985, the size of earth continuity conductor shall not be less than half the size of main current carrying conductor subject to a minimum of 1.5 Sq.mm for copper and 2.5 Sq.mm for aluminium.

31.17. TRANSFORMERS:

31.17.1. GENERAL:

- (a) Transformer to be supplied in this tender shall comply with the requirement of IS-1180(Part1)-2014 with energy efficiency of "Level 2"as modified hereinafter and MES Schedule Part-I (Specifications). The transformer shall be suitable for supplying mixed power and lighting loads. Primary winding (LV side) shall be suitable for with neutral whereas secondary winding (HV side) shall be suitable for

connection. Besides above, transformer should be energy efficient and complying the following requirements:

- (b) Transformer shall be as specified in MES Schedule Part-I (Specifications) and shall be of IS-1180 marked. Transformer fittings and accessories shall conform to IS-3639 and transformer oil shall be IS-335 marked, except as modified hereinafter.
- (c) The transformer shall have continuous maximum rating at specified normal pressure, ratio, frequency and temperature. These shall be capable of carrying sustained overload as specified in IS-1180 and shall be suitable for Vector Group-YND 11.
- (d) The transformer shall be AC, 3 Phase, 50 Hz, Oil immersed, Naturally Cooled with external cooling tubes (ONAN Type), Core type, suitable for indoor/ outdoor installation and shall be insulated with high class materials with high dielectric strength and slow ageing characteristics and able to withstand the impulse voltage as laid down in IS. The winding shall be double copper wound.
- (e) The insulation and magnetic induction shall be suitable for operating the transformer continuously at a voltage 10% more than requisite capacity of transformer. The windings of transformer shall be fully insulated.
- (f) The transformer shall be provided with hand operated "Off-Load" Tap Changer in suitable steps/position on HV side to take care of variation in voltage on HV side to give output of 11KV. The no load and full load losses shall not exceed the values recommended by Central Board of Irrigation and Power (CBIP) and impedance shall be 7.15% plus tolerance as per IS.
- (g) Transformer tank shall be sufficiently strong to allow transportation of each transformer complete with tank and oil by rail, road, ship, jacked or lifted without causing deformation and leakage of oil. The tank shall be made of mild steel plates of suitable thickness and shall be provided with external cooling tubes. Care shall be taken to ensure that the joints between the tubes and body of the tank are oil tight. The transformer shall be provided with four solid cast steel bi-directional reversible detachable rollers to facilitate transporting the transformer to and from its point of installation. The transformer shall be provided with approved arrangement of lugs suitable for lifting the transformer with necessary fittings and complete with first fill of oil. The transformer tank cover shall be designed so as to prevent the collection of moisture on any part. The tank cover shall also be fitted with thermometer pockets.
- (h) The transformer shall be fitted with conservator vessel with oil filling cap, cap drain valve with plug, sump and suitable means of drawing oil.
- (i) The dehydration breather shall be fitted to each conservator vessel and shall be complete with first fill of dehydrating agent.
- (j) The transformer shall be provided with an explosion vent fitted with diaphragm of standard material at the tank as well as the free end and shall be connected directly to main tank top and designed for certain and rapid release of any excessive pressure in the tank due to internal fault that may be generated in the transformer or in the cooling equipment. The pipe should be fitted with a wire net at the free end to prevent any dirt or insect entry. The pressure relief valve shall be reset to normal after release of the pressure.
- (k) The transformer oil shall conform to IS-335. The thermometer fitted on the transformer shall be 150mm vapor pressure type, having range of 0°C-120°C with

reading pointer. One thermometer each shall be provided to indicate the temperature of oil and windings.

- (l) The cost of first fill of transformer oil shall be deemed to be included in the rate quoted for transformers. This oil shall have a dielectric strength not less than 50 KV at 2.5mm gap.
- (m) An oil gauge shall be provided for indicating clearly the oil level in the conservator tank, to an observer standing on ground for indoor transformers and on the platform in case of pole mounted transformers. A tap shall be fitted with oil gauge for the purpose of drawing out quantity of oil for sampling.
- (n) All the valves are of standard type and makes. Means shall be provided to lock the valves. Every valve shall be provided with an indicator to show clearly purpose of the valve and directions of rotation to "Open" or "Close".
- (o) Earthing terminals shall be provided on the tank cover and the tank for earthing purposes. Terminal on the tank cover and tank shall be suitable for connections to the earthing strip of GI of 50mmx6mm section. Separate Natural bushing shall be provided for earthing.
- (p) The NO-LOAD voltage ratio corresponding to the principal tapping shall be 433V/11 KV.
- (q) Transformers shall be provided with HV outdoor bushing insulators on 11KV side and, bimetallic type connectors for vertical take of suitable for ACSR/ Aluminum Conductors shall be provided on 11 KV bushing.
- (r) The dimensions of bushing on 433V side shall conform to IS-3347 (Part-3) and those of 11 KV side shall conform to IS-3347 (Part-4).
- (s) The electrical characteristics of bushing insulators shall be accordance with IS-2099 as amended from time to time. All test (type and routine) shall be carried out in accordance with the above mentioned IS at manufacture's workshop and certificate furnished to GE.
- (t) All the transformer shall be deemed to have undergone satisfactory test as specified in IS-2026 (Para 1, 2, 3 and 4). The test certificate shall be furnished to GE for these tests.
- (u) All electrical installations shall comply with the requirements of Indian Electrical Act and Rules. The following rules of Indian Electricity Rules 1956 area particularly applicable: 35, 45, 50, 51, 59, 61, 63, 64, 65, 67, 68, 69 and 114.
- (v) The transformer shall be fitted with disconnecting chamber complete with LT Cable Boxes and their bushing, disconnecting chamber bushing for indoor transformer and in case of outdoor transformer the HT side shall have bushings (and not cable box), jumpers etc so that if the transformer becomes faulty, it can be taken out without opening the connections from cable boxes and healthy transformer replaced and connected in minimum possible time. The tenderer shall submit, along with the tender, constructional details of disconnecting chamber proposed by him or proposed to be provided by him in the tender.
- (w) All steel works of transformer, not immersed under oil, shall be painted with a coat of anticorrosive paint. The transformer shall be painted with a weather and heat resistant paint of composition and tint as approved by the GE.

- (x) The unit rate inserted in Schedule "A" shall be deemed to include the cost of HT & LT Cable Box and Cable End Joints, provision of all materials etc. The transformer shall be deemed to have undergone satisfactory tests as prescribed in IS. A test report shall be submitted, in original, to the Engineer-in-Charge before incorporating the transformer in the work. The cost of connecting the transformers to HT side and LT side as well as connecting the existing earthing is deemed to be included in the unit rate of transformer.
- (y) The tenderer shall submit complete technical details and specifications along with make and illustrated pamphlet and test report of transformer to the GE for obtaining his approval of the make prior to incorporation in the work.

31.17.2. **INSTALLATION OF TRANSFORMERS:**

- (a) **INSPECTION ON ARRIVAL:** The transformer shall be examined for any sign of damage in transit particular attention is being paid to the following:
 - (i) Denting in Tank sides and cooling tubes.
 - (ii) Damage to Protruding fittings.
 - (iii) Breakage in Oil sight glass.
 - (iv) Damage to Bushings such as cracks or breakage.
 - (v) Loosening of Bolts due to vibration in transit.
 - (vi) Oil leakage particularly along the welds or reduction in the pressure of the gas.
- (b) **INSTALLATION:** The transformer shall be installed as described and per IS-10028 (Part-2).
- (c) **FOUNDATION:** The transformer shall be installed on a level concrete foundation of size to accommodate the transformer in such a way that no person may step on the foundation, if necessary bearing plates of sufficient size and strength shall be provided. When transformer is fitted with rollers, suitable rails or tracks shall be provided and when the transformer is in the final position the wheels shall be locked to prevent accidental movement of the transformer.

31.17.3. **TESTING:** Testing of transformers shall be carried out at the manufacture's workshop as per clause 19.97.8 of MES Schedule Part-I (Specifications) and as per IS-1180 in presence of Representative of Accepting Officer and test results shall be signed by both contractor and inspecting officer before dispatch of Transformer to the work site for erection and copies of the test certificates shall be furnished to the Department. In addition to the prescribed routine tests, Temperature Rise Test shall invariably be done on one transformer of each design. Copies of all tests in accordance with IS including Impulse Test, Pressure Test, Test for Bushing and Test for Short Circuit etc. carried out at manufacturer's workshop shall be supplied along with the transformer. However test results of Winding Resistance, Impulse Voltage, No Load Loss, Full Load Losses and Insulation Resistance will be reflected on test sheet of transformer. In addition to tests at manufacturer's premises all relevant pre-commissioning checks and tests conforming to IS code of practice No. 1886 shall be done before energisation in presence of member nominated by the Accepting Officer. The following tests shall be particularly done and recorded before cable jointing or connecting up the bus-bar trunking:

- (a) Insulation test between HV to earth and HV to MV with 5000 Volts Megger.
- (b) Insulation test on oil.
- (c) Insulation tests between MV to earth wire 500 V Megger.
- (d) Earth resistance Tests.

31.17.4. **TEST CERTIFICATE:** In addition to the manufacturer's test certificates as mentioned above, a certificate from CPRI, for the prototype of the transformer shall be furnished by the tenderer. The contractor shall submit to the GE, Original Purchase Vouchers, Test Certificate and Excise Gate Pass of Transformers or any other equipments/items as considered necessary by the GE, wherever asked for.

31.17.5. **SITE TESTS:** The following tests shall be carried out at site:

- (a) Insulation Resistance Test
- (b) Ratio Test
- (c) Dielectric Strength of Transformer
- (d) Magnetic Balancing Test

31.17.6. However carrying out tests will not absolve the contractor of his responsibilities to ensure satisfactory performance of the Transformer throughout the guarantee period. The contractor shall at his own expense provide all facilities for testing including equipment.

31.17.7. **APPROVAL OF DRAWINGS:** The contractor shall submit drawings of Transformer as decided by GE after approval of the names/brand of the equipment before taking up manufacturing process.

31.18. **EARTHING:** All connections to earth and earthing of neutral shall be carried out in accordance with IS-3043.

31.19. **TAKING OVER OF EQUIPMENT INSTALLATIONS:** If the equipment/installations as described hereinbefore do not show satisfactory results, the contractor shall at his own expense rectify/replace the defective installations or any part thereof as directed by the Garrison Engineer within one month. The decision of the GE shall be final and binding in this regard. The installation shall be re-tested after rectification/replacement of the defective components. The installation/equipment shall be finally taken over after the contractor has given satisfactory testing as certified by the GE.

31.20. **PRECAUTIONS:**

31.20.1. All safety precautions shall be taken by the Contractor to prevent danger to persons while working with electrical equipment.

31.20.2. The Contractor/his workmen shall not start work on the overhead electric line or on electric equipment unless proper shut down is obtained and unless they are reasonably satisfied that there is no danger to the life of workmen.

31.20.3. The Contractor shall be responsible for providing all necessary safety equipment to his workmen to avoid accidents. In case of accidents the Department will not be held responsible.

31.20.4. The layout for external electrification shall be as indicated in the site plan and approved by the GE. The works shall be carried out through a licensed electrician/wireman. The Contractor shall produce such license when required by GE.

31.20.5. Efficient communication facility for executives and contractor's representative shall made available by the contractor regarding site control, safety precautions, quality control to ensure smooth execution of work.

31.21. **AVIATION OBSTRUCTION LIGHTS:** The light fitting shall conform to IS-2147, IP-65 LM 6 alloy with toughened clear transparent dome and endless neoprene gasket with multiple LED's with not less than 5 circuits, including arrangements, etc complete.

31.22. **ELECTRIC CONNECTION:** Electric connection to fittings shall be taken from the essential panel board located in the LT panel roof in ground floor of the building.

31.23. **GENERATING SET:**

31.23.1. **GENERAL:**

- (a) The Generating Set shall be of requisite capacity with acoustic enclosure and as per CPCB norms and shall comprise of one diesel engine of adequate horse power directly coupled to the alternator 415 volts, 3 phase, 4 wire at continuous duty rating at 0.80 power factor 415 V, 3 phase, 50 Hz self-ventilated, self-regulated and self-excited, mounted on a common base, as detailed below:
- (b) The generating set shall be mounted on anti-vibration pads of suitable size similar to that of cushion foot mountings manufactured by M/s Dunlop India Ltd., the cost of which shall be included in the quoted rate.
- (c) The contractor shall within one month of acceptance of the tender forward two sets of design and drawings of foundation from the manufacturers for the approval of Accepting Officer. On approval the contractor shall submit six sets of approved drawings.
- (d) In addition to the anti-vibration pads, sand cushioning all round and bottom of the foundation shall be carried out to arrest the transfer of vibrations to adjacent structures/equipment, the cost of which shall be included in the quoted rate. Proper insulation of exhaust piping up to required length as per standard code of practice shall be made/design for efficient discharge of the gases from engine without back pressure at exhaust main fold. Care shall also be taken so that exhaust piping is properly positioned and supported, flexible bellows are provided to avoid thermal expansion and exhaust system weight does not fall on engine.
- (e) The cost of platform for DG set shall deemed to have been included in the unit rate quoted by the contractor.

31.23.2. **ENGINE:** The engine shall be indigenous make and shall be compact vertical multi cylinder, diesel, naturally aspirated four stroke water cooled type, coupled directly to the alternator through a set of flexible coupling. The engine shall be adequate capacity so as to deliver the rated output of the generator under the existing site conditions. It shall conform to IS-1601 as amended to date. The tenderer shall submit detailed specifications of the diesel engine offered by him in the prescribed proforma as required and approved by the Garrison Engineer. The engine shall be fitted all as per the manufacturer's instructions.

31.23.3. **ALTERNATOR:**

- (a) The alternator shall be designed for an output to suit the DG set at 0.8 power factor,

continuous duty rate 415V, wound for 3 phase 4 wire 50 Hz and shall conform to relevant ISS amended to date. It shall be directly coupled to the engine through a set of flexible coupling. The alternator shall be screen protected, drip proof and fitted with a terminal box for cable connection. The terminal box shall be capable of receiving 3.5 core, 300 sq mm XLPE LT cable armoured. The alternator shall be self-ventilated, self-regulated, the accuracy of regulation being + 5% from no load to full load of the rated voltage.

- (b) The alternator shall be self excited with necessary controls, relays, complete with wiring to control panel and shall be fully tropicalised. The tenderer shall submit detailed specifications of the alternator offered by him in the prescribed proforma as required and shall be approved by the Garrison Engineer.

31.23.4. **CONTROL PANEL:**

- (a) The control panel shall consist of all the control of the alternator as required and recommended by standard codes of practice and shall be as originally manufactured along with the alternator, floor mounted cubical type with LT switch board and complete with internal wiring. Suitable arrangement shall be made for jointing of incoming cable (1 run 3.5 core, 300 Sq.mm) and for connecting the bus duct on the outgoing side. This shall be dust/vermin proof.
- (b) It shall consist of:
 - (i) 4P MCCB.
 - (ii) Ammeter 0-500 Amps with selector switch and CT coil-1 No.
 - (iii) Voltmeter 0-500 Volts with selector switch-1 No.
 - (iv) Frequency meter-1 No.
 - (v) PF Meter-1 No.
 - (vi) KWH Meter-1 No.
 - (vii) Indicator lamps-set of 3.
 - (viii) Fuse-set of 3.

31.23.5. **ELECTRICAL TESTS:**

Before commissioning, the DG set shall be tested by the contractor in the presence of and to the satisfaction of IEM or the representative of the Accepting Officer, GE and Engineer-in-charge for insulation resistance, earth continuity, operation of equipment's and other tests as per the latest ISS/BSS.

The DG set shall be tested on resistive load at unity power factor for a period not less than 12 hours continuously out of which at least 30 minutes on No load, 2 Hrs of 25% rated load, 2hrs on 50% rated load, 2 Hrs 30 minutes on 75% rated load, 4 hrs on rated full load, 1 hr on 110% rated load. Necessary resistive load bank and POL shall be arranged by contractor. All instruments, consumables, stores like engine oil, grease, DHPP etc and appliances for artificial load required for carrying out the tests including manpower shall be provided by the contractor and cost of the same shall be deemed to be included in quoted rate.

The result of such tests shall be recorded, signed by the contractor, IEM or the representative of the Accepting officer, GE and Engineer-in-charge. The installation shall be deemed to be completed only after satisfactory completion of above mentioned tests. The contractor shall submit all test certificates as per latest CPCB-II norms, schematic diagrams, warranty certificates on completion of work and the cost of the same is deemed to be included in rates quoted.

32. **LIGHTENING PROTECTION:**

32.1. The work shall be carried out comply with code of practice vide IS-2300.

32.2. **GENERAL:**

32.2.1. The work under this contract shall be carried out as per IS-2309 and other relevant specifications as applicable to this work and the specifications given hereinafter.

32.2.2. Lightning protection shall be provided generally conforming to the design. As furnished in the drawing and specifications. The contractor is advised to study the site conditions before quoting.

32.3. **MATERIALS:** All materials incorporated in the work shall conform to the relevant BS/IS, specifications and shall be of best indigenous make approved by the Garrison Engineer.

32.4. **SAMPLE:** Before commencing the work the contractor shall produce samples of all materials including accessories proposed to be incorporated in the work for the approval of the GE. Samples that are approved will be retained by GE, until the work is finally completed and accepted. Only materials conforming to the approved samples shall be incorporated in the work.

32.5. **HORIZONTAL CONDUCTORS FIXED ON ROOF:** Where horizontal conductors are used for air termination, no part of the roof should be more than 30 ft from the nearest horizontal protective conductor except that an additional one foot may be allowed for each foot by which the part to be protected is below the nearest protective conductor. Horizontal conductor shall be provided at the quarter perimeter. Wherever lapping of joints is made the length of the overlap should not be less than this also applies to other types of conductors used in this work. The contact surfaces should be first cleaned and then inhibited from oxidation with a suitable non-corrosive compound.

32.6. **DOWN CONDUCTORS:** The down conductors shall be aluminium strip of size 25x3.15mm (and shall be connecting the air termination to the test poles). The number of down conductors shall be as shown in the drawing and described in the Schedule, but shall not be less than number indicated in the clause 10.2 of IS-2309. The down conductor shall be well distributed round the walls of the structure. The place adopted should be such that it is accessible for inspection, testing and maintenance. It should allow the most direct path possible. Fixing arrangements shall be similar to these specified for air terminations. While-right angle bends, if necessary are permissible deep re-entrant loops shall be avoided. Where a loop not be avoided, the conductor shall be arrange in such a way that the distance across the open side of the loop shall be such that it is more than 1/8 the length the loop of the conductor forming the loop. Any extended metal running from the structure shall be bounded to the down conductor at the top and bottom unless the clearance is in accordance with clause 12 of IS-2309.

32.7. **FASTENERS:**

32.7.1. The fasteners used for fixing various conductors shall be mechanically strong substantial in construction and not subject to breakage. The materials used should be such that no

corrosion is caused. The fasteners, similar to these shown in IS-2309 may be used. Full details of the fastener to be used, method of fixing these to roofs, poles etc, shall be furnished by the contractor. The unit rates inserted for air terminations, down conductors etc, are deemed to include the cost of the fastener also.

32.7.2. The hylam block shall be in two halves with control (grip) slot for holding the horizontal/down conductor. First half of the block of size 75x40x10mm shall be fixed to roof/wall/column by 2 Nos. 50mm long heavy gauge (not less than No 9) brass wood screws/eye bolts and nuts. The screws/bolts shall be fixed in suitable rawl jumper holes filled with grip powder (fill plug powder) by adding 10% cement. The second half shall be screwed half shall be screwed to bottom half by 2 Nos. 20mm long heavy gauge (not less than No.9) brass wood screws.

32.8. **TEST JOINT:** Each down conductor shall be provide with testing joint in such a position that while not inviting unauthorised interference, it is convenient to use when testing. This joint will be provided with suitable cover as shown in drawings. Where aluminium conductors are connected to copper, the joint shall be a thick layer of lead as shown in drawings. The rate for the test joints is deemed to include such joints. No connection, other than one direct to an earth electrode shall be made below the test joint.

32.9. **JOINTS AND BONDS:**

32.9.1. The lightning protection system shall have as few joints as possible. In the down Conductors below ground level there shall be no joints. Where joints are necessary they shall be mechanically and electrically effective and shall be so made as exclude moisture completely.

32.9.2. Joints and bonds other than at testing points shall be protected by a suitable material against corrosion. Joints for strip shall be tinned, soldered, welded or braced and at least double reverted. Clamped or bolted joints shall only be used on test points or on bonds to existing metal, but joints for rods may be clamped or screwed type. Protective coating used shall be permanent and non inflammable.

32.10. **EARTH TERMINATION:** An earth termination shall be connected to each down conductor directly or through the earth ring as the case may be. Each of this earth termination shall have a resistance to earth not exceeding 10 ohms. The whole of lightning protection system should have a combined resistance to earth not exceed 2 ohms before any bonding has been effected to metallic or on a structure or to service below ground level. If the value exceeds 2 Ohms reduction should be achieved by increasing the number of earth points. Earth termination should be capable of isolation for testing purposes.

32.11. **CLEARANCE BETWEEN THE LIGHTENING PROTECTION SYSTEM AND METAL ON A STRUCTURE:** Where it is not possible to bond the metal in or on a structure the contractor will ensure the total clearance between the lightning protective system and other metals in the structure shall be as directed by GE.

32.12. **MAKING GOOD OF DISTURBED SURFACES:** The contractor shall make good any disturbed portion of the work to match the surroundings. He shall also make good any minor damages caused to the structures.

32.13. **AIR TERMINATION:**

32.13.1. This shall be horizontal type comprising of 25x3.15mm aluminium Conductor as shown on drawings. The fixing arrangement to roof/parapet/wall Column shall be by means of hylum blocks of size 75x40x10mm, fixed to roof/parapet/wall/column by 2 Nos. heavy

gauge (not less than No.9) 50mm long brass connecting screws/eye bolts and fixed in rawl jumper holes filled by grip powder (fill plug powder) by adding 10% cement. The hylam block shall be in two Valves with a control slot for holding, the conductor firmly. The top half shall be screwed to bottom half by 2 Nos. 20mm long heavy gauge brass screws. The hylam blocks shall be provided at 600mm centres and 150mm distance from edges of Air final termination, test point box and at lap joints.

- 32.13.2. Air finial, aluminium with anodized finish of 12mm dia, 600mm long shall be fixed by threading reverted and welded top and bottom of aluminium base plate of size 125x125x10mm. The entire system shall be fixed to hylam block of size 175x175x10mm by 04 Nos. heavy gauge screws (not less than No.9) and shall be fixed to wall/parapet/roof/columns by GI foundation bolts and nuts..

- 32.14. **TESTING JOINTS/TESTING POINTS CUM GI ENCLOSED BOX:** Phosperbronze/Gun metal/copper test block of size 100x40x30mm, drilled, screwed and fixed to aluminium strip and GI strip by means of 4 Nos. 8mm dia brass screws and washers after drilled and topped. The block shall be fixed to bracket welded to bottom plate of GI box top cover shall be made out of 2mm thick sheet and the bottom shall be 5mm thick MS plate. 4 Nos. suitable studs 8mm dia shall be welded to 5mm thick MS plate at four corners and top cover bottom plate by means of 4 Nos GI nuts and washers. The entire box of size 200x100x100mm shall be hot dip galvanised. Internal surfaces of box and test joint shall be applied with anticorrosive compound. The base plate of box shall be fixed to wall/column by 500mm long brass wood heavy gauge (not less than No.9) screws. Brass screws shall be fixed in rawl jumper holes by means of grip powder (fill plug powder) by adding 10 % cement.

32.15. **EARTH RESISTANCE:**

- 32.15.1. Properly made earth connections are essential to the effective functioning of lightning protection system. Every effort shall be made to provide ample contact with the earth so that the earth resistance can be as low as possible.

- 32.15.2. The whole of lightning protection system should have a combined resistance to earth not exceeding 10 Ohms before any bonding has been effected to metal in or on a structure or to surface below ground.

- 32.16. **TESTING:** After completion of work, the entire system shall be tested by contractor in the presence of Engineer-in-Charge and the results of such test shall be recorded and signed by both parties.

33. **FIRE FIGHTING, FIRE DETECTION AND FIRE ALARM SYSTEM:**

33.1. **GENERAL:**

- 33.1.1. The work under this head shall include provision of intelligent Analogue Addressable Fire Detection and alarm system. The work under system shall consist of furnishing all materials, equipments and appliances and Labour necessary to install the said system, complete with Detectors, Main Control Panel, Sounders, Strobes, Manual Call stations, relays etc, for interfacing with other systems.

- 33.1.2. The Tenders shall also undertake to trip from the Fire Alarm Panel through the use of Addressable Output Modules, individual AHU activated by the fire signal of specified detectors and Input Modules for monitoring water flow switches and other contacts like magnetic door contacts.

- 33.1.3. The general layout of the wiring, detectors, modules etc., shall be designed by reputed fire agency and submitted to GE in four copies for further approval of accepting officer. On approval of layout, the contractor shall submit six sets of approved design to GE and on completion of the contractor shall laminate on set of design and fixed to wall near fire alarm panel.
- 33.2. **STANDARDS:** The system shall meet the following design standard as required by the law of the country. If no specific local laws are available NFPA 72 shall be followed.
- 33.3. **APPROVALS:** The system shall have proper listing and/or approval from any of the agencies i.e EN-54/UL/ULC/FM/MEA/GSFM.
- 33.4. **FIRE ALARM CONTROL PANEL (FACP):** This refers to the Intelligent Analogue Addressable Panel that shall be connected to the various detector/devices by means of 2 wire loops. The FACP shall be able to supervise individual detectors for proper performance as well as to give pin point location of fire alarm. Hooter alarm as well as facility for cutting off of AHU's and electrical power is also be included. The panel shall also have the facility for automatically dialing select phone numbers in case of fire.
- 33.5. **LOOP:** A loop shall mean a 2-wire circuit connecting 250 Addressable Devices, which shall include not more than 125 Intelligent Analogue Addressable Detectors and 125 Intelligent Analogue Addressable input/output Modules. The loop card shall have built in short circuit isolators to accommodate Class A wiring.
- 33.6. **INTELLIGENT ADDRESSABLE DEVICES:** This term indicates the complete group of intelligent addressable devices such as detectors, Manual Call Stations, Addressable Output/Input Modules etc.
- 33.7. **DETECTORS:** The detectors shall have intelligent analogue addressable type. The chamber should be easily removable for the purpose of easy maintenance. The address programming shall be done by a hand held programmer or from the FACP. The detectors shall have a common base to allow easy interchange of various types of detectors. Address setting by DIP Switch shall not be acceptable.
- 33.8. **MANUAL CALL STATION:** The Manual Call station shall be Intelligent Analogue Addressable type with input modules to define the station. The function shall be similar to that of Conventional Manual Call Box and should be reset table with replacing the glass.
- 33.9. **OUTPUT MODULE:** Output Module shall be Intelligent Analogue Addressable type and shall be used for.
- (a) Control and supervision of a notification appliance circuit for 24V DC polarized notification appliance.
 - (b) Tripping the AHU, fan etc.
- 33.10. **INPUT MODULE:** The input modules shall be Intelligent Analogue Addressable dual/single channel type Input module shall be used to connect the any normally opened dry contact devices such as break glass point, water flow switches etc.
- 33.11. **FAULT ISOLATOR MODULE/BASE:** This unit shall be placed on the loop preferably after every 15-20 devices and shall be able to isolate electrical short circuit in the wiring. All the other detectors shall remain functional because of the Class A wiring of the loop. The isolator base shall not utilize an address and shall be built into the detector base wherever required.

- 33.12. **MONITOR MODULE:** Monitor Module shall be Intelligent Analogue Addressable type. Module shall be used for to connect non-addressable smoke detectors and normally opened dry contact devices such as break glass unit, water flow switches etc.
- 33.13. **SOUNDERS:** Sounders shall be addressable type. The sounder shall drive power from separate 24 V DC from Control Panel. It shall be capable of being directly mounted on the wall/ceiling. The sounder shall have an output of at least 100 db at 1 m. The Sounder shall be programmed to get activated in event of an alarm from a single detector/device or a group of detectors/devices.
- 33.14. **SPECIFICATION:** The design, supply and installation and testing of the entire fire alarm system shall conform to UL, ULC & NFPA 71 & 72. The detectors shall conform to relevant codes of Fire Alarm Systems.
- 33.15. **FIRE ALARM SYSTEM:**
- 33.15.1. The fire alarm system shall conform to UL, ULC & NFPA 71/72 in respect of design and installation, and it shall give Audio/Visual Alarm signals when the temperature in case of Heat Detector or smoke density in case of Smoke Detector exceeds the pre-set limit. The system shall give pinpoint location of fire with warning system and voice communication for commands and instruction if required.
- 33.15.2. The system shall be Intelligent Analogue addressable type. The basic function of the system shall be able to achieve pinpoint location of alarm indicator.
- 33.15.3. It shall be possible to program each loop with up to specified detectors and input/output modules.
- 33.15.4. Annunciation facility shall also be added into the FACP, the panel being able to initiate alarm signal for any particular zone.
- 33.15.5. The system shall be fully supervised for all fault conditions with distinctive alarm operated for fault and fire conditions.
- 33.15.6. The FACP shall be so programmed that when a particular detector or group of detectors gives a fire signal the FACP should be able to trip an individual AHU automatically. In case of fire in an area handled by an AHU the FACP shall be able to trigger a Relay that shall shut off the AHU through an additional contact provided in the AHU panel by the AC contractor.
- 33.15.7. The FACP shall have the provision for adding extra loop cards. One loop card shall be incorporated in the FACP at all times. The software shall allow changing the terminal of any of the loops from any operating card to the spare card.
- 33.15.8. The FACP shall be networkable and shall be connect up to specified FACP & 1,60,000 Addressable devices.
- 33.15.9. All detectors input/output modules and control panel should be of same manufacturer.
- 33.15.10. System itself shall have facility to connect security and access control devices such as motion detectors, keypad/display, card reader, card reader controller etc.

33.15.11. System Fire Graphics software shall have provision to interface and monitor the CCTV cameras.

33.16. FIRE ALARM CONTROL PANEL (FACP):

33.16.1. The control panel shall be one of the latest generations of Intelligent Analogue Addressable System. The Fire Alarm Control Panel shall be microprocessor based fully Intelligent Analogue Addressable, Intelligent Analogue Control unit which shall control all Intelligent, Analogue, Addressable, Detectors, Manual Call stations and Switching Systems. (For disconnecting AHU and power supply) connected to it. All addressable units shall be connected to the FACP through the loop cards and shall be addressed through individual numbers.

33.16.2. Loop card shall communicate with devices in digital form.

33.16.3. The FACP shall itself have one loop card build in and expandable to ten loops by adding loop cards. Each loop shall be able to address 250 Addressable Devices. At least specified FACP unit may be networked to enhance system capacity as and when required. All the networked panels shall display all the events occurring anywhere in system. Each FACP on the network shall effectively function as a repeater panel as well.

33.16.4. Loop Card shall have auto-lane facility. Auto-lane facility means loop card lanes where each device is installed relative to other devices on the circuit.

33.16.5. Control panel shall allow for cross zoning or looping of sensors i.e. a detector on any loop may be assigned to any zone. This will prevent the need for excessive wiring.

33.16.6. The control panel should contain a non-volatile Historical Event Log with date and time and with minimum of 1500 events ready for display or printing.

33.16.7. The control panel shall have a CPU watch dog circuit to initiate trouble should the CPU fail.

33.16.8. The control panel shall have automatic detector maintenance alert.

33.16.9. The control panel shall have provision to enable or disable any addressable devices through panel keypad.

33.16.10. The control panel shall allow the programming of any input to activate any output or group of outputs.

33.16.11. Passwords shall protect any changes to system operation.

33.16.12. System shall provide with Ground fault LED to indicate system Ground Fault. The general layout of the wiring, detectors, modules, etc., is to be designed by reputed fire agency duly approved by CFEES Delhi is to be submitted to GE in two copies for further approval of Accepting Officer within one month of acceptance of tender. On approval the contractor shall submit six sets of approved design to GE and on completion of work the contractor shall laminate one set of design and fixed to wall near fire alarm panel.

33.16.13. The FACP shall also give adequate warning signal whenever there is dust accumulation in detectors, and up to the point of its replacement it should be possible to change the level of ambient alarm calibration condition either by the use of software program operable by the owner or by resetting the detector.

- 33.16.14. Short/Open circuit units shall also be reported at the FACP. In such cases, the system through the use of fault isolators shall be able to isolate that segment between the two fault isolators. The missing Detectors/Devices shall also be reported at the FACP with identification of the location.
- 33.16.15. The FACP shall have the facility to perform walk test smoke sensor sensitivity remotely. It shall also be possible to set the sensitivity to a global high or global low based on night or day time.
- 33.16.16. The FACP shall have the facility to perform walk test such that an operation can periodically checked out for all initiating devices. As such device is placed into alarm the FACP shall print the condition and automatically reset the device. If a zone is inadvertently let in walk test mode, it shall automatically reset to normal after the idle time is exceeded. During the work test the zones other than the programmed zones shall be under continuous supervision (normal mode). In case of any alarm initiated by detector/devices the walk test shall get terminated automatically.
- 33.16.17. Programming function shall include alarm/trouble type assignment, point descriptor assignment, alarm message assignment, etc.
- 33.16.18. Utilising the PC setup software via laptop/desktop computer may carry out programming by authorized trained person only.
- 33.16.19. The FACP shall have a Liquid Crystal Display of Alphanumeric type to indicate immediately all conditions. The display should be high resolution, backlit 8 (Lines) X 21 Character. The FACP shall also be able to carry out continuous self-monitoring when in normal condition.
- 33.16.20. FACP shall have external printer coupled to the FACP, which shall log all events with time. The printout shall clearly indicate the event-Fire/Fault etc., with the unit address and time.
- 33.16.21. The FACP also is able to actuate switches automatically in case of Fire condition that of AHU's and power supply or other systems such as piped pressurized gas supply.
- 33.16.22. The system shall be fail safe and adequate safe guards should be undertaken that in the event of failure of a part of the system it should not handicap the complete system.
- 33.16.23. The FACP shall also have its own Battery Backup of a minimum of 48 hours in normal run and then half an hour in alarm condition.
- 33.16.24. It shall be able to withstand temperature variations from 0 centigrade to 55 centigrade Further, Relative Humidity (non-condensing type) up to 95% shall not hamper its performance. The voltage rating shall be from 17 V DC to 31 V DC, through the voltage may change depending upon the working voltages of a proprietary FACP.
- 33.16.25. The FACP shall be totally enclosed dust and vermin proof type made of minimum 16 gauge dust inhibited sheet with even baked finish. The FACP shall be of completely solid stage design. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
- 33.16.26. The logic circuitry shall be based on high noise immunity solid stage hardware employing modular construction. Logic Cards shall be of epoxy fiber glass construction.

- 33.16.27. The FACP shall have UL, ULC, LPCB, FM approval.
- 33.16.28. The system shall be designed such that it shall be possible to add at least 20% of the specified Detectors for future expansion without extra cost on the panel.
- 33.16.29. The FACP shall be capable of being networked (future expansion) with other same make FACP's located at different part of the premises through a single RS 485 bus.
- 33.16.30. The FACP shall have provision for interfacing with the Public Address System.
- 33.16.31. The FACP shall have integrated voice evacuation facility.
- 33.16.32. The panel should have a minimum of specified zones and each zone shall have LED's to indicate independently fire and fault conditions on the panel.

33.17. ADDRESSABLE DETECTORS:

- 33.17.1. Detectors shall be intelligent Analogue Addressable types.
- 33.17.2. Each Detector shall have integral microprocessor. That measure and analyse gathered information and make its own decision and shall not be depends on loop controller.
- 33.17.3. Detectors addressing by means of electronics (not dip switches type).
- 33.17.4. Detectors shall have self-diagnostics and history log.
- 33.17.5. Detectors shall have automatic day/night sensitivity adjustments.
- 33.17.6. Detectors shall have automatic identification of dirty on defective detectors.
- 33.17.7. Detectors should work as standalone incase of CPU failure.
- 33.17.8. The detector shall have environmental compensation Environmental compensation means the sensing element adapts to long-term changes caused by direct, humidity, aging etc.
- 33.17.9. Detector shall have non-voltaic memory for storing detector type, serial number, address, date of manufacture, hours of operation, last maintenance date, date and time of last alarm, number of recorded alarms and troubles.
- 33.17.10. All detectors are fitted with plug-in system type connection, from the maintenance and compatibility point of views. An alarm release will not effect a detector's good functioning. After resetting the alarm, the detector will resume operations without readjustment of any kind.
- 33.17.11. The detector shall be able to sense incipient fire by detecting the presence of visible and invisible products of combustion. The detector shall be suitable for low voltage (17 V to 24 DC) two wire supply. The detector shall be provided with Twin LED indication for fire and normal condition, the sensitivity of the detector shall not vary with change in ambient temperature, humidity, and pressure or voltage variation.
- 33.17.12. Neither its performance shall be affected by air velocity up to 20 metres per second. The detector shall be suitable protected against dust accumulation/ingress and it shall be

free from maintenance and functional tested at intervals. All detectors shall be identical in construction design and characteristic to facilitate easy replacement.

- 33.17.13. The coverage per smoke detector shall strictly follow IS-2189 standards. It shall be possible to connect Smoke Detector with Heat Detector or Manual Push Button in the same circuit. The sensitivity of Detector shall be set from the FACP to suit the site requirement.
- 33.17.14. It shall have in built locking mechanism to check the removal and pilferage of the detector. The quiescent current flow must be exceeding 50 micro amps and alarm condition current shall be maximum 50 milliamps.
- 33.17.15. The smoke detector shall be Intelligent Analogue Addressable type and be able to send digital output to the FACP by the pulses emitted from the FACP.
- 33.17.16. The base of the Detector shall be electronic free and interchangeable with other smoke or heat detectors. The enclosures shall meet IP-42 protection grade.
- 33.17.17. It shall be able to withstand temperature variations from -10 degree centigrade to 50 degree centigrade. Further, relative Humidity (non-condensing type) upto 80% shall not hamper its performance. The voltage rating shall be from 17V-24V DC though the voltage may be changed depending upon the working voltages of a proprietary FACP.
- 33.17.18. The detector shall have UL/FM, ULC, LPCB approval.
- 33.17.19. It shall be possible to mount the detectors in Duct Casting Unit for sampling of supplying Air from the AHU's.
- 33.17.20. Secondary response indicators shall be provided for all the Above False Ceiling Detectors and closed room detectors.
- 33.17.21. LED on the detector shall blink each time the sensor is scanned by the FACP, if the FACP determines that the sensor is in alarm. the FACP will command the sensor LED to remain on to indicated the same.
- 33.17.22. It shall be possible to connect sounder base on the detector loop. The sounder shall have a sound output of at least 100 db at 1 mtr.

33.18. INTELLIGENT ANALOGUE ADDRESSABLE PHOTOELECTRIC SMOKE:

- 33.18.1. These detectors should be able to detect fire by sensing smoke at incipient stage. The sensor should be able sense the visible aerosol of fire.
- 33.18.2. Photo Electric Smoke Detector shall operate on the light scattering principles.

33.19. INTELLIGENT ANALOGUE ADDRESSABLE HEAT DETECTOR:

- 33.19.1. Detectors shall be Intelligent Analogue Addressable types.
- 33.19.2. Detectors shall have both rate of rise and fixed temperature operation.
- 33.19.3. Each Detector shall have integral microprocessor. That measure and analyse gathered information from connected components and makes its own decision.
- 33.19.4. Detectors addressing by means of electronics (not dip switches type)

- 33.19.5. Detectors shall have self-diagnostics and history log.
- 33.19.6. Detectors shall have automatic identification of dirty on defective detectors.
- 33.19.7. Detectors shall have non-environmental compensation. Environment Compensations means the sensing element adapts to long-term changes caused by direct, humidity, aging etc.
- 33.19.8. Detectors shall have non-volatile memory for storing detector type, serial number, address, date of manufacture, hours of operation, last maintenance date, date and time of last alarm, number of recorded alarms and troubles.
- 33.19.9. All detectors are fitted with plug-in system type connections, from the maintenance and compatibility point of views. An alarm release will not effect a detector's good functioning. After resetting the alarm, the detector will resume operations without readjustment of any kind.
- 33.19.10. The detector shall be suitable for low voltage (17V to 24V DC) two wire supply. The detector shall be provided with Twin LED indication.
- 33.19.11. Neither, its performance shall be affected by air current up to 25 metre per second. The detector shall be suitably protected against dust accumulation/ingress and it shall be free from maintenance and functionally tested at intervals. All detectors shall be identical in construction design and characteristic to facilitate easy replacement.
- 33.19.12. The coverage per heat detector shall strictly follow IS-2189 standards. It shall be possible to connect Smoke Detector with Heat Detector or Manual Push Button in the same circuit.
- 33.19.13. It shall have in-built locking mechanism to check the removal and pilferage of the detector. The quiescent current flow must be exceeded 50 micro amps and alarm condition current shall be maximum 50 milliamps.
- 33.19.14. The Heat Detectors shall be Intelligent Analogue Addressable type and be able to send digital output to the FACP regarding its condition. It shall be able to communicate with the FACP by the pulses emitted from the FACP.
- 33.19.15. The base of the Detector shall be electronics free and interchangeable with other smoke or Heat Detectors. The enclosures shall meet IP 42 protection standard.
- 33.19.16. It shall be able to withstand temperature variations from 0 degree centigrade to 55 degree centigrade. Further, Relative Humidity (non-condensing type) upto 95% shall not hamper its performance. The voltage rating shall be from 17V-24V DC though the voltage may be changed depending upon the working voltages of a proprietary FACP.
- 33.19.17. The Detector shall have UL/FM, ULC approval.
- 33.19.18. Secondary response indicators shall be provided for all the above False Ceiling Detectors.
- 33.19.19. LED on the detector shall blink each time the sensor is scanned by the FAS. If the FACP determines that the sensor is in alarm, the FACP will command the sensor LED to remain on to indicated the same.

- 33.19.20. It shall be possible to connect sounder base on the detector loop. The sounder shall have a sound output of at least 100 db at 1 mtr distance.

33.20. MANUAL CALL STATIONS:

- 33.20.1. The manual Call Stations shall have UL, ULC, LPCB, FM approval.
- 33.20.2. Manual Call Station shall be Intelligent Analogue Addressable types.
- 33.20.3. The Manual Station shall be a press to break type. The device shall be red in colour and suitable for surface or flush mounting. Manual Station shall be interfaceable to an addressable input module that can be accommodated within these devices. The manual station shall have normally open fire alarm and Annunciator contacts and these contacts shall close on activation. Contacts shall remain closed until station is manually reset.
- 33.20.4. Each manual Call stations shall have integral microprocessor. That measure and analyses gathered information and makes its own decision and shall not be depends on loop controller.
- 33.20.5. Manual Call Station addressing by means of electronic (not deep switches type).
- 33.20.6. Manual Call Stations shall have self diagnostics and history log.
- 33.20.7. Manual Call Stations shall have nonvolatile memory for storing module type serial number, address, date of manufacture, hours of operation last maintenance date, date and time of last alarm, number of recorded alarm and troubles.

33.21. INPUT MODULES:

- 33.21.1. The input modules shall be Intelligent Analogue Addressable dual/single channel types. Input module shall be used to connect any normally opened by dry contact devices such as manual break glass unit, water flow switches etc.
- 33.21.2. The Input Modules shall have UL, ULC, LPCB, FM approval.
- 33.21.3. Modules shall be Intelligent Analogue Addressable types.
- 33.21.4. Each module shall have integral microprocessor. That measure and analyses gathered information from connected components and makes its own decision.
- 33.21.5. Modules addressing by means of electronics (not dip switches type).
- 33.21.6. Modules shall have self-diagnostics and history log.
- 33.21.7. Modules shall have non-volatile memory for storing Module type, serial number, address, date of manufacture, hours of operation, last maintenance date, date and time of last alarm, number of recorded alarms and troubles.
- 33.21.8. Modules shall be suitable for low voltage (17 V to 24V DC) two wire supply. Modules shall be provided with Twin LED indication.
- 33.21.9. Input modules shall have multiple applications such as alarm, delayed latching (retard) for water flow switches, supervisory, etc.
- 33.21.10. Module shall allow the programmer to select the Module for particular application.

33.22. OUTPUT MODULES:

- 33.22.1. Output Module shall be Intelligent Analogue Addressable type and shall be used for:

- (a) Control and supervision of a notification appliance circuit for 24V DC polarized notification appliances.
 - (b) Tripping the AHU fan etc.
- 33.22.2. The output module shall have UL, ULC, LPCB, FM approval.
- 33.22.3. Modules shall be Intelligent Analogue Addressable types.
- 33.22.4. Each Module shall have integral microprocessors. The measures and analysis gathered information from connected components and makes its own decision.
- 33.22.5. Modules addressing by means of electronics (not dip switches types).
- 33.22.6. Modules shall have self-diagnostics and history log.
- 33.22.7. Modules shall have non-volatile memory for storing Module type, serial number, address, date of manufacture, hours of operation, last maintenance date, date and time of last alarm, number of recorded alarms and troubles.
- 33.22.8. The Modules shall be suitable for low voltage (17V to 24 V DC) two wire supply. The Modules shall be provided with Twin LED indication.

33.23. REPEATER PANEL:

- 33.23.1. The repeater Panel shall have UL, ULC, LPCB FM approval.
- 33.23.2. The Alarm Repeater/Annunciator Panel shall display fire/fault messages simultaneously with the FACP, it shall be capable of interfacing with FACP on a single RS 485 Bus. The Panel shall be capable of operating on 24 V DC supply.
- 33.23.3. The panel shall have 8x21 character backlit alphanumeric LCD Display which shall display date time and description of alarm/trouble events that are displayed in the FACP with an inbuilt buzzer to indicate fault/fire alarm.
- 33.23.4. The Repeater Panel shall be powered from the FACP.
- 33.23.5. It shall have control keys for Alarm Silence, Trouble Silence and to Reset the FACP from the repeater station.
- 33.23.6. More number of LCD Repeater Panels (Only Repeat Panels) should be able to be connected on the same communication line.
- 33.23.7. Repeater Panel shall allow the programmer to program the Repeater Panel to display the fire and fault condition of a particular loop or a particular panel.

33.24. SPRINKLER SYSTEM:

- 33.24.1. Tapping shall be taken from each riser and a network of piping shall be kept under pressure and whenever sprinkler bulb breaks, water sprinkled immediately and the reduction of pressure automatically sensed thereby switching ON the sprinkler pump. The applicable codes and Latest Standards published by the Bureau of India Standards shall govern the design, workmanship, quality and properties of materials and method of testing.
- 33.24.2. After erection, the sprinkler system shall be tested to show the satisfactory performance in line with the requirements of the specification. The following tests shall be undertaken:

- (a) Automatic starting of sprinkler pumps by actuating the sprinkler head.
- (b) Automatic starting of all fire pumps without breaking the sprinkler bulbs by operating the test valves in the pump house.
- (c) Complete sequence of sprinkler annunciator panel shall be activated for the system requirement.

33.25. FIRE HOSE PIPE & HOSE COUPLING:

33.25.1. This shall be of size 63mm controlled percolation type manufactured by Jai Shree Textiles Limited and bearing the ISI mark specially designed for Fire Fighting purpose and duly approved by Tariff Advisory Committee. It shall comply with IS-8423-1977.

33.25.2. All hose coupling shall be of instantaneous spring lock type and nozzle shall be of 20mm dia.

33.26. **HOSE CABINET:** This shall be made of mild steel with glass in front to accommodate two pieces of hoses pipes and one branch pipe with lock and key.

33.27. **Testing:** After completion of the entire work related to fire fighting system, the same shall be tested by the contractor in the presence of the Engineer-in-Charge and the rep. of the Accepting Officer complete all as per the standard FTP (Fire Testing Procedure) code.

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

34. **LIST OF DRAWINGS:** The under mentioned drawings shall form part of the tender documents:

Ser No	Description of Drawing	Drawing No	Sheet No	Date	Date of Last Revision
1	2	3	4	5	6
	<u>SITE PLANS</u>				
1	Site Plan Showing External B & R Services	CEVZ/2022/ L-1005	1R/4	28-02-2023	
2	Site Plan Showing RL of MGL	CEVZ/2022/ L-1005	2R/4	28-02-2023	
3	Site Plan Showing External E/M Supply	CEVZ/2022/ L-1005	3/4	10-02-2023	
4	Site Plan Showing Water Supply	CEVZ/2022/ L-1005	4/4	10-02-2023	
	<u>ARCHITECTURAL DRAWINGS</u>				
	<u>HANGAR</u>				
5	List of Drawings (Architectural)	CEVZ/2022/ LD-2120	1R/1	28-02-2023	04-10-2023
6	Ground Floor Plan	CEVZ/2022/W D-2120	1R/13	28-02-2023	04-10-2023
7	First Floor Plan	CEVZ/2022/W D-2120	2R/13	28-02-2023	
8	Roof Plan	CEVZ/2022/W D-2120	3R/13	28-02-2023	
9	Front and Rear Elevations	CEVZ/2022/W D-2120	4R/13	28-02-2023	
10	Left Side Elevation, Right side Elevation and Section at 'A-A'	CEVZ/2022/W D-2120	5R/13	28-02-2023	
11	Section at 'B-B', 'C-C' & 'K-K'	CEVZ/2022/W D-2120	6R/13	28-02-2023	
12	Section at 'D-D', 'E-E' & 'F-F', 'G-G' & 'H-H'	CEVZ/2022/W D-2120	7R/13	28-02-2023	04-10-2023
13	Stair case, Toilets and other details	CEVZ/2022/W D-2120	8R/13	28-02-2023	
14	Schedule of Finishes(HANGAR, Car & Scooter Parking)	CEVZ/2022/W D-2120	9R/13	28-02-2023	
15	Internal Electrification plan of Ground Floor	CEVZ/2022/W D-2120	10/13	10-02-2023	
16	Internal Electrification plan of First Floor & AC Plant Room	CEVZ/2022/W D-2120	11/13	10-02-2023	
17	Schematic Diagram of Internal Electrification	CEVZ/2022/W D-2120	12/13	10-02-2023	
18	Schematic Diagram of Internal Water Supply of Ground Floor and First Floor	CEVZ/2022/W D-2120	13/13	10-02-2023	
	<u>AC PLANT ROOM</u>				
19	Plan, Elevation, Sections and Toilet Details	CEVZ/2022/W D-2120 AC	1R/1	28-02-2023	
	<u>CAR AND SCOOTER PARKING</u>				
20	Car Parking Plan, Elevations, Sections and other Details	CEVZ/2022/W D-2120 CS	1R/3	28-02-2023	
21	Scooter Parking Plan, Elevations, Sections and Other	CEVZ/2022/W D-2120 CS	2R/3	28-02-2023	

	Details				
22	Inetrnal Electrification Plan of Car & Scooter Parking	CEVZ/2022/W D-2120 CS	3/3	10-02-2023	
	MISC DETAILS				
23	Misc Details	CEVZ/2022/W D-2120 MISC	1/1	10-02-2023	28-02-2023
	STRUCTURAL DRAWINGS				
24	List of Drawings (Structural)	CEVZ/2022/ LD-2120 (S)	1R/1	02-03-2023	28-04-2023
25	General Notes-1	CEVZ/2022/W D-2120 (S) GN	1R/4	28-02-2023	
26	General Notes-2	CEVZ/2022/W D-2120 (S) GN	2R/4	28-02-2023	
27	General Notes-3	CEVZ/2022/W D-2120 (S) GN	3R/4	28-02-2023	
28	General Notes-4	CEVZ/2022/W D-2120 (S) GN	4R/4	28-02-2023	
29	Typical Details of soil stabilization below Flooring, Pile caps, Road	CEVZ/2023/W D-2120 (S) AMDT	1/1	16-05-2023	23-05-2023
	HANGAR				
30	Pile Cap Layout	CEVZ/2022/W D-2120 (S)	1R/40	28-02-2023	
31	Pile Cap RCC Details PC1 to PC15	CEVZ/2022/W D-2120 (S)	2R/40	28-02-2023	
32	Pile Cap RCC Details PC16 to PC25	CEVZ/2022/W D-2120 (S)	3R/40	28-02-2023	
33	Details of Pile &Pile caps Schedule	CEVZ/2022/W D-2120 (S)	4R/40	28-02-2023	
34	Column Layout	CEVZ/2022/W D-2120 (S)	5R/40	28-02-2023	
35	Column RCC Details	CEVZ/2022/W D-2120 (S)	6R/40	28-02-2023	
36	Structural Framing@ +450 Level	CEVZ/2022/W D-2120 (S)	7R/40	28-02-2023	28-04-2023
37	Structural Framing@ +1950 Level	CEVZ/2022/W D-2120 (S)	8R/40	28-02-2023	04-10-2023
38	Structural Framing@ +2850(BOB), +3350(BOB) Level	CEVZ/2022/W D-2120 (S)	9R/40	28-02-2023	
39	Structural Framing@ +4350(BOB), +5650(TOB) Level	CEVZ/2022/W D-2120 (S)	10R/40	28-02-2023	
40	Structural Framing@ +7450, +7460, +8400, +8950, +9000 Level	CEVZ/2022/W D-2120 (S)	11R/40	28-02-2023	
41	Structural Framing@ +10050, +11200, +12450, +12385 Level	CEVZ/2022/W D-2120 (S)	12R/40	28-02-2023	
42	Structural Framing@ +13950, +16450 Level	CEVZ/2022/W D-2120 (S)	13R/40	28-02-2023	
43	Structural Framing@ +17950 Level	CEVZ/2022/W D-2120 (S)	14R/40	28-02-2023	
44	Elevation along Grid 10 to 17	CEVZ/2022/W D-2120 (S)	15R/40	28-02-2023	
45	Crane Arrangement Details	CEVZ/2022/W D-2120 (S)	16R/40	28-02-2023	

46	Elevation along Grid 7 to 9	CEVZ/2022/W D-2120 (S)	17R/40	28-02-2023	
47	Elevation along Grid 6	CEVZ/2022/W D-2120 (S)	18R/40	28-02-2023	
48	Elevation along Grid 3 to 5	CEVZ/2022/W D-2120 (S)	19R/40	28-02-2023	
49	Upper & Lower Roof Bracings Plan	CEVZ/2022/W D-2120 (S)	20R/40	28-02-2023	
50	Upper & Lower Roof Bracings Details	CEVZ/2022/W D-2120 (S)	21R/40	28-02-2023	
51	Upper & Lower Roof Purlings Plan	CEVZ/2022/W D-2120 (S)	22R/40	28-02-2023	
52	Upper & Lower Roof Bird Mesh Plan	CEVZ/2022/W D-2120 (S)	23R/40	28-02-2023	
53	Upper & Lower Roof Sheetting Plan	CEVZ/2022/W D-2120 (S)	24R/40	28-02-2023	
54	Roof Sheetting Details	CEVZ/2022/W D-2120 (S)	25R/40	28-02-2023	
55	20.0M Gate Truss Elevation at Front Side Along Grid 19	CEVZ/2022/W D-2120 (S)	26R/40	28-02-2023	
56	20.0M Gate Truss Elevation at Front Side Along Grid 18	CEVZ/2022/W D-2120 (S)	27R/40	28-02-2023	
57	20.0M Gate Truss Side Elevation	CEVZ/2022/W D-2120 (S)	28R/40	28-02-2023	
58	14.0M Gate Truss Details	CEVZ/2022/W D-2120 (S)	29R/40	28-02-2023	
59	20.0M Gate Truss Grits and Sag Rods Elevation Along Grid 19	CEVZ/2022/W D-2120 (S)	30R/40	28-02-2023	
60	14.0M Gate Truss Grits and Sag Rods Elevation Along Grid 1	CEVZ/2022/W D-2120 (S)	31R/40	28-02-2023	
61	20.0M Door Plan and Elevation	CEVZ/2022/W D-2120 (S)	32R/40	28-02-2023	
62	14.0M Door Plan and Elevation	CEVZ/2022/W D-2120 (S)	33R/40	28-02-2023	
63	Staircase RCC Details	CEVZ/2022/W D-2120 (S)	34R/40	28-02-2023	
64	Miscellaneous Details-1	CEVZ/2022/W D-2120 (S)	35R/40	28-02-2023	
65	Miscellaneous Details-2	CEVZ/2022/W D-2120 (S)	36R/40	28-02-2023	
66	Miscellaneous Details-3	CEVZ/2022/W D-2120 (S)	37R/40	28-02-2023	
67	Schedule of Beams, Slab Details	CEVZ/2022/W D-2120 (S)	38R/40	28-02-2023	
68	20.0M, 14.0M Door Leaf Details	CEVZ/2022/W D-2120 (S)	39R/40	28-02-2023	
69	Door Typical Connection Details	CEVZ/2022/W D-2120 (S)	40R/40	28-02-2023	
	<u>AC PLANT ROOM</u>				
70	Pile Cap Layout	CEVZ/2022/W D-2120(S) AC	1R/3	28-02-2023	
71	Column Layout, Plinth and Roof Beam Layout	CEVZ/2022/W D-2120 (S) AC	2R/3	28-02-2023	
72	Schedule of Beams, Slabs and Other Details	CEVZ/2022/W D-2120 (S) AC	3R/3	28-02-2023	28-03-2023

	<u>CAR PARKING</u>				
73	Pile Cap Layout	CEVZ/2022/W D-2120 (S) CP	1R/3	28-02-2023	
74	Column Layout, Plinth and Roof Beam Layout	CEVZ/2022/W D-2120 (S) CP	2R/3	28-02-2023	
75	Schedule of Beams, Slabs and Other Details	CEVZ/2022/W D-2120 (S) CP	3R/3	28-02-2023	28-04-2023
	<u>SCOOTER PARKING</u>				
76	Pile Cap Layout	CEVZ/2022/W D-2120 (S) SP	1R/3	28-02-2023	
77	Column Layout, Plinth and Roof Beam Layout	CEVZ/2022/W D-2120 (S) SP	2R/3	28-02-2023	
78	Schedule of Beams, Slabs and Other Details	CEVZ/2022/W D-2120 (S) SP	3R/3	28-02-2023	28-04-2023
79	Typical Details of Soil stabilization below flooring, pile caps, road	CEVZ/2022/LD /2120 (S)	1R/1	02-03-2023	28-04-2023
	<u>TD DRAWINGS (ARCHITECTURE)</u>				
80	General Notes for Architectural Drgs	CEVZ/2022/ TD-01	1/1		
81	Architectural Norms for Fixing heights of Lavatory Fitting and Internal Electric Fittings	CEVZ/2022/ TD-02	1/1		
82	Panelled Door with Wooden Frame	CEVZ/2022/ TD-03	1/5 to 5/5		
83	Solid Paneled PVC Door	CEVZ/2022/ TD-11	1/1		
84	Aluminium Sliding Window	CEVZ/2022/ TD-13	1/4 to 4/4		
85	Typcal Details of SS Railing for Staircase	CEVZ/2022/ TD-20	1/2 to 2/2		
86	Typcal Details of SS Railing	CEVZ/2022/ TD-21	1/2 to 2/2		
87	Typcal Details of Drapery	CEVZ/2022/ TD-25	1/1		
88	Miscellaneous Details	CEDD/86/ TD/6A	1/1		
89	Miscellaneous Details	CEDD/86/ TD/6B	1/1		
90	Miscellaneous Details	CEDD/86/ TD/6C	1/1		
91	Miscellaneous Details	CEDD/86/ TD/6D	1/1		
92	Standard Road Cross Section for Plain	MISC/CPT/01/ 2011	1/1		
93	Typical Details of Roads, Hume Pipe Culverts, Drains and RCC Cover Slab	AR-TD/03/03	1/2 to 2/2		
94	Details of Manholes (RCC/RR Masonry)	TD-316(S)	1/2 to 2/2		
95	Legend and Notes of Internal Electrification and Water Supply	TD-287 (E/M)	1/1		
96	Details of HT Poles, Street Light Poles & Other Details	TD-181(E/M)	1/1		

97	Typical Valve Chambers	TD-119	1/1		
98	Openable Aluminium Door	CEVZ/2022/ TD-06	1/2 to 2/2		
99	RCC Septic Tank For 50 to 300 users	TD-389(S)	1/3 to 3/3		
100	Elevation of GRC Jalli Type 'A' to 'R'	TD-390	1/1		
101	Details of Soakage Pit upto 100 users	TD-318(S)	1/1		
102	Details of Acoustic wall paneling	CEVZ/2023/S K-1040	1/1	04-10-2023	

Note: In the event of discrepancies in the dates indicated in Column Nos.5 & 6 above, the actual date prevailing on the drawing with latest amendments date shall take precedence

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

35. **APPROVED NAMES OF MANUFACTURERS:** (Refer Condition 14 of Special Conditions here-in-before)35.1. **CEMENT:**

(i)	M/sThe Associated Cement Companies Ltd, New Delhi-110044, Brand " ACC " all grades of cement
(ii)	M/sUltraTech Cement, Mumbai-400093, Brand " ULTRATECH " all grades of cement
(iii)	M/sThe India Cement ,Chennai- 600002, all grades of cement
(iv)	M/s Dalmia Cement (Bharat) Ltd, TamilNadu-621651, Brand " DALMIA IINFRA PRO " all grades of cement
(v)	M/s Century Cement, Mumbai-400020,Brand " CENTURY " all grades of cement
(vi)	M/sSaurashtra Cement, Mumbai-400093, Brand " SAURASHTRA " all grades of cement
(vii)	M/s Ramco Cements Ltd (Formerly Madras Cement), Chennai-600004, Brand " RAMCO " all grades of cement
(viii)	M/s Mangalam Cement Ltd, Kota, Rajasthan – 326520, Brand " MANGLAM " all grades of cement
(ix)	M/s Birla Corporation Ltd, Kolkata-700001, Brand " BIRLA " all grades of cement
(x)	M/s Orient Cement, Hyderabad-500063, Brand " ORIENT " all grades of cement
(xi)	M/s Nuvoco Vistas Corporation Ltd (Formerly Lafarge Cement , Mumbai – 400070, Brand " NUVOCO " all grades of cement
(xii)	M/s Shree Cement, Ajmer, Rajasthan-305901,Brand " SHREE " all grades of cement
(xiii)	M/s J K Cement, Kanpur-208001 Brand " J K " all grades of cement
(xiv)	M/s JK Lakshmi Cement Ltd, Dist Sirohi, Rajasthan Brand " JK LAKSHMI " all grades of cement
(xv)	M/s Jaypee Rewa Cement, Rewa-486450, M.P,Brand " JAYPEE " all grades of cement
(xvi)	M/s Ambuja Cement Ltd, Junagadh, Gujarat – 362715, Brand " AMBUJA " all grades of cement
(xvii)	M/s Shree Guru Kripa Cement Pvt Ltd, Jammu, Brand " SARTAJ " (OPC- 43 grade & PPC)
(xviii)	M/s Parasakti Cements Ltd, Hyderabad-500038, Brand " PARASAKTI " (OPC-43 grade & PPC)
(xix)	M/s My Home Industries Ltd, Hyderabad-500081 Brand, " MAHA CEMENT "for psc, OPC43 grade & PPC
(xx)	M/s Chettinad Cement Corporation Ltd.,Chennai-600006,Brand " CHETTINAD Cement " (OPC-43 grade & PPC)
(xxi)	M/s Sagar CementsLtd, Hyderabad-500003 Brand " SAGAR " (Portland slag Cement), PPC,OPC43,OPC 53
(xxii)	M/s Sanghi Industries Ltd., Ahmedabad – 380051 " Brand Sanghi " (OPC 53 & PPC
(xxiii)	M/s JSW Cement Ltd, A.P., Mumbai-400051 Brand " JSW PSC (Portland Slag Cement) " (PSC), Brand " JSW OPC 53 & JSW OPC 43 " [OPC 43 & OPC 53]
(xxiv)	M/s Wonder Cement Ltd, Udaipur – 313004, Brand " Wonder Cement " [OPC-43, OPC-53, PPC]
(xxv)	M/s Penna Cement Industries Ltd, Hyderabad – 500034, Brand " Penna Cement " [OPC-43, OPC-53, PPC and PSC] [for Andhra Pradesh and Telangana]
(xxvi)	M/s Kesoram Industries Ltd, Secunderabad, Brand " BIRLA SHAKTI " [OPC 43, OPC 53, PPC]
(xxvii)	M/s Kalburgi Cements Pvt Ltd, Hyderabad, Brand " BHARATHI CEMENT " &VICAT[OPC 43, OPC 53, PPC]

35.2. **TMT STEEL:**

- (i) Steel Authority of India Limited (SAIL) , Brand: "SAIL" , All Grades/Sizes
- (ii) Rashtriya Ispat Nigam Ltd , Brand: "RINL" , All Grades/Sizes
- (iii) Tata Iron & Steel Company (TISCO or Tata steel) ,Brand: "TATA", All Grades/Sizes
- (iv) M/s.ShyamSel and Power Ltd.[For Fe 500 with sizes 8mm to 32mm],Brand: "**SEL**"
- (v) M/s Steel Exchange India Ltd. [For Fe 500D] , Brand : "**Simhadri TMT**" [
- (vi) Shri Bajarang Power & Ispat Ltd. [For Fe 500 & Fe 500 D] , Brand : "**GOEL TMT**" (8-32mm)
- (vii) M/s JSW Steel Ltd. [For Fe 500 D, Fe 550D & CRS] , Brand : "**Neosteel**" (8-40mm)
- (viii) M/s Gallantt Metal Ltd [For Fe 500, Fe 500 D & CRS] , Brand : "**Gallantt TMX**" (8-32mm)
- (ix) M/s Rashmi Metaliks Ltd [For Fe 500 (8-32mm), Fe 500 D & Fe 550D (8- 25mm)] , Brand : "**Rashmi TMT**" (8-25mm)
- (x) M/s Kamachi Industries Ltd [For Fe 500, Fe 500 D, Fe 550, Fe 550D & HCRM] , Brand : "**KAMCHI**"(8-40mm)
- (xi) M/s Electrotherm (India) Ltd [For Fe 500, Fe 500 D & CRS] Brand name "**ET TMT**" (8-32mm)
- (xii) Tulsyan NEC Limited [For Fe 500, Fe 500 D & 550 Grade] Brand name "**TULSYAN TMT**" (8-32mm)
- (xiii) M/s. Incredible Industries Ltd., [For Fe 500 D] Brand name "**ADHUNIK Fe 500 SD**" (8-32mm)
- (xiv) M/s. Jai Balaji Industries Ltd., (WB) [For CRS Fe 500 D] (8-32mm) Brand name "**Balaji shakti**"
- (xv) M/s MSP Steel & Power Ltd, Chattisgarh [For Fe500D] [8-32mm]

35.3. **STRUCTURAL STEEL:**

- (i) Rashtriya Ispat Nigam Ltd , Brand: "RINL"
- (ii) Tata Iron & Steel Company (TISCO or Tata steel) ,Brand: "TATA"
- (iii) Steel Authority of India Limited (SAIL), Brand: "SAIL"
- (iv) Jindal Steel and Power Limited Brand: "JINDAL"

Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

35.4. OTHER MATERIALS:

Ser No.	Materials	Make/Name Of Firms
1	Factory Made Chowkats, Panelled /Skeleton Shutters (Wooden)	M/s. Timber Technic, Phase-V Industrial Development Area Jeedimetla, Hyderabad-500 235/M/s. Wood India Products, Calcutta/M/s. Standard Doors, Jeedimetla, Hyderabad/M/s. Electrical & General Wood Industries K-6, Industrial Development Area, Uppal, Hyderabad-500 035/M/s. Sri Ram Wood Products (P) Ltd, 31-34-145/1, Bangaramma Metta, Visakhapatnam/M/s. MP Wood Products, 124, Labriya Bheru, Dhar Road, Indore/M/s. Berar Timber Industries Pvt Ltd, National High Way No. 8, Village Saran, Valsad, Gujarat-396 001/M/s. Goyal Bros, Goyal House, Ramkund, Raipur-492 001/M/s. Betul Wood Products Pvt Ltd, Industrial Estate Betul-460 022/M/s. Goyal Industrial Corpn, 8343, D.B Gupta Marg, New Delhi-110 005/M/s. Doorking Industries, 27, G.N Block Sector-V, Industrial Estate, Salt Lake, Calcutta-700 091/M/s. Wood Treatment Specialist, Chennai/M/s. Wood Design (P) Ltd, Bangalore/M/s. Kitply Flush Doors And Furniture Co, Chennai/M/s Jain Doors Pvt. Ltd.Brand: Woodify (Factory Made Wooden Panel Door Shutters , Factory Made Wooden Wire-mesh Door Shutters only)/M/s Jain Wood Industries.Brand: JAYNA (Factory Made Wooden Panel Door Shutters , Factory Made Wooden Wire-mesh Door Shutters only)/M/sVidyaPly&BoardPvtLtd/ Ambika Timber Works/ Premier Wood Craft (P) Ltd./ M/s SA Plywood Industry (P) Ltd./ A-1 TeakProducts PvtLtd(Wooden Frame,wire mesh door and panel door only)
2	Factory Made Wooden Flush DoorShutters	M/s Jain Wood Industries.Brand: JAYNA/ M/s Jain Doors Pvt. Ltd. (Brand:Woodify)/ M/s Archidply Industries Ltd./ M/s Sri Bhawani plyboard Industry/ M/s Sylvan Plyboard (India) Pvt. Ltd. (Brand: Sylvan Ply)/ MP Wood Products/ Doorking Kolkata/M/s A-1 Teak Products Pvt. Ltd./M/sVidyaPly&BoardPvtLtd/ Ambika Timber Works/ Premier Wood Craft (P) Ltd./ M/s SA Plywood Industry (P) Ltd
PVC/UPVC Door, Window & Chowkhat		
3	PVC Door/Window & Chowkhat	Kumar Arch Tech Pvt. Ltd/Sintex India Ltd./Polywood/Rajashri Plastiwood Ltd./Marino/ Hindopan/ Polyline Extrusion Pvt Ltd/Navratan Specially Chemicals Ltd /Unifix Plast Pvt Ltd (Solid PVC Doors only)/M/s Chandni Industries
4	BLANK	
5	PVC Door Shutters, Fully/ Partly Glazed Panel Shutters, PVC Wiremesh/ Louver Shutter, PVC Moulded Door Shutter , PVC Door Frame, PVC Window, PVC Cupboard Shutter, PVC Kitchen Cabinet Shutter, VC Sheet Cladding ,PVC Partitions, PVC Wall Lining & PVC False	M/s Polyline Extrusion Pvt Ltd/M/s Rajshri Plastiwood/M/s Navratan Specially Chemicals Ltd./M/s Chandni Industries

	Ceiling	
6	Solid Panel Foam Doors (Solid/Glazed Panel)	Fenesta/Kesar/LG Hausys
7	FRP Door Shutters	Fibreways Technology/Krafto Door/Syntax India Ltd/ M/s Jain Wood Industries.Brand: JAYNA (FRP door frames, doors & Chajjas only)
Wooden Doors & Windows		
8	BLANK	
9	BLANK	
GRIHA Guidelines for Item 1,2,6 to 9: (a) Should NOT have bonded urea formaldehyde resin (Phenol Formaldehyde, Melamine Formaldehyde or Epoxy are acceptable). (b) Should be manufactured from Trees which are rapidly renewable (i.e. the trees have a harvesting cycle of less than 10 years) (c) Manufacturer Declaration required on type of Bonding resin and type of tree used (d) All timber to be used in the project to be FSC certified.		
Door & Window Fittings		
10	Aluminum Door & Window Fittings	M/s Profine India Window Technology Pvt Ltd (Brand:Alupure)/ Aluminium Udyog (GLOBAL)/Trisul Industries/Bharat/Classic/Alans/Argent/Hettich/M/s Crown Industries
11	Floor Springs/Door Closers	Indra Industries/Hardwin/Godrej/Doorset/M/s Crown Industries
12	BLANK	
False Ceiling & Partition Paneling		
13	Calcium Silicate Board/ Calsidicor Tiles in False Ceiling/Wall Lining	Armstrong/India Gypsum/Nuvoco Vistas/Gypstone/Saint Gobain/Everest
14	PVC False Ceiling	Kumar Arch Tech Pvt. Ltd./Accura/Saint Gobain/Modiguard, /M/s Polyline Extrusion Pvt Ltd Group-II valid upto 23 Apr 2021,/ M/s Rajshri Plastiwood Group-I valid upto 23 Apr 2021
15	Mineral Fibre False Ceiling	Armstrong Gyroe (Saint Gobain)/Twiga Insulation/UP Twiga Fibre Glass Ltd./Llyod Insulation
16	Metal False Ceiling	Armstrong/Unifloors/Nittobo
17	Cement Fibre Board Ceiling	Everest/Nuvoco Vistas/Armstrong
18	PUF Insulated Panels	M/s Prestar Infr. Proj.Ltd/ M/s Jindal Mectec Pvt. Ltd/Unifix Plast Pvt Ltd (PUF Panels and Pre-fab Shelters)/M/s Kingspan Jindal Pvt. Ltd./M/s Suntech System Pvt. Ltd / M/s Lloyd Insulations (India) Ltd.
19	Anodised Aluminium Partition System with Solid/ Glazed Panel	Jindal/Hindalco/Indalco/Alpro
20	PVC Partition and Wall Paneling	Kumar Arch Tech Pvt. Ltd/Rajshri Plastiwood Ltd./Polyline Extrusion Pvt Ltd.
Cupboards, Cabinets & Wardrobe		
21	PVC Kitchen (Cupboards, Cabinets & Wardrobes)	Kumar Arch Tech Pvt. Ltd/Rajshri Plastiwood Ltd./Sintex India Ltd./ Commander/ Polyline Extrusion Pvt Ltd(Cupboard Shutter, Kitchen Cabinet Shutter only) /Navratan Specially Chemicals Ltd (Cupboard Shutter, Kitchen Cabinet Shutter only)
22	Steel Cupboard & Bed side Lockers	M/s Trisul industries/ M/s Chandni Industries

PVC Galvanised Sheets, Roofing sheets, Panelling, Partitions, Huts & Bath Rooms		
23	Rigid Foam PVC Sheets from 0.5mm to 40mm thickness	Kumar Arch Tech Pvt. Ltd./Rajashri Plastiwood Ltd./Sintex/Marino
24	Colour Coated Roofing Sheet, Cladding and accessories	M/s Colour Roof (India) Ltd (Brand: Hispan, Histern, Stile Rainbow, Deckspan, Deckspan XTR, Riverclock)/ M/s Dura Roof Pvt. Ltd. (Brand: Dura Roof)/ M/s Jindal Mectec Pvt. Ltd./ M/s Stellar Buildtech Pvt. Ltd. (PPGI &PPGL roofing sheet)/ M/s Prestar Infrastructure Projects Ltd./ Unifix Plast Pvt. Ltd. (Colour Coated Roofing Sheet only)/ SBM Roofing/ M/s Indian Exports Enterprises/MEGA Roof Solutions (Brand: Mega Roof)/M/s Kingspan Jindal Pvt. Ltd./M/s Saraf Roofing/M/s Kamdhenu Ltd./M/s Dhariwal Steel Pvt. Ltd./M/s Suntech System Pvt. Ltd.
Sanitary ware		
25	CP Bath Fittings	M/s Somany Sanitaryware Pvt. Ltd. (Brand:KENZO/VOGUE/ETHER)/ Jaquar & Company Pvt. Ltd. (ESSCO)/Vardhaman Enterprises (Brand: JAINKO)/ Shakti Enterprises (Brand: SHAKTI)/Marc/Kohler/Cera/Parryware/Grohe/Crabtree/Blue Star & Silver Shine/M/s Asian Paints Ltd. (Brand: Aproyale, Bathsense & Essess)/M/s Mohan Metal Industries (Only for CORONET Make fancy bib taps, pillar taps, angle stop valves, long body bib cocks, concealed stop cocks & mixers)/M/s Jain Enterprises/M/s RAK Ceramics India Pvt. Ltd./M/s Blue Star Sanitary Industries/M/s Status Sanitech Pvt. Ltd. (Brand: Player) / Aluminium udyog (Brand : KUNCHAL)/ Prayag
26	Wash Basins/WCs	Jaquar & Company Pvt. Ltd./Prayag/Kohler/Roca/Cera (First Quality)/Hindware (Italian Collection)/Parryware (Superfine)/Johnson Pedder/M/s Asian Paints Ltd. (Brand: Aproyale, Bathsense & Essess)/M/s RAK Ceramics India Pvt. Ltd. /M/s Blue Star Sanitary Industries / M/s Somany Ceramics Ltd.
27	SS Wash Basins & WCs	Diamond/Nirali /Bluestar Sanitary Industries Pvt Ltd. /M/s Blue Star Sanitary Industries
28	Stainless Steel Kitchen Sink (ISI Marked)	M/s Prayag polymers(p) Ltd/ Plastocraft Sanitary (India) Pvt Ltd/ Prabhat Sanitary Pvt Ltd(Brand:IDOOS)/JMD International (Brand: D-sons)/Bluestar Sanitary Industries Pvt Ltd/ Jain Brothers Sanitation Pvt. Ltd./Cera/Blue Star & Silver Shine/Kohler/M/s Jain Enterprises/M/s Blue Star Sanitary Industries
29	Concealed Cisterns	Kohler/Grohe/Hindware/Jaquar/M/s Asian Paints Ltd. (Brand: Aproyale, Bathsense & Essess)/M/s Jain Enterprises
30	Shower Panels	Grohe/Kohler/Jaquar/Lauret
31	Bath Suits	Kohler/Grohe/Jaquar
32	Glass WHB	Zircon/Sparkle Glass/Seabird
33	Glass Frameless Shower Enclosures/ Cubicles	Cera/Hindware/Lauret/Jaquar
34	PTMTBath Fittings	M/s SAK Plast Pvt Ltd(SANITUF) ISI Marked/Prbhat Sanitary Pvt Ltd (Brand: IDOOS)/ Prayag Polymer Pvt. Ltd./M/s Pearl Precision Products Pvt Ltd(Inlet Valves, , Ball Cocks, Seat Covers, Health Faucets, Waste Couplings, Connection Pipes, Bathroom Accessories, Floor Gratings, Jet Spray,taps& fittings and cistern)/M/s Jain Enterprises
35	SS Plate Rack	Suyog/Prayag /Bluestar Sanitary Industries Pvt Ltd./M/s Jain

		Enterprises/M/s Blue Star Sanitary Industries
36	Kitchen Cabinets and Trolleys	Godrej Interio/Zuari/Kitchen Concepts/Dream Kitchens/Kitchen Crafts
37	Normal or Dual-Flow PVC Flushing Cistern	Hindware/Cera/Parryware/Commander/M/s Jain Enterprises
38	Flushing Cistern	M/s Prayag Polymers (p) Ltd./ M/s SAK Plast Pvt Ltd(SANITUF)/Prabhat Sanitary Pvt Ltd (Brand: IDOOS)/M/s Jain Enterprises
39	Glass Mirror	Prayag/Zircon/Cera/Saint Gobain/Modiguard
40	PVC/Acrylic Toilet Mirror Cabinet	Parryware/Polytuff/Commander/Cera
41	Stainless Steel Towel Rail/Towel Rack/ Towel Ring/Soap Dish/ Toilet Paper Holder	Kohler/Grohe/Jaquar/Blue Star & Silver Shine/Cera/M/s Blue Star Sanitary Industries
42	Toilet Seat Cover	Commander/Parryware/Cera/Hindware/Jaquar/Prayag Polymers (only ISI marked) (P) Ltd./M/s Asian Paints Ltd. (Brand: Apropale, Bathsense & Essess)
Paint/Distemper/Polish/Varnishes		
43	Acrylic Washable Distemper	Berger (Jadoo)/Nerolac/British Paint/Jotun India Pvt Ltd/Velvet Acrylic Distemper (Crimson Paints Pvt Ltd.)
44	Plastic Emulsion Paint	Berger (Silk)/ICI (Dulux Velvet Touch)/Shalimar Paints/Asian Paint Ltd./Nerolac Paints Ltd./Jotun India Pvt Ltd./Crimson Paints Pvt Ltd.
45	Synthetic Enamel Paint/ Acrylic Paint	Shalimar Paints Ltd. (Superlac)/Asian (Apolite)/Berger (Luxol)/Jenson & Nicholson Paints Ltd (Brolac)/Jotun India Pvt Ltd./Crimson Paints Pvt Ltd.
46	Cement Based Paint	Snowcem Plus/Berger/Asian Paints (Gutucam)/Jotun India Pvt Ltd/Crimocem Super Cement Paints/Crimson Paints Pvt Ltd.
47	Exterior Acrylic Emulsion Weather Coat Paint	Apex Ultima (Asian)/Extra Maxium Ultra (Shalimar)/Weather Coat (Berger Paints Ltd.)/Dulax/Royal Acrylic (Crimson Paints Pvt Ltd.)/Jotun India Pvt Ltd
48	French Polish	Berger/Jenson & Nicholson Paints Ltd/Asian/Jotun India Pvt Ltd
49	Thermoplastic Road Marking Paint/Retro-Reflective Paint	Asian Apcomark/STP/Shalimar Paints Ltd./Berger Paints Ltd./Jenson & Nicholson Paints Ltd/Jotun India Pvt Ltd
50	Water Based Road Marking Paint	Jotun India Pvt Ltd/Berger/Asian Apcotrak
51	Acid Resistant Paint	Asian/Berger/Jotun India Pvt Ltd
52	Epoxy Paint/ Polyurethane Paint	Fosroc/Pidilite/Asian/Berger/Johnson & Nicholson/Jotun India Pvt Ltd
53	White Cement/Wall Putty	Birla Laval Plast/Berger/J&N/Shalimar Paints/Asian Paints/ M/s Kamdhenu Ltd. (Exterior Emulsions, Interior Emulsions, Distemper, Putty, Primers, Enamels, Varnishes, Textures & Designer Paints, Fire Retardant Paints Wood Coatings, Melamine, Sealeretc)/Crimson Paints Pvt Ltd.

GRIHA Guidelines for Item 42 to 52 above:

a) All Glossy Paints/ Primer paint shall be low VOC (Volatile Organic Compound) Tested should be less than 150 Grams/ Liter.

b) All Matt paints shall be low VOC (Volatile Organic Compound) Tested should be less than 50 Grams/ Liter.

c) Contractor should submit NABL Lab Tested VOC Level in Grams per Liter

Ply Board/MDF & HDF Boards

54	Ply Wood/Prelaminated Ply Wood/ Marine Ply Wood/ Veneered Decorative Plywood/ Structural Plywood/ Fire Retardant Plywood	Greenply Industries (Ply & Board Division)/Kitply/Century/National Plywood Industries Pvt. Ltd./M/s SA Plywood Industry (P) Ltd.
55	Veneered Plain Particle Board/Prelaminated Particle Board	Greenply Industries (Ply & Board Division)/Kitply/Anchor/Bhutan Board/Novapan/ Associate Décor
56	Plywood	M/s Jain Wood industries (Brand:- JAYNA)/M/s Archidply Industries Ltd./ M/s Sri Bhawani plyboard Industry/ M/s Sylvan Plyboard (India) Pvt. Ltd. (Brand: Sylvan Ply)/M/s Vidya Ply &Board Pvt. Ltd. (BWP Plywood only)/ M/s SA Plywood Industry (P) Ltd. (Brand: GLOBE) (BWP Plywood& Marine plywood only)
57	Blockboard	M/s Jain Wood industries)/M/s Archidply Industries Ltd./ M/s Sylvan Plyboard (India) Pvt. Ltd. (Brand: Sylvan Ply)/M/s Vidya Ply &Board Pvt. Ltd./ M/s SA Plywood Industry (P) Ltd. (Brand: GLOBE)
58	Paver Block (Fly Ash Brick)	M/s Stylish Precast Pvt. Ltd./M/s Skyward Concricks Pvt. Ltd. (Fly Ash Brick)/ M/s Shyam Steel Industries Ltd. (Paver Block)
59	Gypsum Board	Saint Gobain gyproc india pvt Ltd/USG Boral Building Products pvt Ltd/ Nuvoco Vistas/Gypsum India Ltd
60	MDF/HDF Boards	Greenply Industries Ltd (Engineered Panel Division)/Balaji Action Buildwell /Novapan /National/ Kitply

GRIHA Guidelines/ Note for Item 53 to 60:

(a) Should NOT have bonded urea formaldehyde resin (Phenol Formaldehyde, Melamine Formaldehyde or Epoxy are acceptable).

(b) Should be manufactured from Trees which are rapidly renewable (i.e. the trees have a harvesting cycle of less than 10 years)

(c) Manufacturer Declaration required on type of Bonding resin and type of tree used

Tile

61	Glazed Vitrified Floor Tiles, Polished Vitrified Floor Tiles, Ceramic Glazed Wall Tiles, Ceramic Glazed Floor Tiles, Wall Tiles, Floor and Wall Tiles of any Size and Type/Nonskid Ceramic Tiles	Varmora/Kajaria Ceramics Ltd/Asian Granito India Ltd/H&R Johnson India Ltd/Nitco/Orient Bell Ltd./M/s Aparna Enterprises Ltd. (APARNA VITERO Brand)/M/s RAK Ceramics India Pvt. Ltd./M/s Sunshine Tiles Co. (P) Ltd. (Brand: SUNHEART)
62	Wall, Floor and Outdoor Tiles (Premium quality)	M/s OASIS Vitrified Pvt Ltd/Varmora 300ranite Pvt Ltd//M/s Sunshine Tiles Co. (P) Ltd. (Brand: SUNHEART)/Somany Sanitaryware Pvt. Limited(First/Superfine quality)
63	Precast Concrete Interlocking Paver Blocks	Anjali Tiles/Ultra Tiles Pvt Ltd/Terra Firma/Ecco Scope/Mehtab Tiles/M/s East West Tiles
64	Precast Plain/	Ultra/Bansal/Nitco/Anjali/Multiwyn

	Chequered Cement Tiles for Flooring	
65	Precast Terrazzo Tiles for Flooring	Johnson/Ultra Tiles Pvt Ltd/Nitco
66	Wooden Laminated Floor Tiles/ Parquet Tiles	Vista/Pergo/Haro
67	Glazed Mosaic Tiles	Hindustan Tiles/Johnson/Ultra Tiles Pvt Ltd/National Tiles & Industries/Coral/Ceco
68	Heavy Duty Exterior Vitrified Tiles	Johnson (Endura)/Multiwyn/Century/Cristal/Somany (Durastone)/ Orient Bell Ltd./M/s Aparna Enterprises Ltd. (APARNA VITERO Brand)/M/s Sunshine Tiles Co. (P) Ltd. (Brand: SUNHEARRT)
69	Glazed Porcelain Elevation Wall Tiles	Century Porcelato/Porcelato/Porcelain/Crystal Porcelain/M/s Sunshine Tiles Co. (P) Ltd. (Brand: SUNHEARRT)
GRIHA Guidelines/ Note for Item 61 to 69 above:		
(a) Should either have recycled content of more than 10% or should be chosen from GRIHA product Catalogue.		
(b) Manufacturer Signed declaration on percentage of Recycled Content.		
70	FLOOR HARDENER	(i)M/s Sika India Pvt Ltd (a) SikaChapdur (b) SikaChapdurC (iii)M/s Maruti Bitumen Pvt. Ltd. (Metallic&NonMetallicFloorHardeners) 1. MarutiFloorMH 2. MarutiFloorNMH M/SthermaxLtd Tec Floor HT TecFloor HTS M/s Bostik India Pvt. Ltd. Floor Hardner
71	Metallic Floor Hardener for Wear Proof Topping	Ironite/Stillonite/Hardonate
72	Non-Metallic Floor Hardener for Wear Proof Topping	Fosroc/Fibrex/Sika/BASF
Steel/Aluminum		
73	Factory MadeSteelWindow/Doors	M/s Chandni Industries/ M/S Madhu Industries /M/S GS UDYOG
74	Pressed Steel Frames for Doors/Windows/Ventilators	BA Enterprises/Multiwyn Industrial Corporation/Doorwyn Industries/ Modern Fabricator/Madhu Industries/Ajanta Ispat/Alusys/M/s Chandni Industries (Pressed Steel Door Framesonly)/M/s Trisul industries (Pressed Steel Door Frames only)/M/s Ashish Industries (Pressed Steel Door Frames only)/M/S GS UDYOG(Door & window frames)/M/s Chandni Industries
75	Anodised/ Powder Coated Aluminum Frames/sections for doors / windows/ partition	Jindal/Hindalco/Indal/Alpro/Balco
76	Aluminium Doors/Windows (Solid /Glazed Panel)	Jindal/Hindalco/Balco/Modern Fabricator/Alumilite Pvt Ltd./Ajit India Pvt Ltd/ Argent Industries (Aluminium Doors/Windows)/M/s Bengal Rolling Shutters & Engineering Works/M/s Chandni Industries/M/s Alpro Extrusion Pvt. Ltd.

		(Brand: Alpro)
76A	Aluminium fabricator	Ajit India Pvt Ltd/ Alumilite Pvt Ltd./M/s Bengal Rolling Shutters & Engineering Works/ M/s Chandni Industries / Modern Fabricator / Modern Fabricator / Argent Industries / M/s Alpro Extrusion Pvt. Ltd. (Brand: Alpro)
77	Frameless Glass Door	Kesar/Super Aluminium/Haresh Aluminium
78	Metal Rolling Shutters and Rolling Grills/Collapsible Gates	BA Enterprises/Multiwyn Industrial Corporation/Doorwyn Industries/Modern Fabricator/M/s Bengal Rolling Shutters & Engineering Works
Window Glazing/Glass Shelving/Urinal Partitions		
79	Plain Sheet Glass/Float Glass/Frosted Glass	Asahi India Glass Ltd/Saint Gobain Glass/Modiguard Float Glass/Hindustan Pilkington Glass/Triveni Float Glass/IAG
80	Toughened Glass/Laminated Glass	Safex/Saint Gobain Glass/Modiguard Float Glass/Kesar/Asahi India/Atul Tuf/Hindustan Pilkington Glass/Triveni Float Glass
81	Solar Control & Thermal Insulation Glass	SGG EVO/Evolite/Envision
82	Wired Glass	Saint Gobain Glass/Modiguard Float Glass/Triveni/Safex/Atul Tuf/Hindustan Pilkington Glass/Kesar
83	Black Painted Glass Tiles	Kesar/Marvel/Dreamwalls Glass/Paladio/Italia/Mridul/Mehtab Tiles Color
84	Glass Top Shelves	Kesar/Ozone/Sparkle Glass
Road Furniture		
85	Cat Eyes/Studs (Metal/Plastic) /Rumble Strips /Speed Breakers	3M/Dark Eye /Greenlite/Ace/Trafitronics/Lion/Automat
86	Delineators/Road Barriers	3M/Dark Eye/ Greenlite/Ace/Trafitronics/Lion/Automat
87	Road Signage	3M/Dark Eye/ Greenlite/Ace/Trafitronics/Lion/Automat
88	Tree Guard	M/s Shankar Weldmesh Pvt. Ltd. or equivalent
HDPE/LDPE Water Tanks/ Sewage Disposal & Miscellaneous Items		
89	HDPE/LDPE Water Tanks	Sintex/Polycon/Oriplast/Jindal/Plasto
90	UPVC/PPR/HDPE Pipe for Sewage	Jain Irrigation/Kisan/Prince/Supreme/Oriplast/Finolex/Diplast/Plasto/M/s Savoir-Faire Manufacturing Co. Pvt. Ltd. (SFMC)/M/s MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)
91	HDPE Pipe	M/s Kiran Infra Tech (Double Wall Corrugated HDPE Pipes of Class SN-8 for underground Drainage and Sewerage), M/s SHK Polymers Industries (Only ISI Marked)/ Jain Irrigation/ Kisan/ Prince/Supreme/ Oriplast/M/s RC Plasto Tanks & Pipes Pvt. Ltd./MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)/M/s Tirupati/M/s Alom Poly Extrusion Ltd. (Brand: ALCOR/TELECOR)
92	CI/DI Centrifugally Cast (Spun) Pipes & Fittings	Neco Centri/ BIC/ Electro Steel Casting Ltd./ AIC/ PIC/ Jai Balaji Industries/Sri Kalahasti Pipes Ltd./M/s Binay Udyog Pvt. Ltd.
93	UPVC Pipes & Fittings	M/s GK Plastics Pvt Ltd(20 mm to 330 mm dia)/M/s Prayag Polymers (p) Ltd./M/s Skipper Ltd./M/s HIL Limited (aCK

		Birla Group Co.) (Birla Aerocon CPVC, UPVC & SWR Pipes and Fittings)/ Fusion Industries Ltd./M/s Ori-Plast Ltd./M/s RC Plasto Tanks & Pipes Pvt. Ltd./M/s MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)
94	CPVC Pipes and Fittings	M/s Prayag Polymers (p) Ltd. (only isi marked)/M/s Vectus Industries Ltd (Brand: VECTUS)/M/s Skipper Ltd./M/s Fusion Industries Ltd./M/s RC Plasto Tanks & Pipes Pvt. Ltd./M/s MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)
95	PVC Soil/Waste/Rain Water (SWR) Pipes and Fittings	Jain Irrigation/ Kisan/ Supreme/ Prince/ Anant/ Oriplast/ M/s Vectus Industries Ltd (Brand: VECTUS) (only SWR Pipes as per IS 13592:1992 and SWR Fittings as per IS 14735:1994), M/s Skipper Ltd.(only SWR Pipes as per IS 13592:1992 and SWR Fittings as per IS 14735:1994)
96	CPVC/UPVC Pipes and Fittings	Prayag Polymers (P) Ltd./Astral/Ashirwad Flowguard/Kisan/Reliance/ Supreme/Prince/Plasto/M/s MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)
97	HDPE Pipes and Fittings (Water)	Kisan/Jain Irrigation/Supreme/Prince/Oriplast/Ajay Flow/Plasto/M/s MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)
98	Brass Ball (Float) Valve	Leader/Kirloskar/Zoloto
99	CI Manhole Covers	AIC/PIC/M/s Binay Udyog Pvt Ltd (Brand: Hepco)
100	PGI Sheet	Tata/Jindal/SAIL
LT & HT Wires & Cables		
101	PVC Insulated Cable up to 1100 Volts Copper/ Aluminium Conductor, Sheathed/ Unsheathed as per IS-694	Havells/Finolex/Nicco/M/s KEI Industries Ltd./Polycab/M/s RR Kabel Ltd./Bentec (BENLO), M/s Gold Medal Electricals Pvt. Ltd./M/s Asian Galaxy Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./M/s Arihant Cables/M/s Rajnigandha Cables Pvt. Ltd./HPL/Plaza Wires Pvt. Ltd./M/s Dynamic Cable Ltd./Ultracab (India) Limited/M/s Shalabh (India) Industries/M/s MESCAB India Pvt Ltd./M/s Cabcon India Ltd/ Fortune Arrt LED wires and cables Pvt Ltd/
102	HRFR, FR, HFFR, FRLS & ZHLS wires (domestic), Flexible cables, Instrumentation cables	Tamra Dhatu Udyog Pvt Ltd/Plaza Wires Pvt. Ltd./Gupta Power Infrastructure Ltd /Batra Henley Cables /Gemscab Industries Ltd (Instrumentation & Flexible Cables)/M/s Gold Medal Electricals Pvt. Ltd./M/s Asian Galaxy Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./Polycab India Limited/HPL/Ultracab (India) Limited/M/s Shalabh (India) Industries/M/s KEI Industries Ltd./M/s RR Kabel Ltd./M/s MESCAB India Pvt Ltd./M/s Cabcon India Ltd.
103	Networking cables , Co-axial cables, Control cables, CCTV cables, Cables for special applications	Tamra Dhatu Udyog Pvt Ltd./Plaza Wires Pvt. Ltd./Gupta Power Infrastructure Ltd./M/s Asian Galaxy Pvt. Ltd./HPL/Ultracab (India) Limited/M/s KEI Industries Ltd./M/s RR Kabel Ltd.
104	Wires & cables	Larsen & Toubro Ltd /Dynamic Cables Limited /Havells India Ltd /Polycab India Limited /Gloster Cables Ltd/V-Guard Industries Ltd /BCH Electric Ltd./ GM Modular Pvt Ltd./Ultracab (India) Limited/VK Industries /Panasonic Life Solutions India Pvt Ltd (Anchor) /Syska LED Lights/M/s MESCAB India Pvt Ltd. (PVC Insulated Cable upto 1100 volts, PVC/XLPE Armoured/ Unarmoured Cables upto 1100 Volts only) ,M/s Richa Cables Pvt Ltd (PVC Insulated Cables, PVC/XLPE Insulated PVC sheathed heavy duty cable & wires and PVC Conduits only), Bentec (BENLO), M/s Gold Medal

		Electricals Pvt. Ltd./M/s Asian Galaxy Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./M/s Arihant Cables/M/s Rajnigandha Cables Pvt. Ltd./HPL/Plaza Wires Pvt. Ltd./ M/s Shalabh (India) Industries/M/s KEI Industries Ltd./M/s RR Kabel Ltd./M/s Cabcon India Ltd.
105	PVC/ XLPE Insulated PVC Sheathed Heavy Duty Armoured/ Unarmoured Cables up to 1100 Volts, Aluminium/ Copper Conductors, Solid/ Stranded as per IS-1554, Part-I & IS-7098, Part-I.	Havells/Gloster Cables/KEI Industries Ltd./Polycab/Asian Cables/ Finolex Dynamic Cables Limited(only XLPE cables upto 1.1 KV (HT/LT)) /HPL Electric & Power Ltd(only XLPE cables upto 1.1 KV (HT/LT))/M/s Asian Galaxy Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./Plaza Wires Pvt. Ltd./Ultracab (India) Limited/M/s RR Kabel Ltd./M/s Cabcon India Ltd.
106	LT XLPE/PVC Aluminium & copper cables	M/s KEI Industries Ltd./M/s Grandlay Electricals (India) /M/s Gloster Cables Ltd./M/s Asian Galaxy Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./HPL/ Havells/Plaza Wires Pvt. Ltd./M/s Dynamic Cable Ltd./Ultracab (India) Limited/Polycab Industries Ltd./M/s RR Kabel Ltd./M/s Cabcon India Ltd.
107	PVC Copper Flexible Wire	M/s KEI Industries Ltd./M/s HPL Electric & Power Ltd./Grandlay Electricals (India)/M/s Asian Galaxy Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./M/s Arihant Cables/M/s Rajnigandha Cables Pvt. Ltd./Havells/Plaza Wires Pvt. Ltd./M/s Dynamic Cable Ltd./Ultracab (India) Limited/Polycab Industries Ltd./M/s Shalabh (India) Industries/M/s RR Kabel Ltd./M/s Cabcon India Ltd.
108	LT-PVC/HR-PVC/FR/FR-LHS PVC cable 1.1KV Grade	M/s RR Kabel Ltd./M/s Dynamic Cables Ltd./ M/s Gupta Power Infrastructure Ltd/ M/s Batra Henley Cables/M/s Gemscab Industries Ltd (1.1 KV PVC/XLPE Power & Control Cables)/ M/s Harsh Electro Systems Pvt. Ltd /M/s Asian Galaxy Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./ HPL/Havells/Plaza Wires Pvt. Ltd./Ultracab (India) Limited/Polycab Industries Ltd./M/s KEI Industries Ltd./M/s MES CAB India Pvt Ltd./M/s Cabcon India Ltd.
109	HT XLPE Cables	Havells/Gloster Cables/KEI Industries Ltd./Asian (RPG)/CCI/ Polycab/ Finolex/ M/s Asian Galaxy Pvt. Ltd./M/s Dynamic Cable Ltd./M/s RR Kabel Ltd.
110	LT/ HT Power Cables, EHV Cable upto 66 KV	KEI Industries Ltd./Gloster Cables Ltd /Gemscab Industries Ltd (HT XLPE cables upto 66 KV)/M/s Asian Galaxy Pvt. Ltd./M/s Dynamic Cable Ltd./Polycab Industries Ltd./M/s RR Kabel Ltd./M/s Cabcon India Ltd.
111	LT-XLPE Power and Control cable 1.1 KV Grade	M/s RR Kabel Ltd./M/s Dynamic Cables Ltd./Gloster Cables/M/s Asian Galaxy Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./HPL/ Havells/Plaza Wires Pvt. Ltd./Ultracab (India) Limited/Polycab Industries Ltd./M/s KEI Industries Ltd./M/s Cabcon India Ltd.
CI, DI ,PVC ,UPVC,CPVC & GI Pipes		
112	CI Pipes	Electrosteel/Kesoram/Tisco/M/s Singhal Iron Foundry Pvt Ltd (Brand: SKF) (Hubless centrifugal CI pipes and fitting only) M/s Jayaswal Neco Industries Ltd (Only for maint purpose) (Hubless centrifugal CI pipes and fitting only) /M/s Binay Udyog Pvt. Ltd.
113	DI Pipe, ISI Marked of bore 80 to 1000mm (Except DN 125 &	Jindal Saw Ltd/Electrosteel Casting Ltd./Tata Metaliks/Tata Kabuto

	750mm) of Class K7, K8, & K9 Conforming to IS-8329)	
114	ERW MS Pipes/GI Pipes/Fittings	Surya Roshni Ltd/Tata/Jindal steel/Prakash/ Bhushan Power & Steel Ltd (pipes only)/M/s Nezone Tubes Ltd.(pipes only) (15 mm to 150 mm)/M/sAPLApollo TubesLtd
115	PVC Pipes & Fittings	GM Modular Pvt Ltd(pipes only)/ Kanha Plastics pvt Ltd(pipes only)/ Ori-Plast/Supreme/Prince/Finolex/Kisan Mouldings Ltd.
116	RWP Pipes	Ori-Plast/Supreme/Prince/Finolex
117	UPVC Pipes	Ori-Plast/Supreme/Prince/Finolex/ Prayag Polymers(P) Ltd (Pipes and Fittings)/GK Plastics Pvt Ltd(20mm to 330 mm dia) (Pipes and Fittings)/ Fusion Industries Ltd(Pipes and Fittings) /Skipper Ltd(Pipes and Fittings) /HIL Limited (Pipes and Fittings)/ Kisan Mouldings Limited/M/s RC Plasto Tanks & Pipes Pvt. Ltd. /M/s MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)
118	CPVC Pipes	Ori-Plast/Supreme/Prince/Finolex/ Prayag Polymers(P) Ltd (Pipes and Fittings)/ Fusion Industries Ltd(Pipes and Fittings) /Skipper Ltd(Pipes and Fittings)/ Vectus Industries Ltd (Brand VECTUS) (Pipes and Fittings)/M/s RC Plasto Tanks & Pipes Pvt. Ltd. /M/s MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)
119	PVC SWR Pipes	Kisan Mouldings Limited/Supreme/Prince
120	PPR Pipes & Fittings	M/s Savoir-Fair Manufacturing Co. Pvt Ltd/ Vectus Industries Ltd /Fusion Industries Ltd/SHK Polymers/ Reliance /Finolex/Supreme/ M/s Kanha Plastics Pvt Ltd./M/s Savoir-Faire Manufacturing Co. Pvt. Ltd. (SFMC)/M/s Kanha Plastics Pvt. Ltd. (Brand: KPT)
Other Cat of Pipes		
121	Composite Pipes/ ASTM/ Plumbing Pipes/Submersible Pipes/ Micro Irrigation Pipes/ Casing Pipes/ Underground Drainage Pipes/ Hot & Cold Water Distribution System	M/ Vectus Industries Ltd (Composite Pipes only)/Kisan Mouldings Limited/Jain Irrigation Systems Ltd
122	Conduit Steel ERW	Tata/Jindal/Kalinga/BEC
123	Conduit PVC	Presto Plast/Finolex/Indo American Electricals Ltd/Kalinga Gold/Richa Cables Pvt. Ltd/ Panasonic Life Solutions India PvtLtd {Conduit Pipe & accessories (Anchor) only }M/s Harsh Electro Systems Pvt.Ltd (Rigid PVC Conduit only)/ M/s AKG Industries (Rigid PVC Conduit only), M/s Gold Medal Electricals Pvt. Ltd./Polycab India Limited
124	PVC Casing Caping	Presto Plast/Finolex/Kalinga/Payal/ AKG Industries /Richa Cables Pvt Ltd/Harsh Electro Systems Pvt Ltd (PVC Casing 'N' Caping only)/M/s MS Plasto Mould Pvt. Ltd. (Brand: RclassiC)
Light Fittings/Lamps		
125	Frame Proof Light Fittings	Bajaj/Crompton Greaves/Sudhir/M/s Signify Innovations India Ltd.
126	Fluorescent Tube Light/CFL Fittings	Philips/Crompton Greaves/Havells/Surya Roshni Ltd/Bajaj/Wipro/C & S Electric Ltd./M/s Century LED Ltd./M/s Ramswaroop Multi Engineering Solution Pvt. Ltd. (Brand:

		NAMASTE LED)/M/s Signify Innovations India Ltd.
127	FTL/CFL/PLS/HPSV/HP MV/ Metal Halide Fittings/Lamps (Outdoor Lighting)	Philips/Crompton Greaves/Havells/Surya Roshni Ltd/Bajaj/Wipro/C & S Electric Ltd./HPL Electric & Power Ltd. (Indoor/Outdoor) /M/s Century LED Ltd. /M/s Ramswaroop Multi Engineering Solution Pvt. Ltd. (Brand: NAMASTE LED)/M/s Signify Innovations India Ltd.
128	LED Light Fittings External/ Internal	Philips/Havells/Surya Roshni Ltd/Wipro/GE/Bajaj, M/s Gold Medal Electricals Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./M/s Oliive Exports Pvt. Ltd. (Brand: Olive LED)/Polycab India Limited/HPL/M/s Century LED Ltd./M/s Simoco Telecom/M/s Ramswaroop Multi Engineering Solution Pvt. Ltd. (Brand: NAMASTE LED)/M/s Hager Electro Pvt Ltd./M/s Signify Innovations India Ltd.
129	LED Lighting Products	Simoco Telecommunications(South Asia) Ltd/Jaquar & Company Pvt Ltd /Eveready Industries India Ltd /Crompton Greaves Consumer Electricals Ltd/Halonix Technologies Pvt Ltd/ Century LED Ltd (Brand MAGIK)/ Panasonic Life Solutions India Pvt Ltd (Brand: Panasonic)/Dhanashree Electronics Ltd (Brand: RASHMI)/ SORIL Infra Resources Limited /Syska LED Lights /Surya Roshni Limited (External/Internal) /Orient Electric Limited (a CK Birla Group Company) /Ram Ratna Electricals Ltd /Pyrotech Electronics Pvt Ltd /Gupta Power Infrastructure Ltd /FortuneArrt LED Lighting Pvt Ltd /Polycab India Limited (LED Lighting & Luminaries)/M/s C&S Electric Limited, Bentec (BENLO)/M/s Adhunik Switchgears Pvt. Ltd./HPL/M/s Luker Electric Technologies Pvt. Ltd./M/s Signify Innovations India Ltd.
130	LED Solar lights	M/s Crompton Greaves Consumer Electricals Limited./ M/s Halonix Technologies Pvt Ltd / M/s Dhanashree Electronics Ltd (Brand: RASHMI)/ M/s Adhunik Switchgears Pvt. Ltd./HPL/M/s Ramswaroop Multi Engineering Solution Pvt. Ltd. (Brand: NAMASTE LED)/M/s Signify Innovations India Ltd.
131	Switch Fuse/ Changeover Switch	Novateur Electrical & Digital Systems/L&T/Legrand/ABB/Siemens/ GE/C&S/Schneider/Havells/ M/s Gold Medal Electricals Pvt. Ltd./M/s Shalabh (India) Industries/M/s Hager Electro Pvt Ltd.
132	Switchgears (MCB/ RCCB/ RCBO/ DBs/ MCCB/ ACB/ COS/ SDF)	M/s Larsen & Toubro Ltd /Havells (MCB-BRAND:- Max ³ ,EURU-II and MCCB-BRAND:- HIM &HIX)/M/s Panasonic Life Solutions India Pvt Ltd (Switch Gear: Panasonic)/HPL Electric & Power Ltd./M/s VK Industries (MCB & DB only)/M/s C&S Electric Limited/Polycab India Limited, Bentec (BENLO), M/s Gold Medal Electricals Pvt. Ltd./BCH Electric Ltd./M/s Adhunik Switchgears Pvt. Ltd. /M/s Shalabh (India) Industries/M/s Novateur Electrical & Digital Systems Pvt. Ltd. (Brand: Optipro)/M/s Hager Electro Pvt Ltd.
133	MCCB/ACB	Legrand/L & T/Siemens/ABB/C & S/Schneider/GE/M/s BCH Electric Limited/M/s Novateur Electrical & Digital Systems Pvt. Ltd (Indo Asian) (Brand: OPTI POWER)/M/s Hager Electro Pvt Ltd., Bentec (BENLO)/M/s Adhunik Switchgears Pvt. Ltd./Polycab India Limited/ HPL/Havells/M/s Gold Medal Electricals Pvt. Ltd.
134	Switches/Switch Socket/Bell Push/Ceiling Rose/Regulator Piano	Havells/Anchor/Legrand/Schneider/ GM Modular/M/s Panasonic Life Solutions India Pvt Ltd {Non-Modular Switch (Model- Anchor PENTA) & Modular Switch (Model-ROMA)

	Type/Buzzer	only, M/s Gold Medal Electricals Pvt. Ltd./ BCH Electric Ltd./M/s Adhunik Switchgears Pvt. Ltd./ Polycab India Limited/ Havells/Novateur Electrical & Digital Systems (ELVIRA)
135	Modular Type Switches/ Sockets/ Regulator	Anchor (Woods)/Legrand/M/s RR Kabel Ltd./MK Honey Wall/ Schneider/C&S Electric/Novateur Electrical & Digital Systems (ELVIRA)/Larsen & Toubro Ltd/ GM Modular Pvt Ltd /Havells India Ltd (Brand : IVY & IRENE) /VK Industries, Bentec (BENLO), M/s Gold Medal Electricals Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./Polycab India Limited/M/s Hager Electro Pvt Ltd.
Substation/Transformers		
136	Power Transformers 33/11 KV	BHEL/ABB/Siemens/Andrew Yule/Alstom/Schneider/Bharat Bijlee/M/s RTS Power Corporation Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon
137	Oil Cooled Power Transformers up to 5 MVA of 33 KV	Esennar Transformers (P) Ltd /Kotsons Pvt Ltd/BHEL/ ABB/Siemens/Andrew Yule/Alstom/Schneider /Bharat Bijlee/ M/s Jayesh Elec Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Kanyaka Parmeshwari Engineering Ltd./M/s RTS Power Corporation Ltd.
138	Transformers 11 KV, Distribution Type Step Down/Up <400 KVA	Voltamp/ Siemens/ Crompton Greaves/ Alstom/ Schneider/ ABB/ Bharat Bijlee/ M/s Jayesh Elec Ltd./M/s RTS Power Corporation Ltd./ M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Kanyaka Parmeshwari Engineering Ltd.
139	Distribution Transformer (Oil-immersed/Dry Type/ Resin Cast)	Voltamp Electricals Pvt Ltd (2 MVA, 11/0.433 KV upto 630 KVA ,1 MVA, 11/0.433 KV)/Indian Transformers &Electricals Pvt Ltd (Upto 1 MVA)/Jaybee Industries (upto 630 KVA)/Esennar Transformers (P) Ltd (upto 5 MVA of 11 KV and up to 5 MVA above 11 KV and up to 33 KV)/ Kotsons Pvt Ltd(up to 2500 KVA 33 KV Class) /M/s Jayesh Elec Ltd./ M/s RTS Power Corporation Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Kanyaka Parmeshwari Engineering Ltd.
140	Transformers 11 KV, Distribution Type Step Down/Up ≥400 KVA	BHEL/ABB/Siemens/Areva T & D/Schneider /Crompton Greaves/ Bharat Bijlee/M/s Jayesh Elec Ltd./M/s RTS Power Corporation Ltd./ M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Kanyaka Parmeshwari Engineering Ltd.
141	Isolation Transformer	Vintek Electronics (VOLINA) (1KVA to 1050 KVA)/Live line Electronics/Instruments & Equipment Co /Vintec Electronic Laboratory/M/s Fuji Electric ConsulNeowatt Pvt. Ltd. /M/s Jayesh Elec Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Instruments & Equipment Co. /M/s Kanyaka Parmeshwari Engineering Ltd.
142	Packaged/Unified Substation	BHEL/ABB/Siemens/Andrew Yule/Schneider/Crompton Greaves/M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Kanyaka Parmeshwari Engineering Ltd.
143	Unitised Substation	Raychem RPG Pvt Ltd (100 KVA to 2000KVA up to 33KV Voltage Class/Voltamp Transformers Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon
144	Compact Sub-station	Raychem RPG Pvt Ltd (100 KVA to 2000 KVA up to 33KV Voltage Class/Voltamp Transformers Ltd/Larsen & Toubro Electrical & Automation(11 KV)/M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon
145	VCB & SF6 (11 KV & 33 KV) & Ring Main Units	BHEL/ABB/Areva T & D/Siemens/Andrew Yule/Schneider/Pascal/ Yamuna/M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Lucy Electricals Pvt. Ltd.

146	HT & LT VCB (12KV/36KV, 1250/1600/2000a, 25/26.3 /31.5 KA) INDOOR/ OUTDOOR	CG Power and Industrial Solution Ltd/Stelmec Limited/Pascal Switchcare India/M/s Yamuna Power & Infrastructure Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon
147	Current & Potential Transformers (LT & HT)	AE/English Electric/Crompton Greaves/Areva T & D/Schneider/M/s Jayesh Elec Ltd. /M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Hager Electro Pvt Ltd.
148	Electronic Energy Meter (Tamper Proof with Optical Port)	Siemens/L & T/Havells/HPL/Schneider, Bentec (BENLO)/M/s Hager Electro Pvt Ltd.
149	Multifunction Energy Meter	L&T /Secure Meters Limited/MB Control & Systems Pvt Ltd./HPL
150	Electrical Instrumentation/ Measuring Instruments Digital/ Analog/ Energy Meters/Volt Meter/ Ammeter	Havells/HPL (Energy Meter & Panel Meter Only)/L&T/AE/Schneider/ M/s Hager Electro Pvt Ltd.
151	Water Heater (Geyser)	Bajaj/Usha/Crompton Greaves/Jaquar/V-Guard Industries Ltd. (upto 35 ltr) 5 Star Rating/M/s Cera Sanitary Ware Ltd. (5 Star Rating)/M/s Adhunik Switchgears Pvt. Ltd./Havells
152	Exhaust Fan/Ceiling Fan/Air Circulator/Wall Mounting Fan	Crompton Greaves/Havells/Almonard/Bajaj/Orient, M/s Gold Medal Electricals Pvt. Ltd./M/s Adhunik Switchgears Pvt. Ltd./Polycab India Limited/Ram Ratna Electricals Ltd./EON Electric Ltd/Panasonic Life Solutions India Pvt Ltd (Brand: Anchor)
153	Capacitor Bank/APFC Panel	ABB/Siemens (EPCOS)/L & T/BCH Electric Ltd./Schneider/C&S Electric Ltd (APFC Panel only) /M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Shalabh (India) Industries
154	Thermoplastic Street Light Junction Box/DB	Hensel/Sintex/C & S/Hager Electro Pvt Ltd (DB only)/Larsen & Toubro Ltd(DB only)/ CAPE
155	Nature Switch/Street Light Timer	Legrand/L & T/Bajaj/Schneider/BCH
156	LT Switch Board Panel (Indoor Wall Mounted Prewired)	Schneider/L & T/ABB/Havells/C & S/BCH Electric Ltd./M/s Adhunik Switchgears Pvt. Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Shalabh (India) Industries
157	LT Control Panel/Feeder Pillar Box	L&T/Milestone/Advance/Unilec/C&S/Schneider/Hensel Electric India Pvt. Ltd. (Feeder Pillar Box only)/ Power Systems & Control (LT Control Panel only)/Indian Transformers & Electricals Pvt. Ltd. (LT Control Panel only)/Global Electro Control (LT Control Panel only)/BCH Electric Ltd./M/s Yamuna Power & Infrastructure Ltd./M/s Adhunik Switchgears Pvt. Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/ M/s Shalabh (India) Industries/M/s Novateur Electrical & Digital Systems Pvt. Ltd.
158	LT Panels	Jackson & Company/Neptune Systems Pvt Ltd/C&S Electric Ltd./Sterling Generators Pvt Ltd(LT/HT Panels)/BCH Electric Ltd./M/s Adhunik Switchgears Pvt. Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Shalabh (India) Industries
159	Steel Tubular Poles	Jindal Steel/National Tubing Co/Bombay Tubes & Store/Calcutta Poles & Tubes/M/s Kolkata Poles

		Corporation/M/s Signify Innovations India Ltd.
160	Cable Joint LT & HT, Hot & Cold Shrinkable	M-Seal/Birla-3M/Denson/Raychem/ Vishwa Power & Infrastructure (P) Ltd./M/s Yamuna Power & Infrastructure Ltd./M/s Vishwas Electrical Pvt. Ltd.
161	Air Break Switches/HT Isolators/HT Isolators	Pactil/BHEL/Jaipuria Brothers
162	DSC/Pin Type Porcelain Insulators	BHEL/Jaipuria Brothers/Pactil/Southern Insulators/M/s Yamuna Power & Infrastructure Ltd.
163	Diesel Generating Set Engines	Kirloskar Green/Cummins/Ashok Leyland/Greaves Cotton/Sterling Generators Pvt. Ltd. (7.5 KVA to 3000 KVA)
164	Alternator	Alstom/Crompton Greaves/Kirloskar Electric/Siemens/Bharat Bijlee
165	Lightning Arrester (Station Class)	Oblum/Elpro/BHEL/Jaipuria Brothers
166	Cable Tray	M/s Yamuna Power & Infrastructure Ltd./M/s Sumip Composites Pvt. Ltd./M/s Shalabh (India) Industries
167	ACSR Conductor	Indian Aluminium Ltd/Alind/Bharat Conductors/M/s Gupta Power Infrastructure Ltd (Conductors (AAC,AAAC,ACSR upto HTLS) only)/ M/s Dynamic Cable Ltd./M/s Cabcon India Ltd.
168	Single Phase Preventor/ Contactors/ Thermal Over load Relay	ABB/L&T/Siemens/C&S/Schneider/BCH/M/s Hager Electro Pvt Ltd.
169	Battery Maintenance Free	Exide/AMCO/Nicco/Amaron
170	Battery Chargers	Escorp/Su-Kam/Microtek/ Baid Power Services Pvt Ltd. /M/s Instruments & Equipment Co.
171	Servo Control LT Voltage Stabiliser	Voltamp/APLAB/Andrew Yule/Brentford/AE
172	Servo Voltage Stabilizers	Live Line Electronics/Vintek Electronics (VOLINA) (1KVA to 1050 KVA) /Vintec Electronic Laboratory/ Instruments & Equipment Co. (Up to 2000 KVA)/M/s Fuji Electric Consul Neowatt Pvt. Ltd./M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/M/s Instruments & Equipment Co.
173	Automatic Voltage Stabilizers	Vintek Electronics (VOLINA) (0.5KVA to 10 KVA)/Vintec Electronic Laboratory/M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon/ M/s Instruments & Equipment Co.
174	HT Voltage Stabiliser (11 KV)	Andrew Yule/Brentford/APLAB/M/s Indian Transformers and Electricals Pvt. Ltd., Gurgaon
175	Indicator Lamp/Selector Switch	L&T/Siemens/GE/RR Micro/BCH Electric Ltd./Schneider/M/s Hager Electro Pvt Ltd.
176	Sluice Valve/ Reflux Valve/ Air Release Valve/ Foot Valve/ Non-Return Valve/ Gate Valve/ Butterfly Valve	Kirloskar/Leader/Zoloto/Audco/Venus/Upadhaya
177	DOL/Star-Delta Starter	Siemens/L & T/ABB/Schneider/C & S/BCH
178	Submersible Cable	Finolex/Havells/M/s RR Kabel Ltd./Polycab/ Tamra Dhatu Udyog Pvt Ltd./HPL/ Ultracab (India) Limited/M/s KEI Industries Ltd./M/s MES CAB India Pvt Ltd.
179	Centrifugal Pumps	Crompton Greaves/Kirloskar/KSB/M/s Wilo Mather and Platt Pumps Pvt. Ltd.
180	Submersible Pumps	Crompton Greaves/Colama/KSB/Kirloskar/M/s Wilo Mather and Platt Pumps Pvt. Ltd.

181	Bleaching Dozer	Ion Exchange/RMCO/Avon/Aquapura/Maic India/ Sathya Sai Aqua Pura Services (Bleaching Dozer only)
182	Chloronome Plant/Chlorinator	Auqa/Pearl Filters/Jesco/Advance-2000
183	PVC Overhead Tank (ISI Mark)	M/s Vectus Industries Ltd /Sintex/Polywell/Polycon
184	Electric Motors	Crompton Greaves/ Siemens/ ABB/ Kirloskar Electric/ Havells/ BCH/ Havells
185	Monoblock Pumps	Crompton Greaves/Kirloskar/KSB
186	Chiller Units/ Compressors, Scroll/ Screw Type	Blue Star/Voltas/York/Kirloskar/Carrier/Daikin/Trane
187	Condenser & Chiller Pumps	Crompton Greaves/Kirloskar/KSB
188	Cooling Towers	Paharpur/Mihir/Delta/ Weldon Engineers (POLO)
189	Cooling Coil/AHU	Blue Star/Voltas/Zeco/Llyod
190	Filters	Blue Star/Airtech/Thermodyne
191	Balancing Valves	Leader/Audco/C & R/Advance
192	Refrigerant Controls	Sporlan/ALCO/Honeywell/Danfoss/Jhonson Control
193	Strainer	Rapid Control/Emberland/Sant
194	Insulation Crosslink Polye-thylene with Adhesive	Torcellen/Paramount/Thermoflex
195	Thermometers/Pressure Gauges	Hguru/Taylor/Fiebig
196	Thermostat/Humidistat	Honeywell/Jhonson Control/Danfoss/Siemens
197	Actuators	Siemens/Rapid Control/Honeywell
198	Heaters	Daspas/Racold/Bajaj
199	Thermostatic Expansion Valve	Siemens/Honeywell/Danfoss
200	Grills/Diffusers/Fire Dampers	Caryaire/Mapro/Conaire
201	Split Type AC/ Package Type AC/ Window Type AC	Blue Star/Voltas/Hitachi/Daikin/Carrier
202	Fire Pump	Crompton Greaves/Kirloskar/KSB
203	Fire Hose Real	Minimax/Firex/Safex/Newage
204	Stand Post Type Hydrant	Minimax/Firex/Safex/Newage
205	RRL Hose Pipe	Dunlop/Cosmos/Jayshree
206	Sprinkler Head	Minimax/Tyco/Ceasefire/Safex
207	Pressure Switch	Siemens/Honeywell/Danfoss/Schneider/Rapid Control
208	Fire Extinguisher	Minimax/Firex/Newage/Cease Fire/AN Exflame Fire Protection Pvt Ltd
209	Single Head Landing Valves Three/Four Way Brigade Inlet Hose Reel Drum and Shut-Off Nozzle, Aluminium Branch Pipe	Minimax/Safex/Superex/Newage
210	20mm dia Rubber Pipe	Jyothi/Dunlop/Minimax
211	Hooter	Safex/Honeywell/Mnimax
212	EOT Cranes	Tyojam/Anupam/Mukund/Jessop/WMI/Dinesh Enterprises.
213	Solar Power Inverter	M/s Fuji Electric ConsulNeowatt Pvt. Ltd. or equivalent

**Signature of Contractor
Date:**

**AA Dir (Contracts)
For Accepting Officer**

32.5. E-In-C's Branch Approved makes:

SL. NO.	PRODUCT DESCRIPTION	NAME OF FIRM
(A)	<u>CONSTRUCTION CHEMICALS:</u>	
1	(a) Sika Swell P Profile (b) Sika Fuko Swell 1 (c) Sika Injection 101h (d) Sika Waterbar h (e) Sika Swell A/S2 (f) Sika Fuko VT1/VT2/Eco1 (g) Sika MultiSeal (h) Sikainjection 202IN/201CE/306/307/310 (i) Sika Seal Tape S (j) SikaBit W 15 (k) Sikaflex 118 Extreme Grab (l) Sika Ceram (m) Sika Tilofix (n) Sika Wall Décor (o) Sika Block Joining Mortar (p) Sika Tilogrout/Epoxy Tilogrout (q) Sika CeramGrey/155/212/255 (White & Grey)/288 (White & Grey) (r) Rokkon 1 (s) Rokkon r (t) Separol	M/s Sika India Pvt Ltd valid upto 18 nov 2023
2	(a) Cebex 100 (b) Nitoflor Hardtop	M/s Fosroc Chemicals valid upto 29 jan 2024
3	Rustonil ® FZ-10 (Water based Rust Remover cum Rust Converter and Rust Protector Solution)	M/s Trimurti (India) valid upto 24 nov 2021
4	Masterol WD/MRA	M/s Choksey Chemicals Pvt. Ltd valid upto 04 dec 2021
5	(a) Bostik IWP (b) Boscomate Plaster (c) Bostik LW (d) Bostik Two in One TILE ADHESIVE (a) Fix All (b) Super Fix All (c) Tile Grout (d) Epoxy Tile Grout	M/s Bostik india pvt ltd valid upto 27 Jan 2023
(B)	<u>CONCRETE SURFACE IMPROVEMENT:</u>	
6	(a) Sikafloor Curehard 24 (b) sika floor Proseal 22	M/s Sika India Pvt Ltd. valid upto 18 nov 2023
7	Reebol	M/s Fosroc Chemicals valid upto 29 jan 2024
8	(a) Mastergrout EP-150 (b) Masterbond EP (c) Masterock Basic (d) Mastergrout CNS 50/100	M/s Chokesy Chemical pvt ltd valid upto 04 dec 2021
(C)	<u>ADMIXTURES</u>	
9	(a) Sika AER	M/s Sika India Pvt Ltd

	(b) Sika FerroGard 901 (c) Sika Rapid 1 (d) Sika Antifreeze (e) Sikament 2004NS (f) Sikament 4003NS (g) Sikament 4211 PQ (h) Sikament NN (j) Sikament 1016 NS (k) Sikament 2002 NS (l) Sika Viscorete 5101 NS (m) Sikaplast 5201NS (n) Sikaplast 4210NS (o) Sikaplast 3001NS (p) Sika viscorete 20HE (q) Sika Viscorete 2004NS (r) Plastiment BV 40 (s) Singunit L (t) Singunit L54AF (u) Singunit Powder 1 (v) Singunit Powder (K) (w) Sika Rapid C100 (x) Sikament 3070NS/2009PQ (y) Sika Viscocrete 4107PQ (z) Sikaplast 3144PQ (aa) Sika Control WP-200P (IN) (ab) Sika Control WT 200 PIN	valid upto 18 nov 2023
10	(a) Auramix 400 (b) Auramix 300 (c) Conplast SP430	M/s Fosroc Chemicals valid upto 29 jan 2024
11	(a) Masterplast SPL 8 (b) Masterplast SPI 10	M/s Choksey Chemicals Pvt Ltd. valid upto 04 dec 2021
12	(a) Tecnos 94 (b) Tecnos 95 (c) Tecnos RP (d) Neutrol 100 (e) Neutrol 200 (f) Neutrol 500 (g) Accelerator NT (h) Warep 1000/l (j) Warep 1000/p (k) MuCis AD 28 Tecnos	M/s Thermax ltd valid upto 21 feb 2024
13	<u>Concrete Admixtures</u> (High End Super Plasticizer Retarder, Air Entrainment, Foaming Agent etc) (a) MARUTI PLAST SP 100/200/300 & 400 (b) MARUTI PLAST SR 100/200/300 & 400 (c) MARUTI PLAST PC (d) MARUTI PLAST XL (e) MARUTI PLAST FA	M/s Maruti Bitumen Pvt Ltd. valid upto 17 sep 2022
14	(a) SmartCare MaximoPlast PX 100, PX 200, PX 300 (b) SmartCare MaximoPlast PC 100, PC 200, PC 300 (c) SmartCare Hypershot AF 100 (d) SmartCare TechnoPlast S 300 (d) SmartCare TechnoCor	M/s Asian Paints Limited Valid up to 28 Apr 2024

	(e) TechnoPlast AEA (f) SmartCare TechnoShrin	
(D)	CURING COMPOUNDS:	
15	(a) Antisol A. (b) Antisol EWP	M/s Sika India Pvt Ltd valid upto 18 nov 2023
16	(a) Concure WB (b) Concure LP90 (c) Concure-1315	M/s Fosroc Chemicals valid upto 29 Jan 2024
17	Mastercure RB 2M & WB	M/s Choksey Chemicals Pvt Ltd. valid upto 04 dec 2021
18	(a) Maxcure CC 75 (b) Maxcure CC 80 (c) Maxcure CC 90 (d) Maxcure RR (e) Maxcure MRA 102	M/s Thermax ltd valid upto 21 feb 2024
19	<u>CURING COMPOUNDS & SHUTTERING OILS</u> (Wax Based & Resin Based) (A) MARUTI CURE WB (B) MARUTI CURE RB (C) MARUTI DEMOULD OB (Oil Based) (D) MARUTI DEMOULD WB (Water Based)	M/s Maruti Bitumen Pvt Ltd valid upto 17 sep 2022
20	Bostik CCC	M/S BOSTIK India Pvt Ltd valid upto 27 jan 2023
21	(a) SmartCare Curing Compound	M/s Asian Paints Limited Valid up to 28 Apr 2024
(E)	FLOOR HARDNER	
22	(a) Sika Chapdur. (b) Sika Chapdur C.	M/s Sika India Pvt Ltd valid upto 18 Nov 2023
23	TecFloor HT TecFloor HTS	M/s Thermax ltd Valid upto 21 Feb 2024
24	(Metallic & Non Metallic Floor Hardeners) (a) MARUTI FLOOR MH (b) MARUTI FLOOR NMH	M/s Maruti Bitumen Pvt Ltd valid upto 17 sep 2022
25	Bostik Floor Hardner	M/S BOSTIK India Pvt Ltd valid upto 27 jan 2023
26	(a) SmartCare Apcoflor Cementitious Floor Hardener	M/s Asian Paints Limited Valid up to 28 Apr 2024
(F)	JOINT SEALANT	
27	(A) Sikasil 728NS/SL (B) Sika Polysulphide (C) Sikaflex Construction + (D) Sikaflex PRO-3 (E) Sikadur Combiflex SG (F) Sikaflex 11FC (G) Sikaflex Pro 3 SL (H) Sikaflex 402 Airport (I) Sika Emseal Joint Systems (J) SikaSeal 106 Construction (K) Sikaflex 406 KC (L) SikaHyflex 160 construction (M) Sikafloor joint S/EXA/XS/X	M/s Sika India Pvt Ltd valid upto 18 nov 2023

28	Techseal RDL 940/941	M/s Choksey Chemicals Pvt Ltd. valid upto 04 dec 2021
29	(a) MaxFlex PS (b) MaxFlex PU (c) maxflex PSPR (d) MaxFlex PUPR (e) MaxFlex ACS (f) MaxFlex PS 500	M/s Thermax ltd valid upto 21 Feb 2024
30	SEALANTS (Acrylic, Polysulphide & Polyurethane) (a) MARUTI SEAL AS (b) MARUTI SEAL PS (Gun Grade & Pouring Grade) (c) MARUTI SEAL EMS (d) MARUTI SEAL SS	M/s Maruti Bitumen Pvt Ltd valid upto 17 Sep 2022
31	(a) Colpor 200 PF (b) Expoband One	M/s Fosroc Chemicals valid upto 29 Jan 2024
32	(a) Bostik seal N flex 1 (b) Bostik seal N flex fc (c) Bostik seal N flex 2k (d) Bostik No More Nails	M/s BOSTIK India Pvt Ltd valid upto 27 Jan 2023
33	(a) SmartCare Hybrid PU Sealant (b) SmartCare Polysulphide Sealant	M/s Asian Paints Limited Valid up to 28 Apr 2024
(G)	WATERPROOFING CHEMICALS/ MATERIALS	
33	(a) SikaCim Pink (b) Sika Cemcrete (c) Plastocrete Plus	M/s Sika India Pvt Ltd valid upto 18 Nov 2023
34	(a) Conplast (b) Supercast SW20 (c) Supercast PVC	M/s Fosroc Chemicals valid upto 29 Jan 2024
35	(a) Masterproof IWP-1&2 (b) Mastercrete M-81 (c) Mastercrete URP (d) Tar o Thane (e) Techoxy (f) Techcoat (g) Futura 5 (h) Master Latex (SBR) (j) Coal Tar Epoxy (k) Techforce Grey (l) Sunshelid-100 (m) Techrepel WB/SB	M/s Choksey Chemicals pvt ltd valid upto 04 Dec 2021
36	(a) Elastplast Rol 10 MuCis (b) Anticorr 280 II MuCis (c) Tecnoseal V1 (d) Maxshield PF 900 (e) CRYSTECO PWD (f) Maxshield Roofkot (g) Maxshield Wallkot (h) Maxshield T 15 (j) Maxshield P 600 (k) Maxshield Primer (l) MuCis Mia 200	M/S Thermax Ltd valid upto 21 feb 2024

	(m) Maxshield PF 100 PW	
37	WATERPROOFING PRODUCTS (Modified Waterproofing System) (a) MARUTI VARSHA GARD (b) MARUTI LATEX SBR (c) MARUTI CRETE E (d) MARUTI CRETE P INTEGRALWATERPROOFING COMPOUND MARUTI PLAST LW+ (Liquid & Powder)	M/s Maruti Bitumen Pvt Ltd Valid upto 17 Sep 2022
38	(a) Boscocem Slurry (b) Bostik K11 Slurry (c) Boscocrete (d) Moisture Seal (e) Bostik Cwp (f) Hydroment 476 (g) Boscolastic	M/s BOSTIK India Pvt Ltd Valid upto 27 Jan 2023
39	(a) SmartCare EPDM Adhesive (b) Quartz Crystalline Coating, Admix (c) SmartCare Apcorep Food Grade Epoxy, 2K Coal Tar Epoxy	M/s Asian Paints Limited Valid up to 28 Apr 2024
(H)	APP MEMBRANE	
40	(a) Sika WP Shield 103P/PM/104P/PM (b) Sika WP shield 103F/102F (c) Sika Bit T 130PG/140PG/130MG/140MG (d) Sika Bit T 130 SG /140SG (e) Sika WP shield 103	M/s Sika India Pvt Ltd Valid upto 18 Nov 2023
41	(a) Asian Paints Smartcare App Dampproof (b) Asian Paint Smartcare Damp Block 2K	M/S Asian Paints Ltd Valid upto 25 oct 2021
42	Torchtar Brand APP Membrane, Flashing Tapes and Wrapping Coats	M/S Torchtar Membranes & Bitumen Product Pvt. Ltd Valid upto 21 Jan 2023
43	HYDROSTOP Waterproofing Membrane, in all its permutations and combinations, as also Tiki Primers-WB & OB & Tiki Flash (Bitumen Based Aluminum Paint)	M/S Tiki Tar Danosa (India) Pvt Ltd. Valid upto 17 feb 2023
44	"Shivam" brand Superior (a) Multi Polyster felt (b) Multi Polyplast	M/S Shivam Tar Products valid upto 120 nov 2023
45	APP Modified Polymeric Membrane-Bengal Aquaflex,Bengal Aquaflex Aluminum and Bengal SuperMat	M/S Bengal Bitumen valid upto 15 mar 2024
(I)	REPAIR & REHABILITATION/BONDING AGENT/ GROUTS:	
46	(a) Bostik EP Bond (b) Boscocem 475 (c) Bostik Plug Leak (d) Bostik Patch Fix MC (e) Bostik Patch Fix Concrete (f) Bostik LVEP (g) Bostik Grout Admix	M/S BOSTIK India Pvt Ltd VALID UPTO 27 JAN 2023

	(h) bostik ERM (i) Bostik Anchor Grout (j) Bostik Evo Stik Flasband original (k) Bostik Flowfill Grout GP	
47	<u>GROUTS & ANCHORS</u> (Cementitious, Polymer,Epoxy & Polyester Resin Based for Static & Dynamic loads) (a) MARUTI GROUT 50 (b) MARUTI GROUT 60 (c) MARUTI GROUT AG (d) MARUTI GROUT EG-65 (e) MARUTI FLOWADD 100	M/S Maruti Bitumen Pvt Ltd valid upto 17 Sep 2022
48	(a) Renderoc S2 (b) Nitomortar S (c) Renderoc RG (d) Renderoc HS Xtra (e) Nitowrap EP (CF) (f) Nitowrap EP (GF) (g) Nitowrap (CFP) (h) Nitobond EP (i) Nitobond AR (j) Nitobond SBR (k) Nitofill EPLV (l) Conbextra EP10 (m) Conbextra GP2 (n) Conbextra GP3 (o) Lokfx	M/S Fosroc Chemicals valid upto 29 Jan 2024
49	(a) Sika Grout 104 (b) Sika Grout 214 (c) Intrplast EP (d) Intraplast N 200 (e) Intraplast NN (f) Sikadur 42 (g) Sikadur 42 HES (h) Sikadur 52 (i) Sikadur 53 UF (j) Sikadur 42 MP (IN) (k) Sikadur 52 LP (IN) (l) Sika Grout 60 RR (m) Sikagrout 295 IN (n) Sikawrap Glass Fibre (o) Sikawrap Carbon Fibre (p) Sika Anchorfix 2/3+ (q) Sikadur 31 (r) Sikadur 32 (s) Sikadur 32 LP (t) Sikadur 41 (u) Sikadur 43 (v) Sika Rep Microcrete ½ (w) Sika Rep Microcrete 3UW (x) Sika Rep Microcrete 4 (y) Sika Carbo Dur (z) Sikadur 12 Pronto (aa) Sika Top 77 (bb) Sika Top 122.	M/S Sika India Pvt Ltd valid upto 18 nov 2023

	(cc) Sika Top 122HS. (dd) Sika Mono Top 122 F/R (ee) SikaGrout Precast 40 (ff) Sika Anchorfix 3030 (gg) Sikawrap FX 50 (hh) Sika Carbodur BC Rod (ii) Sika Carbodur NSM (jj) Sika Monotop 412N	
50	(aa) Bs 66 MuCis (ab) BS 5F (ac) Maxtreat Patchup (ad) MuCis Protezione Ferro Mono (ae) Maxtreat Fibrenet C (af) Maxtreat Fibrenet G (ag) Maxtreat Carbon Rod (ah) Maxtreat Laminate (aj) Maxtreat EHS (ak) Seismocrete UHP (al) Rapido fix (am) Flash Tixo (an) Maxtreat EFC (ao) Maxtreat EPG (ap) Maxtreat Primer (aq) Maxtreat Saturant (ar) Maxtreat Glue (as) Maxtreat LM <u>Bonding Agents,Adhesive and grouts</u> (aa) TM-Bond AR (ab) TM-Bond EP (ac) TM-Bond SG (ad) TM-Bond SBR (ae) Maxtite MP (af) Maxtite MG (ag) Maxtite Grout EP (ah) Maxtite Grout (aj) Maxtite Block Fix (ak) Maxtite LG (al) MaGrout 100 (am) MaGrout MMA (an) MaGrout E 10 (ao) MaGrout PAF (ap) MaGrout 45 (aq) MaGrout 60 (ar) MaGrout LE	M/S Thermax Ltd valid upto 21 Feb 2024
51	<u>BONDING AGENTS:</u> (a) Asian Paints SmartCare Epoxy Bonding Agent (b) SmartCare Acrylic Bonding Agent <u>GROUTS:</u> (a) SmartCare General Purpose Grout <u>REPAIR & REHABILITATION:</u> (a) SmarCare Microconcrete, HS, Repair Mortar (b) SmartCare Apcorep Inject Grout	M/s Asian Paints Limited Valid up to 28 Apr 2024

	(c) SmarCare Apcorep Epoxy Mortar, Epoxy Seal (d) SmartCare Ultrawrap Primer (e) SmartCare Apcorep Sacnode	
(J)	<u>REINFORCEMENT/ CONCRETE PROTECTIVE COATING/SYSTEMS:</u>	
52	(a) Sika FerroGard 903 (b) Freiazinc R (c) Sikagard 550W Elastic (d) Sika Top Armatec 108 (e) Sika Top Armatec 110 Epo Ce (f) Sikagard 551S Elastic Primer (g) Sikagard PU UR/Sikagard PU UR (W) (h) Introl Poxitar (i) Sikagard 552W Aquaprimer (j) Sikagard 625 Clearcoat (k) Sikagard XT (l) Sika Rustoff 100 (m) Sikagard 63 (n) Sikagard 63/1 (o) Sikagard 67	M/S Sika India Pvt Ltd valid upto 18 nov 2023
53	(a) T-Guard AC (b) T-Guard WBP (c) T-Guard EC 200 (d) T-Guard ENC (e) T-Guard CTE 45 (f) T-Guard CTE 65 (g) T-Guard BC (h) T-Guard BCP	M/S Thermax Ltd valid upto 21 Feb 2024
54	PROTECTIVE COATINGS(Anti Carbonation, Zinc Rich Products) (a) MARUTI GARD AC (b) MARUTI COAT ZR	M/S Maruti Bitumen Pvt Ltd valid upto 17 Sep 2022
55	(a) Epoxy Coat UW (b) Rainshield PU (c) Procoat PU (d) Scratch Coat (e) Bostik CTE (f) Magic Repellent SB (g) Magic Repellent WB (h) Exterior Coat	M/S BOSTIK India Pvt Ltd VALID UPTO 27 JAN 2023
56	(a) Nitozinc Primer (b) Dekgurd S (c) Nitocote EP410 (d) Nitocote EP405 (e) Nitocote UR512 (f) Nitocote BCS300 (g) Nitocote ET140 (h) Nitocote ET550 (i) Nitocote SN522	M/S Fosroc Chemicals valid upto 29 Jan 2024
(K)	<u>EPOXY/ POLYURETHENE INDUSTRIAL FLOORING</u>	
57	(a) Techfloor Mortar (b) Techfloor SL-2 (c) Techfloor HT 200	M/s Choksey Chemicals Pvt Ltd valid upto 04 Dec 2021

	(d) Masterprime 52 (e) Mastercoat PU-150	
58	TechFloor EC 500 TechFloor ET1000/2000/3000/4000 TechFloor UL TechFloor PU CEM TechFloor EC 100 TechFloor PR TechFloor ESD	M/S Thermax Ltd valid upto 21 Feb 2024
59	(a) Bostik Ultralevel ESL 1000 (b) Bostik Ultralevel ESL 2000 (c) Bostik Ultralevel EUL 1000 (d) Bostik ESM	M/s BOSTIK India Pvt Ltd valid upto 27 Jan 2023
60	(a) Sikafloor 20N PurCem (b) Sikafloor 21N PurCem (c) Sikafloor 29N PurCem (d) Sikafloor 31N PurCem (e) Sikafloor 81 EpoCem (f) Sikafloor 82 EpoCem (g) Sikafloor 105 (h) Sikafloor 161 (i) Sikafloor 220 W Conductive (j) Sikafloor 262 ASN (k) Sikafloor 264 (l) Sikafloor 381 (m) Sikafloor 381 ECF (n) Sikafloor 7530 (o) Sikafloor 235 ESD (p) Sikafloor 315 (q) Sikafloor 325 (r) Sikafloor 359 (s) Sikafloor 25 N Purcem (CN) (t) Sikafloor 326 (u) Sika Extender T (v) Sikafloor Leitest (Earthing Kit) (w) Sikafloor 290 Primer (x) Sikafloor 291 (y) Sikagard 720 Epocem (z) Sikafloor Multidur System (aa) Sika Deco Flake	M/S Sika India Pvt Ltd valid upto 18 nov 2023
61	(a) Nitoflor SL 2000 (b) Nitoflor FC 150 (c) Nitoflor TF 5000 (d) Nitoflor EU5 (e) Nitoflor SL Conductive (f) Nitoflor SL Dissipative (g) Trafficguard UR 150 (h) Nitoflor SL 3000 UT	M/S Fosroc Chemicals valid upto 29 Jan 2024
62	(a) SmarCare Apcoflor HFP 120, 130, MFP 140, FP 110 (b) SmartCare Apcoflor SL 1 TC, SL 2, SL 1 AM, SL 1 TC BH, SL EPU, SL 1 TC F, SL 1 TC XL, SL 2 EPU (c) SmartCare Apcoflor LSC 3, LSC 3 N, LSC 3 NBH, LSC 3 N F, LSC 3 XL, HSC 3 (d) SmartCare PU Crete 4K, XL	M/s Asian Paints Limited Valid up to 28 Apr 2024

	(e) SmartCare Apcoflor PU Screed, PU Screed HD, Screed SOL (f) SmartCare Apcoflor TC 510, TC 650, AS 500, WPF 200 (g) SmartCare Apcoflor ESD SL, ESD Primer (h) SmartCare Apcoflor Car Deck TC, BC (i) SmartCare Apcoflor Oil Sealer (j) SmartCare Terraflor GC, SC, BC	
(L)	MEMBRANE & LIQUID MEMBRANE / COATINGS	
63	(a) Sikaplan WP 1120-15HL/20HL (b) Sikalastic 450h/450l (c) Sika Cemflex (d) Sika Latex (e) Sika 101h (f) Sika Topseal 107 (g) Sika Topseal 109hi (h) Sika 2 (i) Sika 4a (j) Sikalastic 830N (k) Sikalastic 842BG (l) Sikalastic 618 MTC (m) Sikaplan 12G/15G (n) SikaProof P 12/A12HC/T10 (o) Sarnafil G410L/G476/S327L (p) Sikalastic 560/614 (q) Sikalastic 851/851R/901 (r) Sika Raintite I (s) Sika FlexiCoat 1K (t) Sika Cool/Coat/SikaCoolCoat Primer (u) Sikalastic 853 RAP (v) Sika Monotop 160Migrating	M/S Sika India Pvt Ltd valid upto 18 nov 2023
64	Techothane-700	M/s Choksey Chemicals Pvt Ltd valid upto 04 Dec 2021
65	MARUTI MEMBRANE	M/S Maruti Bitumen Pvt Ltd valid upto 17 Sep 2022
66	(a) Aquablocker (b) Bosco seal PU (c) Elaso coat	M/s BOSTIK India Pvt Ltd valid upto 27 Jan 2023
67	<u>Asian Paints Smartcare APP Membranes</u> (a) Glass fibre sheet reinforced (2mm,3mm,4mm) (b) Hybrid sheet reinforced (2mm,3mm,4mm) (c) Polyester sheet reinforced (2mm,3mm,4mm)	M/S Asian Paints Ltd valid upto 25 oct 2021
68	(a) Proofex Engage (b) Proofex PGP (c) Proofex ORG (d) Proofex OGP (e) Proofex Self Adhesive PR20 (f) Proofex Self Adhesive Geotext (g) Proofex Self Adhesive Antiroot (h) Fosroc Polyurea WPE	M/S Fosroc Chemicals valid upto 29 Jan 2024

	(i) Brushbond (j) Brushbond RFX (k) Nitocote CM210 (l) Brushbond Roof Guard (m) Brushbond TI Flexicoat (n) Nitoproof 600 std.	
69	(a) SmartCare PU Aqua (b) SBS Modified Polyyster Sheet Reinforced Self Adhesive Bituminous Membrane (2mm, 3.5mm) (c) SmartCare APP Modified Bituminous Membrane with Mineral Top (3mm, 4mm, 5mm), APP 7 Layer Membrane (d) SmartCare Self Adhesive SBS Membrane with HDPE Lining (e) SmartCare Preapply HDPE 40, HDPE 80, HDPE Tape (f) SmartCare Ultron Hybrid Antirroot Polyurea (g) SmartCare PVC Membrane B02, B01 (h) SmartCare Proffessional Damp Block 2K, Damp Prime Ultra, Suprema, Bitumen Primer	M/s Asian Paints Limited Valid up to 28 Apr 2024
(M)	THERMA INSULATION COATING	
70	(a) SC PU Insulator (Polyol + Isocyanate)	M/s Asian Paints Limited Valid up to 28 Apr 2024
(N)	OTHER CIVIL CONSTRUCTION PRODUCTS	
71	(a) Marvelloplast, Marvelloplast Classic	M/s Asian Paints Limited Valid up to 28 Apr 2024
(O)	GEOTEXTILE /GEO CELL	

(P)	PEB	
1.	Pre Engineered Buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s BNAL prefabs Pvt Ltd
2.	Pre Engineered Buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s Kirby Building Systems and structures India Pvt Ltd.
3.	Pre Engineered Buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s Kartikeys Industries Pvt Ltd. Valid
4.	Pre Engineered Buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s Cold steel Corporation
5.	Pre Engineered Buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s Lloyd Insulations (India) Ltd. Valid
6.	Pre Engineered Builgings (PEB) i.e. Designing manufacturing supply and execution of stel structures	M/s Epack Polymers (P)
7.	Pre Engineered Buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s Paramount Building solutions Pvt Ltd.

8.	Pre Engineered Buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s Pinax steel Industries Pvt Ltd.
9.	Pre Engineered Buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s Fabex steel structures Pvt Ltd.
10.	Pre Engineered buildings (PEB) i.e. Designing manufacturing supply and execution of steel structures	M/s Interarcs Building products Pvt Ltd.
11.	Pre Engineered buildings (PEB) i.e. designing manufacturing supply and execution of steel structures	M/s Smith structures India Pvt Ltd.
12.	Pre Engineered buildings (PEB) i.e. designing manufacturing supply and execution of steel structures	M/s Smith structures India Pvt Ltd.

(P)	LGSF	
83	M/s Epack Polymers (P)	Valid upto 05 May 2024
84	M/s Nipani Infra & Industries Pvt Ltd	Valid upto 12 Dec 2023

(Q)	LIFTS	
SRL NO	NAME OF FIRM	
1	M/S KONE INDIA	
2	M/S SCHINDLER INDIA PVT. LTD.	
3	M/S KINETIC HYUNDAI ELEVATOR & MOVEMENT TECHNOLOGIES LTD	
4	M/S HITACHI LIFTS INDIA PVT.LTD.	
5	M/S MISTUBISHI ELEVATOR INDIA PRIVATE LIMITED.	
6	M/S OTIS ELEVATOR COMPANY INDIA LTD.,	
7	M/S FUJITECH INDIA PVT LTD.,	
8	M/S JOHNSON LIFTS PVT LTD	
9	M/S THYSSENKRUPP ELEVATORS INDIA PVT LTD	
10	M/S OMEGA ELEVATORS PVT LTD	
11	M/S ESCON ELEVATORS PVT LTD	
12	M/S LT ELEVATORS PVT LTD	
13	M/S IES ELEVATORS	

(R)	CRANES	
1.	(a) Single Girder EOT Cranes (b) Double Girder EOT Cranes (c) Under Slung Cranes (d) HOT Cranes (e) Mono Rail (f) Jib Cranes (g) Goliath Cranes (h) Hoist (i) Gear Box	M/s Dinesh Enterprises upto 13 Jun 2024

(S)	GEOTEXTILE/GEO CELL	
1.	M/s MECCA FERRI ENVIRONMENTAL SOLUTION PVT LTD	
2.	M/S STRATA GEOSYSTEMS INDIA PVT LTD.	
3.	M/S TECHFAB INDIA	

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**Signature of Contractor
Date:**

**AA Dir (Contracts)
For Accepting Officer**

33. **GRIHA GUIDELINES FOR PROCUREMENT OF MATERIALS**

33.1. GRIHA Specifications shall be under:

Items	Suggested Makes	Green Property that must be present	Document Required
CIVIL ITEMS			
Sand		1. Locally Sourced within India. Preferably River Sand	1. Declaration from Manufacturer on location of Extraction of Sand and/or Manufacture
Steel	As specified in Tender documents	1. Locally Sourced within India.	1. Declaration from Steel Manufacturer mentioning place of Manufacture
Cement	As specified in Tender documents	1. PSC Cement with Percentage of Pozollona Material- Either Flyash or GGBFS for more than 25% by Volume	1. NABL Lab Test report for Flyash/ Pozollona content
Flat Roof Finish Tile/ Paint	As specified in Tender documents	1. Must have SRI (Solar Reflective Index) > 50	1. NABL Lab Test report of SRI Value
Sloped Roof- Mangalore Tile		1. Locally Manufactured. Preferably Clay Tiles. If using Cement Tiles, then it must have Pozollona material for 25%.	1. NABL Lab Test report for Recycled content and Material used in Recycle 2. Batch Report indicating percentage of Pozollona Material
Glass	As specified in Tender documents	1. Should have minimum 10% Recycled Content & Should be Locally Manufactured	1. Manufacturer Signed declaration on percentage of Recycled Content 2. Declaration from Manufacturer on location of Extraction and/or Manufacture
Particle Board	As specified in Tender documents	1. Should NOT have bonded urea formaldehyde resin (Phenol Formaldehyde, Melamine Formaldehyde or Epoxy are acceptable). 2. Should be manufactured from Trees which are rapidly renewable (i.e. the trees have a harvesting cycle of less than 10 years)	1. Manufacturer Declaration on Type of Bonding Resin used. 2. Manufacturer Declaration on Type of Tree used
All Ceramic/ Vetrified tiling	As specified in Tender documents	1. Should either have recycled content of more than 10% or should be chosen from GRIHA	1. Manufacturer Signed declaration on percentage of Recycled Content

		product Catalogue	2. Declaration from Manufacturer on location of Extraction and/or Manufacture
Marble/ Granite	As specified in Tender documents	1. Should be Locally Harvested within India or 2. Should either have recycled content of more than 10% or should be chosen from GRIHA product Catalogue	1. Manufacturer Signed declaration on percentage of Recycled Content 2. Declaration from Manufacturer on location of Extraction and/or Manufacture
Paver Blocks Exterior	As specified in Tender documents	1. Grass Grid Pavers design to show percentage of Opening in the Paver 2. Light Grey Concrete Mix design to show colour 3. Must have solar reflective index (SRI) >50	1. Manufacturer Technical Brochure 2. Photographs 3. Test certificate has to be given for SRI
Door Frame	As specified in Tender documents	1. Should be Locally Harvested within India 2. FSC Chain custody certified products or certified wood	1. Declaration from Manufacturer on location of Extraction and/or Manufacture
Wooden Door	As specified in Tender documents	1. Should NOT have bonded urea formaldehyde resin (Phenol Formaldehyde, Melamine Formaldehyde or Epoxy are acceptable). 2. Should be manufactured from Trees which are rapidly renewable (i.e. the trees have a harvesting cycle of less than 10 years) 3. FSC Chain custody certified products or certified wood	1. Manufacturer Declaration on Type of Bonding Resin used. 2. Manufacturer Declaration on Type of Tree used
Piping Insulation	As specified in Tender documents	1. Free from CFC & HCFC 2. R value for Cold Water Pipes- 0.74 Sqm K/W for Hot Water Pipes- 0.35 Sqm K/W	1. Manufacturer Signed declaration on properties
Fire Extinguishers	As specified in Tender documents	1. Free From Halons	1. Manufacturer Signed declaration on properties
Exit Signage		1. Backlit	1. Photographs
PAINTS/ COATINGS/ ADHESIVES			
Curing Admixture	As specified in Tender documents	1. Any Super Plasticizer or Accelerator	1. Manufacturer Signed declaration on properties
Putty/ Primer	As specified in Tender documents	1. VOC (Volatile Organic Compound) Tested should be less than 150 Grams/ Liter	1. NABL Lab Tested VOC Level in Grams per Liter
Wood	As specified in	1. VOC (Volatile Organic	1. NABL Lab Tested

Varnish	Tender documents	Compound) Tested should be less than 200 Grams/ Liter	VOC Level in Grams per Liter
Tile Adhesive	As specified in Tender documents	1. VOC (Volatile Organic Compound) Tested should be less than 65 Grams/ Liter	1. NABL Lab Tested VOC Level in Grams per Liter
Tile Grout Chemical	As specified in Tender documents	1. VOC (Volatile Organic Compound) Tested should be less than 65 Grams/ Liter	1. NABL Lab Tested VOC Level in Grams per Liter
Wood Adhesive	As specified in Tender documents	1. VOC (Volatile Organic Compound) Tested should be less than 100 Grams/ Liter	1. NABL Lab Tested VOC Level in Grams per Liter
Glass Sealant	As specified in Tender documents	1. VOC (Volatile Organic Compound) Tested should be less than 250 Grams/ Liter	1. NABL Lab Tested VOC Level in Grams per Liter
Anti Rust Coatings	As specified in Tender documents	1. VOC (Volatile Organic Compound) Tested should be less than 250 Grams/ Liter	1. NABL Lab Tested VOC Level in Grams per Liter
ELECTRICAL ITEMS			
Transformers	As specified in Tender documents	1. Losses Must be tested at 50% and 100% rated load and should be ECBC complaint	1. Manufacturer Signed declaration on properties with Third party test report
Automatic Power Factor Correction Device	As specified in Tender documents	1. Must be Installed	1. Manufacturer Signed declaration on properties
Lights (all must be LED)	As specified in Tender documents	1. Must have '.ies file' available for simulation. Must have a luminous Efficacy of more than 100 Lumens/Watt per Fixture	1. IES File for Specified Model from Manufacturer
Ceiling Fans	As specified in Tender documents	1. Must be BEE 5 Star Rated with BLDC Technology	1. Manufacturer Signed declaration on properties
Streetlights (LED)	As specified in Tender documents	1. Must have a luminous Efficacy of more than 75 Lumens/Watt per Fixture	1. Manufacturer Signed declaration on properties
Landscape Lights	As specified in Tender documents	1. Must have a luminous Efficacy of more than 75 Lumens/Watt per Fixture	1. Manufacturer Signed declaration on properties
Autotimer for Exterior Lights	As specified in Tender documents	1. Should be connected to ALL exterior lights	1. Manufacturer Signed declaration on properties
Energy Meters	As specified in Tender documents	Following Uses must be measured through Separate Meters 1. Each Dwelling unit	1. Manufacturer Signed declaration on properties

		2. Common Area Lighting 3. Exterior Lighting 4. Pumps & Motors 5. Elevators	
Pumps	As specified in Tender documents	1. BEE 5 Star Rated with Efficiency of 75% or more	1. Manufacturer Signed declaration on properties
DG SET	As specified in Tender documents	Aquastic enclosure should have been provided and has to confirm CPCB norms	1. Manufacturer Signed declaration on properties
Motors	As specified in Tender documents	1. BEE 5 Star Rated with Efficiency of 75% or more	1. Manufacturer Signed declaration on properties
Elevators	As specified in Tender documents	1. With Regenerative Motor 2. Braille Lettering 3. Audio Announcement Device	1. Manufacturer Signed declaration on properties
Exhaust Fans	As specified in Tender documents	1. Should have Rated CFM	1. Manufacturer Signed declaration on properties
Organic Waste Convertor	As specified in Tender documents	1. Should be capable of converting Kitchen and Garden Waste to Manure	1. Manufacturer Signed declaration on properties
PLUMBING FIXTURES			
WC	As specified in Tender documents	1. Dual Flush 3/6 Litre per Flush	1. NABL Lab tested Flow Rated measured at 15PSI, 30PSI and 45 PSI
Urinal	As specified in Tender documents	1. With 1 litre per Flush	1. NABL Lab tested Flow Rated measured at 15PSI, 30PSI and 45 PSI
Hand Wash Basin Faucet	As specified in Tender documents	1. Flow Rate 2.5 litres per Minute	1. NABL Lab tested Flow Rated measured at 15PSI, 30PSI and 45 PSI
Kitchen Sink Faucet/ Lavatory faucet/ Bath tap	As specified in Tender documents	1. Flow Rate 2.5 litres per Minute	1. NABL Lab tested Flow Rated measured at 15PSI, 30PSI and 45 PSI
Shower	As specified in Tender documents	1. Flow Rate 6 litres per Minute	1. NABL Lab tested Flow Rated measured at 15PSI, 30PSI and 45 PSI
Health Faucet/ IWC water closet	As specified in Tender documents	1. Flow Rate 4 litres per Minute	1. NABL Lab tested Flow Rated measured at 15PSI, 30PSI and 45 PSI
Physically Challenged Grab Bars	As specified in Tender documents	1. Only for the toilet reserved for Physically challenged.	1. Photographs
SOLAR SYSTEM			
Solar Hot Water	As specified in Tender documents	Compliant with IS 13129 (Part 1 & 2) and Insulation	1. IS Compliance Certificate

System		must be CFC free	
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33.2. Consider item of glazing with following specifications:

Light Factors			Energy Factors		
Transmission	Reflection		SF	SC	U-Value
	External	Internal			
%	%	%	%		W/m ² K
45	20	6	42	0.48	4.60

33.3. Limits for Low-VOC Content in Interior Paint:

Paint Applications	VOC Limits (Grams of VOC per Litre)	
Interior Coatings	Flat	<50
	Non-Flat	<150
Exterior Coatings	Flat	<200
	Non-Flat	<100
Anti Corrosive	Gloss/Semi-Gloss/Flat	<250

33.4. Limits for Low-VOC content in Adhesive In Interior Applications:

Architectural Adhesive Applications	VOC Content Limits (Grams of VOC per Litre)
Ceramic Tiles	65
Structural Glazing	100
Multi-purpose Construction	70
Sub-floor	50
Wall Boards/Panel	50
PVC Welding	285
Adhesive Primer for Plastic	250
Sub-specific Use Metal to Metal	30
Wood	30
Fibre Glass	80
Plastic Foams/Porous Materials (Except Wood)	50

33.5. Limits for Low-VOC content in Interior Sealants:

Sealant Applications	VOC Content Limits (Grams of VOC per Litre)
Architectural/Road Ways	250
Single Ply Roof Materials Installation/Repairs	450
Others	420
Sealant Primer Applications Architectural/Non-porous	250
Sealant Primer Applications Architectural/Porous	775
Other Sealant Primer Applications Architectural	750

33.6. LPM and LPF for flow fixtures for plumbing shall be considered with following flow rates and flush rates. The following figures shows 70% reduction over the Base Case. This is in order to earn 4 Credits:

Fixture Type	Maximum Flow Rate/Consumption
Water Closets (Full Flush)	2.7 LPF
Lavatory Faucets/Taps	3 LPM
Shower Head/Handheld Spray	3 LPM
Urinals	1.2 LPF
Kitchen Faucets	3 LPM

34. **MATERIALS AND TESTS:**

- 34.1. If facility for testing of building materials for any particular test is not available in the Site / Command Testing Lab, the same will be got tested in National Test House / SEMT Wing / Government Approved Laboratories / NABL Accredited Laboratories / Regional Research Laboratories / IIT / National Institute of Technology at the discretion of Garrison Engineer, All expenses for testing shall be borne by the contractor.
- 34.2. Manpower, material and infrastructure like electricity, water etc., required for conducting these tests shall be provided by the contractor. Tenderer is deemed to cater for above provisions in his quoted Lumpsum.
- 34.3. Remedial measures, if any, required to achieve/obtain desired results for each test shall be taken promptly by contractor. Lumpsum is deemed to include for this eventuality and nothing extra shall be payable to the contractor. No extension of time shall be admissible on this account.
- 34.4. Rate per test given is applicable for recovery in case of unavoidable circumstances where some tests as laid down could not be done and in the opinion of the GE nonperformance of tests does not affect quality control. However, in case, GE in his opinion considers that contractor is purposely not adhering to laid down frequencies of tests, he shall reserve the right to get it tested in Command Testing Lab or any other lab as deemed fit and make penal recovery from RAR which shall be double the rate of testing charges indicated or testing charges actually paid to lab whichever is higher. GE's decision, in this regard, shall be final and binding.
- 34.5. The contractor is to provide the following tentative list of equipment at site lab with all the equipment, as per relevant IS all as mentioned in the list of material and their tests as per PS. However, the list of equipment is not exhaustive. The actual equipment to be provided shall be all as approved by GE.

34.6. **LIST OF SUGGESTED ESSENTIAL EQUIPMENT FOR SITE LAB:**

Ser No	Name of Equipment
1	Cube Mould (150 +/- 0.2mm)-12 Nos
2	Tamping Bar (16mm dia, 600 mm long)
3	Balance 12 Kg (LC 1 gm)
4	Balance 220 gm (LC 0.001 gm) digital
5	Weights
6	Compression Testing machines with three gauge (capacity 2000KN)

7	Slump Test Apparatus
8	Standard Test Sieve (80 to 4.75mm) Square hole, perforated plate
9	Standard Test Sieve (3.35mm to 75 micron) fine mesh, wire cloth.
10	Soft brush & Camel hair brush
11	Lid & Pan
12	Hot air oven (Thermostatically controlled)
13	Thickness Gauge
14	Measuring Cylinders (graduated)
15	Steel Tape (LC 1 mm), Steel scale (Lc.5 mm)
16	Plywood sheet (2 No.) 3mm thick
17	Dish (180mm, 180mm, 40mm) of glass or porcelain of glazed stoneware
18	Distilled water
19	Moulds for casting concrete beams for testing flexural strength.
20	Relevant IS Codes
21	Concrete Hammer
22	Hand Penetro Meter
23	Vicat Apparatus
24	Vernier Caliper
25	Micrometer
26	Indian Standard Sand
27	Cube Moulds For Cement Testing
28	Stop Watch
29	Cement Cube Vibrator
30	Thermometer up to 300°C
31	Sieve Shaker for Coarse Aggregate Test Sieve
32	Sieve Shaker for Fine Aggregate Test Sieve
33	Thermometer for Hot Bitumen
34	Thermometer for Recording Day Temp
35	Humidity Recorder Meter
36	Timber Moisture Content Meter.
37	Field Procter Density Test Equipment
38	Cement Testing Machine for Initial / Final Setting / Consistency.

39	Working Platform.
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Signature of Contractor
Date:

AA Dir (Contracts)
For Accepting Officer

APPENDIX 'A'**FORMAT FOR QUALITY CONTROL PLAN**(To be submitted by Contractor with 30 days of commencement of contract)

1.	Contract Agreement Reference No	:	
2.	CPM network prepared and approved by GE	:	
3.	Resource scheduling done based on CPM	:	
4.	Site Laboratory (with equipments) set up as per Contract Agreement (CA)	:	
5.	Concrete mix design submitted and approved	:	
6.	Preliminary works completed to standard engineering practice	:	
7.	Arrangements for water made (including testing of water)	:	
8.	Arrangement for electric supply made	:	
9.	Materials	:	

PART-I

Sl No	Item	Source as per CA	Contractor's plan of sourcing	Refer to testing clause	agency for testing	Responsibility

10.	List of all T&P, make and numbers that the contractor would deploy at site of work	:	
11.	Name of person nominated by contractor for exercising quality control	:	
12.	Qualifications/Experience of person at Serial No 11 above.	:	
13.	Names of supervisors with their qualifications/ experience employed by contractor	:	
14.	Confirmation that contract requirement relating to quality of all materials and quality standards of workmanship and finishes and acceptance criteria are explained and understood by all	:	
15.	Confirmation that requirement of tests to be conducted on materials before approval of sample and during execution, test on workmanship, tests before acceptance including the testing procedure, sampling techniques, frequency and agencies responsible for testing are understood and shall be complied with.	:	
16.	Method to be adopted for maintaining records of test result	:	
17.	Certificate that contractor shall maintain a log of all materials received at site as per the following format :-	:	

SI No	Date	Material	Quantity received	Source	Whether as per approved sample or not	Tests carried out by supplier	Tests to be carried out before incorporation	

18.	General Remarks by contractor of his plan of actions to ensure that quality standards	:	
-----	---	---	--

Date :

(Signature of Contractor)

PART-II

(To be completed by GE before forwarding for approval by CWE)

1. Verification of Serial No 2 to 8 of Part-I :
2. Verification of Serial No 9 to 18 of Part-I :
3. Confirmation that Stages Passing Register: laying down the stages and authority responsible for approving the same has been prepared, shown to contractor and kept at site
4. Confirmation that all sites as require by :
contract had been handed over to contractor on the date fixed in Work Order No 1
5. Confirmation that arrangements for Govt :
liability in supply of water and electricity have been made and no hold up on this account is expected.

Dated:

(Signature of GE)

Approved by CWE

APPENDIX 'B'**IN/OUT CEMENT REGISTER**

Ser No	Date	CEMENT In		CEMENT OUT			Quantity Balance (in bags)	SIGNATURE		Remarks
		Quantity (in bags)	Control No	Quantity (in bags)	Reasons*	Age of Cement		Contractor	AGE / GE	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(k)	(l)

* **Note:** The following reasons may be mentioned for taking out cement from store:

For testing purpose :

For use in work :

Rejected cement taken out of site :

IN/OUT STEEL REGISTER

Ser. No.	Date	Steel IN			Steel OUT			Quantity Balance
		Quantity (Tons)	Section	Control No.	Quantity (Tons)	Section	Reasons *	

***Note:** The following reasons may be mentioned for taking out Steel from storage:

(a) For testing purpose

(b) For use in work

(c) Rejected Steel taken out of site

APPENDIX 'F'**LIST OF MATERIALS HAVING ISI/BIS CERTIFICATE MARKING**

Srl No	Name of Materials	Relevant IS
1	CONCRETE	
	(a) Integral cement water proofing compound	2645
	(b) Plywood for concrete shuttering work	4990
2	JOINERY	
	(a) Wooden flush door shutters, solid core type	2202 (Part-1)
	(b) Particle board and hard board face panel	2202 (Part-II)
3	BUILDERS HARD WARE	
	(a) Steel Butt hinges	1341
	(b) Non-Ferrous metal butt hinges	205
	(c) Ferrous tower bolts	204 (Part-I)
	(d) Non-Ferrous tower bolts	208
	(f) Parliament hinges	362
	(g) Hydraulically operated door closers	3564
	(h) Continuous piano hinges	3818
	(j) Non-Ferrous metal sliding door bolts	2681
	(k) Tee and strap hinges	206
	(l) Mild steel sliding door bolts	281
4	STEEL & IRON WORK	
	Steel doors, windows, and ventilators	1038
5	ROOF COVERING	
	Bitumen felts for water proofing and dampproofing	1322
6	CEILING AND LINING	
	(a) Plywood for general purpose	303
	(b) Blockboards	1659
	(c) Veneered particle board	3097
	(d) Marine plywood	710
	(e) Fiber hard board	1658
	(f) Wood particle board	3087
7	FLOORING	
	(a) White Portland cement	8042
	(b) Cement concrete flooring tiles.	1257
8	WATER SUPPLY, PLUMBING DRAINS AND SANITARY APPLIANCES	
	(a) Concrete pipes with or with out reinforcement	458
	(b) Salt glazed stone ware pipes and fittings	651
	(c) Flushing cisterns for water closets and urinals valve less syphonic type	774
	(d) Cast copper alloy screw down bib tap and stop valves	781
	(e) Galvanised mild steel tubes	1239 (Part-I)
	(f) Galvanised mild steel tube fittings	1239 (Part-II)
	(g) Sand cast iron, spigot and socket soil, waste and ventilating pipes & fittings	3989
	(h) Ball valves (horizontal plunger type) including floats for water supply purposes	1703
	(i) Cast iron manhole cover sand frames	1726 (Part I to VII)
	(j) AC pressure pipes	1592

	(k) Automatic flushing cisterns for urinals	2336
	(l) Vitreous china ware appliances	
	(i) Wash down water closet	2556 (Part-II)
	(ii) Squatting pans	2556 (Part III)
	(iii) Wash Basin	2556 (Part IV)
	(iv) Laboratory sinks	2556 (Part V)
	(v) Urinals bowl type	2556 (Part VI)
	(vi) Half round channels	2556 (Part VII)
	(vii) Syphonic wash down water closets	2556 (Part VIII)
	(viii) Foot rests	2556 (Part X)
	(m) Plastic WC seat covers	2546
	(n) Vertically cast iron pressure pipes for water gas and sewage	1537
	(o) Pillar taps for water supply purposes	1795
	(p) Centrifugally cast pipes for water, gas and sewage	1536
	(q) Centrifugally cast (spun) iron spigot & socket soil, waste and ventilating pipes, fittings and accessories.	3989
	(r) Rubber sealing rings for gas mains, water mains and sewers	5382
	(s) Cast iron fittings for pressure pipe for water, gas and sewage	1538 (Part I to XXIII)
9	ELECTRICALWORKS	
	(a) Ceiling roses	371
	(b) Tumbler switches	3854
	(c) Socket outlet 3-pin plug & socket	1293
	(d) Switch, fuses (Main & Switch)	4064 (Part I&II)
	(e) Rigid non-metallic conduit	9537 (Part III)
	(f) Single core cable polythene insulated and PVC sheathed cable.	1596
	(g) Rigid steel conduits	9537 (Part-II)
	(h) Starter for tube light	2215
	(i) Fluorescent lamps	2418 (Part-I)
	(j) Aluminium Conductor for overhead	398 (Part I& II)
	(k) Switch gears	2208
	(l) HRC fuse links upto 650 volts	9224 (Part-I)
	(m) Porcelain insulators for over head power lines	731
	(n) MCB	8828

Note: All fittings & fixtures for buildings including hardware and all other items enumerated in this Appendix sanitary fittings & electrical fittings etc shall be ISI marked. In case any fittings/fixtures of ISI marked is not manufactured then the fittings & fixtures conforming to relevant IS may be incorporated as approved by the GE. The contract provision shall be deemed to be amended accordingly & the lumpsum amount quoted shall be deemed to be inclusive for the same & no extra payment on this account shall be admissible.

APPENDIX 'C'**MATERIAL TESTS AND THEIR RECOVERY RATES OF TESTING CHARGES**

Note: List of tests given hereunder is not final. Other tests required as per MES Schedule / BIS to satisfy the quality requirement will also be got done by the GE and necessary expenditure for the same shall be borne by the contractor.

S.No	Materials	Test	Method of Testing	Frequency of Tests	Level of Test	Rate Per test Rs. Ps.	Remarks															
1	2	3	4	5	6	7	8															
1.	Bricks	i. Compressive strength	IS-3495 (Part-II)	As Per IS-5454 as given under: <table><tr><td>Lot Size</td><td>Sample Size</td><td>Permissible No. of defective bricks</td></tr><tr><td>1001 to 10000</td><td>5</td><td>0</td></tr><tr><td>10000 to 35000</td><td>10</td><td>0</td></tr><tr><td>35001 to 50000</td><td>15</td><td>1</td></tr><tr><td colspan="3"></td></tr></table>	Lot Size	Sample Size	Permissible No. of defective bricks	1001 to 10000	5	0	10000 to 35000	10	0	35001 to 50000	15	1				A	330/-	Checks for visual and dimensional characteristics shall also be carried out as per IS 5454
		Lot Size	Sample Size		Permissible No. of defective bricks																	
		1001 to 10000	5		0																	
		10000 to 35000	10		0																	
		35001 to 50000	15		1																	
		ii. Water absorption	IS-3495 (Part-II)		A	330/-																
		iii. Efflorescence	IS-3495 (Part-I)		A	330/-																
2.	Coarse Aggregate	i. Sieve Analysis	IS-2386 (Part-I)	One Test for every 15 Cum of aggregate or part thereof brought to site.	A	660/-	Legend: A. Site Lab B. Command Testing Lab C. National Test House/SEMT wing/ Government Approved Laboratories / NABL Accredited Laboratories / regional research Laboratories / IIT/															
		ii. Flakiness Index	IS-2386 (Part-I)	One Test for every 15 Cum of aggregate or part thereof brought to site.	A	250/-																
		iii. Estimation of deleterious material	IS-2386 (Part-I)	One Test for every 100 Cum of aggregate or part thereof brought to site.	A	600/-																
		iv. Organic impurities	IS-2386 (Part-I)	One Test for source of supply	B	275/-																
		v. Moisture Content	IS-2386 (Part-II)	Regularly as required	A	330/-																

		vi. Specific Gravity	IS-2386 (Part-II)	One Test for each source of supply	B	330/-	National Institute of Technology
3.	Fine Aggregate	i. Sieve Analysis	IS-2386 (Part-I)	One Test for every 15 Cum of aggregate or part thereof brought to site.	A	660/-	
		ii. Test for clay, silt and impurities	IS-2386 (Part-I)	One Test for every 15 Cum of aggregate or part thereof brought to site.	A	500/-	
		iii. Specific gravity	IS-2386 (Part-II)	One for each source of supply	B	330	
		iv. Moisture Content	IS-2386 (Part-II)	Regularly as required subject to 2 tests per day when being used	A	330/-	
		v. Test for organic impurities	IS-2386 (Part-II)	One test for each source of supply	B	275/-	
4.	Structural Concrete (M-25 Grade and above)	i. Slump test or compacting factor test or Vee-bee time	IS-119	The Minimum frequency of sampling of concrete each of grade shall be as under:-	A	300/-	Random sampling shall be carried to cover all mix units.
				Qty of concrete in the work in Cum			
		ii. Compressive Strength	IS-516	No. of samples	A	900/-	As per IS-456 clause 15.2.2 for frequency of sampling
				1-5			
				6-15			
				16-30			
				31-50			
				51 and above			
				4+1 for each additional 50 Cum or part thereof			
S.No	Materials	Test	Method of Testing	Frequency of Tests	Level of Test	Rate Per test Rs. Ps.	Remarks
1	2	3	4	5	6	7	8
5.	(a) PCC for Block walling (Hollow Block)	i. Compressive Strength	IS 2156-1984 (Appx B)	08 blocks out of 14	A	900/-	Sample : 14 blocks form consignment of every 5000 blocks or part thereof
		ii. Water Absorption	IS 2156-1984 (Appx B)	03 blocks out of 14	B	330/-	

			B)				
		iii. Density	IS 2156-1984 (Appx C)	03 blocks out of 14	B	330/-	
	(b) PCC Solid block for walling	i. Compressive strength	IS-2185	12 blocks out of 18	A	900/-	Sample: 20 blocks from consignment of every 5000 blocks or part thereof as per IS
		ii. Water absorption	IS 2185	03 blocks out of 18	B	330/-	
		iii. Density	IS 2156-1984 (Appx C)	03 blocks out of 18	B	330/-	These blocks to be checked for dimension and weight

S.No	Materials	Test	Method of Testing	Frequency of Tests	Level of Test	Rate Per test Rs. Ps.	Remarks
1	2	3	4	5	6	7	8
6.	Cement flooring tiles / terrazzo tiles	i. Water absorption	IS-1237 (Appx D)	06 tiles out of 18	B	330/-	Sample of 18 tiles from each source of supply selected at random.
		ii. Wet transverse strength	Is-1237 (Appx E)	06 tiles out of 18	B	660/-	
		iii. Resistance to wear	IS-1237 (Appx F)	06 tiles out of 18	C	1000/-	
7.	Water construction for purposes	i. Test for acidity	IS-456 & 3015	One at the stage of approval of source of water.	B	500/-	Also refer clause 5.4 of IS-456 and its subsequent sub-clauses regarding suitability of water.
		ii. Test for alkalinity	-do-		B	500/-	
		iii. Test for total dissolved solids (TDS) content	-do-		B	500/-	
8	Reinforcement Steel	i. Physical tests upto 16mm dia (Normal mass, tensile elongation, bend and rebend)	-	-	B	2500/-	i. 1 Sample [3 Specimen] for 25 every 25 tonne for less than 10mm dia.
		ii. -do- more than 16mm dia	-	-	B	2750/-	ii. 1 sample [3 specimen] for 25 every 35 tonne for 12 & 16 mm dia. iii. 1 sample [3 specimen] for 45 every 45 tonne for more than 16mm dia.

APPENDIX 'D'**CEMENT SUPPLY & ACCEPTANCE REGISTER**

1. CA No & Name of Work :
2. Control No* :
3. Name of Manufacturer/Brand Name/Gde of Cement (A) Manufacture ____ (b) Brand __ (c) Grade
4. Qty of cement & Lot No/Week No (in Bags) : (Qty ____ (b) Lot No/Week No ____
5. Manufacturers's test certificates No _____
6. Random Test Details (a) Physical test report from ____ vide their letter No _____ (Name of NABL approved Lab/Engg College)
(b) Chemical test report from ____ vide their letter No _____ (Name of NABL approved Lab/Engg College)
7. Details of Physical & Chemical properties:

	Physical Requirements (As per IS 4031)									Chemical Requirements (As per IS 4032)								
	Specific Surfaces Area (Sqm/Kg)	Soundness by Le Chatelier	Soundness by Auto Clave	Initial Setting Time (Minute)	Final setting time (Minute)	Compressive Strengths (Mpa)			Temp during testomg °C	Standard consistency (%)	Lime saturation factor (Ratio)	Alumina Iron Ratio (Ratio)	Insoluble Residue (%)	Magnesium (%)	Sulphuric Anhydride (%)	Loss on ignition (%)	Alkalies (%)	Chlorides (%)
1						03 Days	07 days	28 Days										
As per relevant IS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
As per manufacture's test certificate																		
As per random test																		

Remarks with Signature

Accepted/Rejected

Contractor

Junior Engineer

Engineer-in-Charge

GE(I) / GE / AGE(I)

Remarks of BOO/Inspecting Officer/CWE

APPENDIX 'E'**STEEL SUPPLY & ACCEPTANCE REGISTER**

1. CA No & Name of Work :
2. Contract No :
3. Name of Manufacturer's TC No :
4. Manufacturer :
5. Random Test Details
 - (a) Physical test report from _____ (Name of NABL approval lab/Engg College) vide their letter No _____
 - (b) Chemical test report from _____ (Name of NABL approval lab/Engg College) vide their letter No _____
6. Type of Steel, Dia & Qty(a)type : TMT/CRS (b) Dia____ mm (c) Actual Wt ____ MT (d) Conversion Wt ____ MT

	Chemical Test							Mechanical Test						
	Carbon %	Sulphur %	Phosphorous %	Sulphur + phosphorus %	Manganese %	Silicon %	Corrosion Resistant element	Wt per meter	Yield Stress (N/mm ²) 0.2% proof	Tensile Strength (N/mm ²)	Elongation % (As Per IS)	Bend test	Rebend test	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
As per IS 1786-2008														
As per manufacturer's test certificate														
As per independent test														

Remarks with Signature

Accepted/Rejected

Contractor Junior Engineer
Remarks of BOO/ Inspecting Officer/ CWE

Engineer-in-Charge

GE(I)/GE/ AGE(I)

APPENDIX 'G'

PAINTING PROGRESS REPORT**(A) SITE DETAILS AND OTHER INFORMATION:**

Name _____ of _____ the _____ site:

Name _____ of _____ the _____
Applicator: _____

Name of Person visiting From manufacturer: _____

Date _____ of _____
Visit: _____

Observation taken for (Panel/Area/Side) for building (A/B/C) _____

Finalised _____ products/
Shade: _____**(A) PAINTING STAGE:**

Sr.No	Parameter	Observation Remark
1.	Coverage_____Sq.Ft (as communicated by applicator) covered using _____ ltrs of _____ Coverage obtained _____Sq.Ft/ Ltr/_____ coat	Satisfactory / Dissatisfactory coverage obtained
2.	Dilution _____% with water for _____ coat _____% with water for _____ coat	Satisfactory /Dissatisfactory
3.	No. of coats applied One/ Two/ Three	Satisfactory /Dissatisfactory
4.	Adhesion Passes/ Fails	Satisfactory /Dissatisfactory
5.	Hiding Adequate/ Poor	Satisfactory /Dissatisfactory
6.	Sheen Adequate/ Poor	Satisfactory /Dissatisfactory
7.	Other observations if any	
8.	Final Remarks Above observations are for Panel Nos _____	

SURFACE PREPARATION REPORT

Name _____ of _____ the _____ site
:

Report Submitted by : _____

Panel _____ Observed
:

Date _____ of _____ Visit
:

Name _____ of _____ Applicator
:

Sr No	PARAMETER		OBSERVATIONS	TREATMENT IF REQUIRED
1	Condition of Plaster	<input type="checkbox"/>	Re- Plastering done	Completed on panel Nos _____ No treatment required/ Yet to be started
		<input type="checkbox"/>	Patch work plaster done	
		<input type="checkbox"/>	No plastering	
2	Plaster curing	<input type="checkbox"/>	Re- Plastering done	Cured for _____ days / Not Applicable
		<input type="checkbox"/>	Patch work plaster done	
3	Filling of cracks		Completed on panel Nos _____ with _____	No further treatment required/ Yet to be started
4	Water Proofing		Yet to be started/ Not applicable	Apply Ultima Protek System /Not applicable
5	Dampness		Observed on panel Nos _____	Not observed/ It is recommended that suitable waterproofing of these areas is done before commencement of painting
6	Old loose paint removal	<input type="checkbox"/>	Jet wash/ Pressure wash	Completed on panel Nos _____ No further treatment required/ Yet to be required
		<input type="checkbox"/>	Wire brushing	
7	Dust removal and cleaning surface		Completed on panel Nos _____	No further treatment required/ Yet to be required
8	Fungal / Algal Growth		Completed on panel Nos _____ with _____	No further treatment required/ Yet to be required
9	Efflorescence / Lime Blooming		Removed/ Not observed any	No further treatment required
10	Vegetation growth		Removed/ Not observed any	No further treatment required

NAME OF WORK: PROVISION OF HANGER AND ANNEXE BUILDING AT VISAKHAPATNAM**SCHEDULE 'A' PART-I (BUILDINGS & STRUCTURES)**

Sl. No.	Description of Item	3 Ref. to Drg. No.	No. of Units Required	UNIT	RATE	Amount	Period of completion for individual item from date of handing over of site	Remarks
1	2	3	4	5	6	7	8	9
1	Construction of HANGER BUILDING with permanent specification in RCC framed structure with Partly PEB complete all as specified and as directed		1	Each Block	17,18,13,000.00	17,18,13,000.00		
2	Construction of AC PLANT ROOM with permanent specification in RCC framed structure in RCC M-30 grade concrete complete all as Shown on drawings, as specified and as directed		1	Each Block	42,71,000.00	42,71,000.00		
3	Construction of PARKING SHED FOR 12 CARS with permanent specification in RCC framed structure in RCC M-30 grade concrete complete all as shown on drawings, as specified and as directed.		1	Each Block	82,72,000.00	82,72,000.00		
4	Construction of PARKING SHED FOR 50 SCOOTERS with permanent specification in RCC framed structure in RCC M-30 grade concrete complete all as shown on drawings, as specified and as directed.		1	Each Block	22,00,000.00	22,00,000.00		
5	RCC 50 users septic tank, designed to carry sewage and sullage water, RCC walls, Base slab, Baffle walls and Roof slab including beams etc with vent shaft, manhole openings with cover connection excavation and earth work etc., complete with effective depth of 1.5m and overall depth of 3m for 300 users complete all as specified and as shown on TD-389(S) sheet No. 1/3 to 3/3 and as directed.		1	Each Block	6,05,820.00	6,05,820.00		

SCHEDULE 'A' PART-I (BUILDINGS & STRUCTURES) (Contd...)

1	2	3	4	5	6	7	8	9
6	Soakage wells with size of 3.0m x 6.0m effective depth for 50 users excavation, in any type of soil, walls of honey combed masonry with top ring of M-25 concrete including intercepting chamber and screen chamber made of Brick masonry in CM 1:4, RCC cover slab in M-25/SFRC cover, interconnecting pipes of RCC/DWC complete filled with brick bats complete all as specified and as directed.		1	Each Block	20,599.00		20,599.00	

Total amount of Schedule 'A' Part-I Carried over to BOQ**18,71,82,419.00**

(i) Earth work, excavation including surface excavation, surface dressing, returning filling in, filling under floors as shown in drawings for buildings/structures covered under this schedule is deemed to be included in the lumpsum.

(ii) GL shown in the drawing is the existing ground Level.

(iii) All earth fillings i.e upto GL and from GL to FFL shall be included in the scope of

(iv) The scope of pile foundation is not included in the lump sum. The same shall be measured and paid separately under relevant items of Sch 'A' Part-III (Pile Foundation). However, the foundation up to and including pile caps is included in the scope of lump

(v) The dowel bars of pile reinforcement projected in to pile caps (LD i.e. development length) shall be measured and paid in pile foundation schedule.

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-II (SITE CLEARANCE/AREA DEVELOPMENT/EARTH WORK/EXCAVATION)

Note: All earthwork excavation required for the works under other schedules shall also be measured and paid under this part unless specified/mentioned otherwise in the description of items.

Sl. No.	Description of Item	Ref. to Drg. No.	No. of Units Required	UNIT	RATE	Amount	Remarks
1	2	3	4	5	6	7	8
1	Rough excavation not exceeding 1.5 m deep and getting out soft/loose soil complete all as specified		9,975.00	Cubic Metre	179.10	17,86,522.50	
2	Excavating over areas, not exceeding 1.5 m deep and getting out soft/loose soil complete all as specified		1,415.17	Cubic Metre	258.50	3,65,821.45	
3	Excavating over areas, exc 1.5m deep n exc 3.0 m deep and getting out soft/loose soil complete all as specified		9,975.00	Cubic Metre	417.20	41,61,570.00	
4	Excavating over areas, exc 3.0 m deep n exc 4.5 m deep and getting out soft/loose soil complete all as specified		9,975.00	Cubic Metre	575.90	57,44,602.50	
5	Excavating over areas, exc 4.5 m deep n exc 6.0 m deep and getting out soft/loose soil complete all as specified		4,987.50	Cubic Metre	734.60	36,63,817.50	
6	Material and Labour for Moorum/ red bajri filling in floors or pavings, laid in layers not exceeding 15cm thick (Moorum/ red bajri shall be obtained from outside MD land), spreading, levelling and rammed including watering complete all as specified and as directed.		4,401.60	Cubic Metre	1240.10	54,58,424.16	
7	Removing excavated material exc. 250 m but not exc. 500 m and depositing where directed complete all as specified.		35,907.90	Cubic Metre	582.60	2,09,19,942.54	
8	Earth work in all kind of soil excavation by mechanical means (Hydraulic excavator) means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5m, complete all as specified and as directed		1,329.46	Cubic Metre	166.62	2,21,514.63	

SCHEDULE 'A' PART-II (SITE CLEARANCE/AREA DEVELOPMENT/EARTH WORK/EXCAVATION)

1	2	3	4	5	6	7	8	9
9	Removing excavated material exc. 50 m but n.exc 250 m and depositing where directed		9.61	Cubic metre	495.20		4,758.87	
10	Removing excavated material exc. 250 m but n exc. 500 m and depositing where directed		995.40	Cubic metre	582.60		5,79,920.04	
11	Returning, filling in, including spreading, levelling, watering and well ramming in layers n. exc. 25 cm complete all as specified and as directed.		276.15	Cubic metre	139.10		38,412.47	
Total amount of Schedule 'A' Part-II Carried over to BOQ							4,29,45,306.65	

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-III (PILE FOUNDATION)

Sl. No.	Description of Item	Ref. to Drg. No.	No. of Units Required	UNIT	RATE	Amount	Period of completion for individual item from date of handing over of work	Remarks
1	2	3	4	5	6	7	8	9
1	Controlled concrete, M30 grade design mix as in piles etc., complete all as specified and as directed. Note: Pile shall be casted as mentioned in drawings. However, for payment purpose the length of pile shall be measured up to cut off level only. The unit rate quoted shall be deemed to included this aspect.		3,471.49	Cubic Metre	7,977.02	2,76,92,145.16		
2	M&L Corrosion resistant TMT bars 10mm dia and over cut to length bent to shape required including cranking, bending spirally for hooping for piles, hooking ends and binding with and including mild steel wire (annealed) not less than 0.9 mm dia all as specified and directed.		4,72,826.00	Kilogram	82.60	3,90,55,427.60		
3	M&L Corrosion resistant TMT bars 5 to 10mm dia and over cut to length bent to shape required including cranking, bending spirally for stirrups, spacers and binders for pile, hooking ends and binding with and including mild steel wire (annealed) not less than 0.9 mm dia all as specified and directed.		83,336.00	Kilogram	85.18	70,98,560.48		
Total amount of Schedule 'A' Part-III Carried over to BOQ						7,38,46,133.24		

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-IV (INTERNAL WATER SUPPLY)

Note: Water supply pipe line inside the building shall be concealed. The cost of cutting chases & making good wherever required shall be deemed to be included under respective item of Schedule 'A' Part-I.

Sl. No.	Description of Item	Ref. to Dig. No.	No. of Units Required	UNIT	RATE	Amount	Period of completion for individual item from date of handing over of	Remarks
1	2	3	4	5	6	7	8	9
1	S & F CPVC (chlorinated poly vinyl chloride) 50 mm outer dia of pipe, SDR 11 including plain CPVC SDR 11 fittings fixed to walls, ceilings or in floors etc. complete all as specified and directed.		14	Running Metre	1,049.70	14,695.80		
2	S & F CPVC (chlorinated poly vinyl chloride) 40 mm outer dia of pipe, SDR 11 including plain CPVC SDR 11 fittings fixed to walls, ceilings or in floors etc. complete all as specified and directed.		28	Running Metre	619.70	17,351.60		
3	S & F CPVC (chlorinated poly vinyl chloride) 32 mm outer dia of pipe, SDR 11 including plain CPVC SDR 11 fittings fixed to walls, ceilings or in floors etc. complete all as specified and directed.		27	Running Metre	496.80	13,413.60		
4	S & F CPVC (chlorinated poly vinyl chloride) 25 mm outer dia of pipe, SDR 11 including plain CPVC SDR 11 fittings fixed to walls, ceilings or in floors etc. complete all as specified and directed.		28	Running Metre	353.40	9,895.20		
5	S & F CPVC (chlorinated poly vinyl chloride) 20 mm outer dia of pipe, SDR 11 including plain CPVC SDR 11 fittings fixed to walls, ceilings or in floors etc. complete all as specified and directed.		15	Running Metre	244.60	3,669.00		
6	S & F CPVC (chlorinated poly vinyl chloride) 16 mm outer dia of pipe, SDR 11 including plain CPVC SDR 11 fittings fixed to walls, ceilings or in floors etc. complete all as specified and directed.		10	Running Metre	175.90	1,759.00		
7	S & F PVC connections 15mm size with PTMT nuts of length 375mm complete all as specified and directed.		20	Each	125.00	2,500.00		
8	S&F gun metal globe or gate valve 50mm dia., with iron wheel head, screwed both ends for iron pipe and fixed complete all as specified and as directed.		2	Each	979.08	1,958.16		

SCHEDULE 'A' PART-IV (INTERNAL WATER SUPPLY) (Contd)

1	2	3	4	5	6	7	8	9
9	S&F gun metal globe or gate valve 40mm dia., with iron wheel head, screwed both ends for iron pipe and fixed complete all as specified and as directed.	3	Each	784.97		2,354.91		
10	S&F gun metal globe or gate valve 25mm dia., with iron wheel head, screwed both ends for iron pipe and fixed complete all as specified and as directed.	1	Each	587.24		587.24		
Total amount of Schedule 'A' Part-IV Carried over to BOQ						68,184.51		

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-V (INTERNAL ELECTRIFICATION)

Sl. No.	Description of Item	Ret. to Dig. No.	No. of Units Required	UNIT	RATE	Amount	Period of completion for individual item from date of handing over of work	Remarks
1	2	3	4	5	6	7	8	9
1	S&F modular switch single pole, 1 way 6 Amps, 1 module complete all as specified and as directed.		282	Each	260.50	73,461.00		
2	S&F modular switch 1 way 16 Amps, 1 module complete all as specified and as directed.		71	Each	343.70	24,402.70		
3	S&F modular two way switch 6 Amp 1 module complete all as specified and as directed.		14	Each	307.30	4,302.20		
4	S&F modular socket, 6 Amps, 2/3 pin combined 2 module complete all as specified and as directed.		68	Each	340.54	23,156.72		
5	S&F modular socket, 6/16 Amps, 2/3 pin combined 2 module complete all as specified and as directed.		65	Each	528.40	34,346.00		
6	Supply and fixing modular white cover plate with frame for one module complete all as specified and as directed.		6	Each	197.20	1,183.20		
7	Supply and fixing modular white cover plate with frame for two module complete all as specified and as directed.		3	Each	195.80	587.40		
8	Supply and fixing modular metal flush box for one/two module, factory manufactured white cover plate with frame for two module complete all as specified and as directed.		9	Each	179.10	1,611.90		
9	S&F ceiling rose 3 terminals polycarbonate isolated body complete all as specified and as directed.		197	Each	65.70	12,942.90		
10	Supply and fixing concealed in wall MCB DB. double door type, triple pole and neutral pole 04 way sheet steel phosphetised powder painted with 200 amps rated bus bar 415 Volts neutral link, IP : 43 protection, complete all as specified and directed.		12	Each	2,642.70	31,712.40		
11	Supply and fixing concealed in wall MCB DB. double door type, Single pole and neutral 08 way sheet steel phosphetised powder painted with 200 amps rated bus bar 240 Volts neutral link, IP : 43 protection, complete all as specified and directed.		4	Each	1,912.70	7,650.80		

SCHEDULE 'A' PART-V (INTERNAL ELECTRIFICATION) (Contd)

1	2	3	4	5	6	7	8	9
12	Supply and fixing concealed in wall MCB DB. double door type, Single pole and neutral 4 way sheet steel phospetised powder painted with 200 amps rated bus bar 240 Volts neutral link, IP : 43 protection, complete all as specified and directed.	1	Each	1,544.40	1,544.40			
13	Supply and fixing concealed in wall MCB DB. double door type, Single pole and neutral 2 way, 240 Volt sheet steel phospetised powder painted with , IP : 43 protection, complete all as specified and directed.	4	Each	544.10	2,176.40			
14	S&F MCB TPN 415V, 50Hz, 16KA of capacity 63 Amp."C" curve complete all as specified and as directed.	1	Each	1,300.00	1,300.00			
15	S&F MCB TPN 415V, 50Hz, 16KA of capacity 32 Amp."C" curve complete all as specified	11	Each	1,200.00	13,200.00			
16	S&F MCB SPN, 6 to 32 Amps 240 Volts , 10KA, C curve complete all as specified	13	Each	431.52	5,609.76			
17	S&F MCB SP, 6 to 32 Amps 240 Volts , 10KA, C curve complete all as specified and as directed.	162	Each	380.14	61,582.68			
18	Supply and fixing GI Earth continuity strip of size 25mm x 4mm as earthing lead drawn through GI pipe with and including GI light grade pipe 32mm, fixed to wall or fixed to floor complete all as specified and as directed.	20	Each	510.10	10,202.00			
19	Supply and fixing GI Earth continuity conductor of size 4mm dia as earthing lead drawn through GI protection pipe with and including GI pipe light grade 15 mm, fixed to wall or floors or any other indicated situation(For Sub MCB DB)	30	Each	180.70	5,421.00			
20	Supply and fixing Sheet metal enclosures with socket plug top and MCB of single pole and neutral enclosure with a two pin and earth plug and socket complete with one single pole MCB of 20 Amps 240 volts complete all as specified and as directed.	4	Each	1,817.80	7,271.20			
Total amount of Schedule 'A' Part-V Carried over to BOQ						3,23,664.66		

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-VI (EXTERNAL WATER SUPPLY)

Sl. No.	Description of Item	Ret. to Dig. No.	No. of Units Required	UNIT	RATE	Amount	Period of completion for individual item from date of handing over of work	Remarks
1	2	3	4	5	6	7	8	9
1	Supply and laying 80mm dia GI tubing medium grade including fittings such as bend, elbow, tees short pieces, connectors, backnuts, diminishing pieces, caps, plugs and unions etc., in trenches complete all as specified and as directed.		290	RM	760.50	2,20,545.00		
2	Supply and laying 50mm dia GI tubing medium grade including fittings such as bend, elbow, tees short pieces, connectors, backnuts, diminishing pieces, caps, plugs and unions etc., in trenches complete all as specified and as directed.		55	RM	421.20	23,166.00		
3	Supply and laying 20mm dia GI tubing medium grade including fittings such as bend, elbow, tees short pieces, connectors, backnuts, diminishing pieces, caps, plugs and unions etc., in trenches complete all as specified and as directed.		20	RM	158.60	3,172.00		
4	Supply and fix Valves, Sluice, flanged of class 1.6 PN supplied and installed complete, size 80 mm (4")dia. all as specified and directed.		2	EACH	9,500.00	19,000.00		
5	Supply and fix Gun-metal, gate valves, with iron wheel head, screwed both ends for iron pipe and fixed for 50 mm dia all as specified and directed.		2.00	EACH	979.08	1,958.16		
6	Supply and fix Gun-metal, gate valves, with iron wheel head, screwed both ends for iron pipe and fixed for 20 mm dia all as specified and directed.		4.00	EACH	540.11	2,160.44		
7	supply and fix Rotational moulded polyethylene 1000 ltrs capacity water storage tank (cylindrical vertical with closed top) hoisted and fixed in position all as specified.		1.00	EACH	8,196.46	8,196.46		
Total amount of Schedule 'A' Part-VI Carried over to BOQ						2,78,198.06		

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-VII (EXTERNAL ELECTRIFICATION)

Sl. No.	Description of Item	Ref. to Drg. No.	No. of Units Required	UNIT	RATE	Amount	Removal or completion for individual item from date of handing over of	Remarks
1	2	3	4	5	6	7	8	9
1	Supply and fix cable jointing kit for 11 KV grade cable for outdoor termination heat shrink type joint complete with jointing material and accessories suitable for 3 core XLPE, armoured, Al conductor cable of size 95 sqmm complete all as specified as directed.		4	EACH	6,150.70	24,602.80		
2	Supply and erect two pole structure on with SP-410-55, 11 meter steel tubular swaged pole with necessary spaces, for mounting of HT air break switch and DO fuse units complete with all excavation and concrete filling on foundation and base, painting, Steel bracing, clamps, channels, insulators, anti climbing device etc. complete all as specified and as directed.		1	EACH	18,443.78	18,443.78		
3	Supply and fix Galvanised iron strip of size 32 x 6mm with saddles and fixing screws etc. for roof/wall complete all as specified.		190	RM	213.00	40,470.00		
4	Supply & erect steel tubular swaged poles Type 410 SP-31 (9.0 metres long) complete with CI base plate and finial and single swan neck including foundation(12 for street light, 03 for solar street lights) all as specified and as directed.		10	EACH	11,499.00	1,14,990.00		
5	Supply and fix MCB DB concealed in wall vertical double door type, TPN 4 way 415 V, 50 Hz, IP 43 protection with 200 A bus bar, including provision for fixing RCBO 63 A as incomer and SP MCBs as outgoings complete, fill empty way with blanking plates complete all as specified and directed.		2	EACH	2,426.70	4,853.40		
6	Supply and fix MCB SPN 6 to 32 Amps, 240 Volts, 10 KA , C curve complete all as specified.		24.00	EACH	431.52	10,356.48		
7	supply and fix RCBO FP 63 Amps, 100mA, 415 Volts complete all as specified and directed.		2	EACH	3,111.87	6,223.74		

SCHEDULE 'A' PART-VII (EXTERNAL ELECTRIFICATION) (Contd)

1	2	3	6	4/5	4/5	7	8	9
7	Material and labour for Cement Concrete in foundation ,filling and mass concrete with PCC 1:3:6 type C-2 with 40 mm graded aggregate complete all as specified and as directed.		7.00	CUM	5,862.00	41,034.00		
8	Supply and spreading clean dry sand over and around the cable for cable protection in trenches, levelled and punned down for cable cushioning in trenches complete all as specified and as directed. (Note: Punned thickness only shall be measured)		66	CUM	1,974.30	1,30,303.80		
9	Supplying and laying unreinforced Precast Cement Concrete Cable Covers, Class LV, Type -1 flat, size 250mm X 150mm X 40mm in trenches for cable protection, embossed with "ELECTRIC" on the top surface complete all as specified and as directed.		4,380	EACH	44.20	1,93,596.00		
10	Supplying and laying un-reinforced precast concrete cable cover, class HV, type- 1 with flat, size 300mm x 180mm x 40mm in trenches for cable protection, embossed with "ELECTRIC" on the top surface all as specified and directed.		900	EACH	57.40	51,660.00		
11	Material and labour for PCC 1:2:4 type B-1 (using 20 mm graded aggregate) for coping of poles up to 30 cm above ground including necessary form work, and finishing the surface even and smooth without using extra cement PCC coping complete all as specified and as directed.		1.00	CUM	8,369.90	8,369.90		
Total amount of Schedule 'A' Part-VII Carried over to BOQ						6,44,903.90		

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-VIII (AREA DRAINAGE)

Sl. No.	Description of Item	Ref. to Dig. No.	No. of Units Required	UNIT	RATE	Amount	Period of completion for individual item from date of handing over of	Remarks
1	2	3	4	5	6	7	8	9
1	M & L for plain cement concrete 1:3:6 type C2 (using 40 mm graded stone aggregate) as in foundation complete all as specified and as directed.		210.00	Cubic Metre	5,862.00	12,31,020.00		
2	M & L for precast concrete solid block Grade 'C' masonry with compressive strength of 5 N/mm ² , exc 10 cm in width as in Wall set in cement mortar (1:6) complete all as specified and as directed.		378.00	Cubic Metre	8,439.60	31,90,168.80		
3	M&L rendering 15mm thick on concrete surfaces in cement mortar 1:4 and finished fair and even with out using extra cement complete all as specified and as directed.		1,890.00	Square Metre	304.24	5,75,013.60		
4	M&L PCC 1:2:4 type B1 (Using 20mm graded aggregate) as in coping complete all as specified and as directed.		42.00	Cubic Metre	9,259.40	3,88,894.80		
5	Extra for forming fair finished drain or channel 30 cm inner girth in cement concrete, using extra cement, including forms, moulds, mitred/stopped ends etc. complete all as specified		700.00	Running Metre	43.35	30,345.00		
Total amount of Schedule 'A' Part-VIII Carried over to BOQ						54,15,442.20		

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-IX (SEWAGE DISPOSAL)

Sl. No.	Description of Item	Ref. to Drg. No.	No. of Units Required	UNIT	RATE	Amount	Removal or completion on for individual item from date of handing over of	Remarks
1	2	3	4	5	6	7	8	9
1	M&L PCC 1:3:6 type C2 (Using 40mm graded stone aggregate) as in foundation filling and mass concrete complete all as specified and as directed.		1.82	Cubic Metre	5,862.00	10,668.84		
2	M & L for precast concrete solid block Grade 'C' masonry with compressive strength of 5 N/mm ² , exc 10 cm in width as in Wall set in cement mortar (1:6) complete all as specified and as directed.		5.44	Cubic Metre	8,439.60	45,911.42		
3	M & L for reinforced concrete 150mm bore pipes, Class NP3, spigot & socket ends laid and jointed complete all as specified and as directed.		27.60	Running Metre	400.00	11,040.00		
4	M&L concrete bed to drain pipes 150mm dia. with cement concrete 1:3:6 type C2 including packing under, and haunching against the sides of pipes after they are laid and tested all as specified and as directed.		26.80	Running Metre	466.89	12,512.65		
5	M & L for plain cement concrete 1:2:4, type B1 (Using 20 mm graded granite stone aggregate) as in benching of manholes including forming centre channels half round or 1/4 section complete all as specified and as directed.		0.63	Cubic Metre	6,611.70	4,165.37		
6	M&L for rendering 15mm thick on fair faces of brick work or concrete surfaces in cement mortar 1:4 and finished fair and even without using extra cement complete all as specified and as directed.		14.28	Square Metre	304.24	4,344.55		
7	M&L for rendering 15mm thick on fair faces of brick work or concrete surfaces in cement mortar 1:6 complete all as specified and as directed.		4.64	Square Metre	243.37	1,129.24		
8	Supply only Integral water proofing compound		1.61	Per Kg	46.10	74.22		
9	M&L for preparation of newly plastered surface of walls and three coats of white wash complete all as specified and as directed.		8.32	Square Metre	24.50	203.84		

SCHEDULE 'A' PART-IX (SEWAGE DISPOSAL) (Continued)

1	2	3	4	5	6	7	8	9
10	M&L PCC type B1 1:2:4 (using 20mm graded stone aggregate) as in benching of manholes complete all as specified and as directed.		0.63	Cubic Metre	6,638.10		4,182.00	
11	M&L PCC type B1 1:2:4 (using 20mm graded stone aggregate) as in coping including necessary formwork complete all as specified and as directed.		0.21	Cubic Metre	9,259.40		1,944.47	
12	RCC septic tank designed to carry sewage and sullage water excavation in any type of soil PCC 1:4:8 below foundation , RCC M-30 design mix in walls base slab, baffle walls and roof slab including beams etc., with vent shaft, manhole openings with covered connection etc., complete with effective depth of 1.5m with overall depth of 3.0m for 100 users complete all as specified and as directed.		1.00	Each	6,08,200.00		6,08,200.00	
12	Soakage wells excavation in any type soil foundation in PCC 1:3:6 walls of honey combed masonry with top ring of M-25 concrete including intercepting chamber and screen chamber made of brick masonry in CM, RCC cover slab in M25/SFRC cover inter connecting pipes of RCC/DWC complete filled with brick bats of size 1.2 dia and 1.5m effective depth complete all as specified and as directed.		1.00	Each	20,599.00		20,599.00	

Total amount of Schedule 'A' Part-IX Carried over to BOQ**7,24,975.61**

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-X (LIGHTENING PROTECTION)

Sl. No.	Description of Item	Ref. to Dig. No.	No. of Units Required	UNIT	RATE	Amount	Period of completion for individual item from date of handing over of	Remarks
1	2	3	4	5	6	7	8	9
1	Supply and fix single pointed air terminal aluminium rod 12mm dia 300mm long with aluminium box plate of size of 125x125x10mm fixed cover hylem sheet of size 174x175x10mm and fixed on roof top complete including necessary fasteners etc. complete. all as specified and as directed.		42	Each	278.90	11,713.80		
2	Supply and fix horizontal roof conductor and down conductor of size 25 x 3.15 mm Aluminium strip fixed on porcelain block /insulator duly fixed /grafted to Walls/ columns/ projections /roof and spaced at 1 Mtr interval complete all as specified and as directed.		2,070	RM	125.10	2,58,957.00		
3	Supply and fix test point terminal block made out of Gun metal or Phosphorus Bronze size 75 x 75 x 25 mm drilled and screwed including 3 Nos 8 mm dia 25 mm long hexagonal head screws, etc. complete. all as specified and as directed.		42	Each	689.70	28,967.40		
4	Supply & install GI strip 32 mm x 6 mm Complete with fixing of GI pipe protection of 40 mm light with saddles and fixing with saddles and fixing screws complete all as specified and as directed.		350	RM	230.80	80,780.00		

Total amount of Schedule 'A' Part-X Carried over to BOQ**3,80,418.20**

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-XI (ROAD/PATH/CULVERT)

Sl. No.	Description of Item	Ref. to Drg. No.	No. of Units Required	UNIT	RATE	Amount	Removal or completion for individual item from date of handing over of	Remarks
1	2	3	4	5	6	7	8	9
1	Rolling and consolidating formation surface in cutting by using power road roller 8 to 12 tonne capacity complete all as specified and as directed.		229.00	Ten Square Metres	26.00	5,954.00		
2	Material and Labour for Laying and compacting 150mm thick (compacted thickness) Granular Sub Base Course (GSB) grading as per Grade V as specified Table 900-1 of MoRTH specifications for Road and Bridge works, 2013 in a single layer over compacted subgrade with natural sand, crushed gravel, crushed stone, crushed slag or combination thereof as per the grading required. The materials are mechanically mixed, spread and levelling on the subgrade by using motor grader of adequate capacity and rolling with vibratory roller of capacity 80-100 KN static weight for achieving required compaction density, consolidating to required gradient and camber complete all as specified and directed with finished surface tolerances as per Table 900-1 of MoRTH specifications for Road and Bridge works 2013 complete all as specified and as directed.		256.00	Ten Square Metres	4,083.42	10,45,355.52		
3	Material and Labour for 200mm thick WBM in two layers (compacted thickness) with granite, trap or basalt aggregate of grading 2 (63 to 40mm) or of grading 3 (50 to 20mm), surface formed and rolled and consolidated to required gradient and camber with 8 to 15 tonne roller, complete all as specified and as directed.		229.00	Ten Square Metres	6,651.60	15,23,216.40		
4	Preparation of unsurfaced Water Bound Macadam surface by brushing with wire brushes for removing caked mud etc. sweeping with brooms and finally fanning the cleaned surface with gunny bags to remove all loose dirt etc. complete all as specified and as directed.		229.00	Ten Square Metres	360.60	82,577.40		
5	Applying evenly a priming/tack coat with bituminous primer at 5kg per 10 square metre complete all as specified.		229.00	Ten Square Metres	263.00	60,227.00		

SCHEDULE 'A' PART-XI (ROAD/PATH/CULVERT) (Continued)

1	2	3	4	5	6	7	8	9
6	Bituminous premix asphaltic dense concrete 40mm consolidated thickness with 5.5% (Paving bitumen) binder content by weight of total mix, rolled and compacted to required camber and gradient complete all as specified and as directed.	229.00	Ten Square Metres	3,828.50	8,76,726.50			
7	Material and Labour for Painting lines, dashes, arrows, letters,etc. on roads pavements and the like n.exc 10cm wide with road marking paint, white or golden yellow complete all as specified and as directed.	79.00	Ten Running Metre	62.00	4,898.00			
8	Material and Labour for Pre-cast cement concrete block with solid blocks type B1 1:2:4 (using 20mm graded aggregate) exc 10 cm in width and setting in mortar 1:4 as in kerb stone complete all as specified and as directed.	27	Cubic Metre	9,158.70	2,47,284.90			
9	M & L for reinforced concrete 600mm bore pipes, Class NP3, spigot & socket ends laid and jointed complete all as specified and as directed.	30	Running Metre	1,450.00	43,500.00			
10	Material and Labour cement concrete 1:3:6 type C2 bed to drain pipes including packing under and completely surrounding pipes with concrete after they are laid and tested complete all as specified and as directed.	30	Running Metre	1,354.35	40,630.50			
11	Material and Labour for Rendering 10mm thick on fair faces of brick work or concrete surfaces in CM(1:4) including even and smooth (without using extra lime or cement) complete all as specified and as directed.	18.00	Square Metre	245.92	4,426.56			
12	Material and Labour for three coats of white wash on walls of cement plastered surface complete all as specified and as directed.	22	Square Metre	24.50	539.00			
Total amount of Schedule 'A' Part-XI Carried over to BOQ						39,35,335.78		

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer

SCHEDULE 'A' PART-XII (FIRE FIGHTING SYSTEM)

Sl. No.	Description of Item	Ref. to Drg. No.	No. of Units Required	UNIT	RATE	Amount	Removal or completion on for individual item from date of handing over of	Remarks
1	2	3	4	5	6	7	8	9
1	Supply and lay MS flanged pipe 150 mm NB heavy duty duly painted with 2 coats of synthetic enamel paint over coat of zinc chromate primer conforming to IS:3589:91 complete all as specified and as directed.		60	RM	1,260.00	75,600.00		
2	Supply and laying MS flanged pipe 100 mm NB heavy duty duly painted with 2 coats of synthetic enamel paint over coat of zinc chromate primer conforming to IS:3589:91 complete all as specified and as directed.		160	RM	903.00	1,44,480.00		
3	Supply and lay MS flanged pipe 80 mm NB heavy duty duly painted with 2 coats of synthetic enamel paint over coat of zinc chromate primer conforming to IS:3589:91 complete all as specified and as directed..		25	RM	662.00	16,550.00		
4	Supply and fix MS flanged pipe 25mm NB heavy duty duly painted with 2 coats of synthetic enamel paint over coat of zinc chromate primer conforming to IS:3589:91 complete all as specified and as directed.		30	RM	241.00	7,230.00		
5	Supply and fix single Headed fire hydrant landing valve of type A of size 63 mm dia confirming to IS 5290 all as specified and directed.		10	Each	29,399.00	2,93,990.00		
6	Supply and fix 63 mm dia 15 meter long hose conforming to IS 636 complete with male and female coupling conforming to IS 903		20	Each	4,652.00	93,040.00		
7	Supply and fix Hose box made of 18 gauge MS Sheet 800mm X 600mm X 250mm with double door with 4 mm thick glasses and door frame made of 16 gauge MS sheet painted fire red out side and brilliant white suitable to fix in yard all as specified and as directed.		10	Each	3,359.00	33,590.00		
8	Supply and fix 63 mm dia gun metal branch pipe with 12.5 mm nozzle conforming to IS 903 complete all as specified and as directed.		20	Each	3,048.00	60,960.00		

SCHEDULE 'A' PART-XII (FIRE FIGHTING) (Continued)

1	2	3	4	5	6	7	8	9
9	Supply and fix hose reel drum of swing type with not less than 19 mm dia rubber braided hose conforming to IS 884 of 36 mtr length with and shut of nozzle and complete as specified and directed.	20	Each	8,578.00	1,71,560.00			
10	Supply and fix CI sluice valve of 150 mm dia, flanged conforming to IS 14846 PN 1.6 complete all as specified	2	Each	14,500.00	29,000.00			
11	Supply and fix Butterfly valve conforming to IS 13095 complete of size 100 mm dia complete all as specified and as directed	2	Each	8,012.00	16,024.00			
12	Supply and fix Butterfly valve conforming to IS 13095 complete of size 80 mm dia complete all as specified and as directed	1	Each	5,431.00	5,431.00			
13	Supply and install Valve, reflux, with by-pass Arrangement supplied and Installed complete of size 150 mm (6") dia. complete all as specified and as directed	1	Each	11,420.00	11,420.00			
14	Supply and install Valve, reflux, with by-pass Arrangement supplied and Installed complete of size 100 mm (4") dia. complete all as specified and as directed	2	Each	8,610.00	17,220.00			
15	Supply and install Valve, reflux, with by-pass Arrangement supplied and Installed complete of size 80 mm (3") dia. complete all as specified and as directed	1	Each	5,920.00	5,920.00			
16	Supply and fix Air cushioning tank (Air vessel) 250mm dia x 1000mm high with dished top, made of minimum 6mm thick MS pipe /plate complete with 20mm dia. Brass air valve (ball type), 20mm dia stop valve, pressure gauge with brass stop cock, nipple tees elbows and all accessories complete fixed on top of suitable flange hydrant line all as specified and as directed.	1	Each	43,824.00	43,824.00			
17	Supply and fix Gun Metal Fire brigade inlet connection (suction collecting head) consisting of four nos 63mm dia instantaneous type male coupling with built in check valves and 150mm dia sluice valve(one in no 150mm dia NRV),and 150mm dia flanged outlet complete with all accessories complete all as specified and as directed.	1	Each	10,140.00	10,140.00			

SCHEDULE 'A' PART-XII (FIRE FIGHTING) (Continued)

1	2	3	4	5	6	7	8	9
18	Supply and fix water pressure gauge 100 mm dia at the delivery side of pump set complete tubing fitted with the stop cock etc. of pressure 25 kg/sqcm, all as per standard practice and as directed.	3	Each	1,564.00	4,692.00			

Total amount of Schedule 'A' Part-XII Carried over to BOQ**10,40,671.00****Signature of the Contractor
Date:****Jt Dir (Contracts)
For Accepting Officer**

SCHEDULE 'A' PART-XIII (FIRE ALARM)

Sl. No.	Description of Item	Ref. to Drg. No.	No. of Units Required	UNIT	RATE	Amount	Removal or completion on for individual item from date of handing over of	Remarks
1	2	3	4	5	6	7	8	9
1	Supply, install and commissioning analogue addressable type Fire alarm control panel along with network interface card and with Lead acid battery back up for 08 hours normal operation and 15 minutes alarm operation. (The control panel, battery charger, etc. shall be UL listed) Complying with BS EN 54 Single loop panel with 99 detectors & 99 modules & upto 200 detectors and modules (per each loop) all as specified and as directed.		1	Each	64,641.00	64,641.00		
2	Supply and fix Detectors Complying with and type certified to EN - 45 analogue Addressable type multi sensor heat and smoke detector combination type Photoelectric /Optical with base with self built intelligence as per IS: 11360 (To be provided below and above false ceiling) all as directed and specified.		168	Each	2,498.00	4,19,664.00		
2	Supply and Fixing remote response indicator for all detectors. Note: Response indicator should be fixed to wall/fall ceiling with proper fixing arrangement.		20	Each	189.00	3,780.00		
3	Supply and fix Fire Alarm sounders / Sirens electronic type horizontal single stage continuous normal operation for at least 50 minutes with sound level 65 DB to 120 DB measured at 1.5 meter with sound output variation of + 5 DB for 1000 meter range complete all as specified and as directed.		1	Each	3,951.00	3,951.00		
4	Supply and fix horn/ strobe rated at 82 dBA @ 3 M for audible annunciation and 75 cd flashing at 1 Hz for visual indication		4	Each	7,094.00	28,376.00		
5	Supply and fix addressable single action manual call point having an integrally mounted addressable module that monitors and reports contact status.		4	Each	3,132.00	12,528.00		
Total amount of Schedule 'A' Part-XIII Carried over to BOQ						5,32,940.00		

Signature of the Contractor
Date:

Jt Dir (Contracts)
For Accepting Officer