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**Drawings:** Sheets

Signature of Contractor: Jt. Director [Contracts]
Date: For Accepting Officer
Dear Sir[s],

1. Tender documents, BOQ, Schedules and Drawings are published with tender ID NO. [TENDER ID No. 2017_MES_155539_1] by this office on the MES portal www.eprocuremes.gov.in, on 04 Nov 2017 with Bid submission start date 04 Dec 2017 and end date as 11 Dec 2017. The tender is on Single Stage Two Cover system. The tenderer shall submit the tender documents with BOQ duly quoted as under:-

   (a) Cover 1: Application, tender fee, MoU, GST code, EMD for DGNP enlisted and other Contractors
   (b) Cover 2: BOQ/Financial bid, Tender documents, Schedules and Drawings

2. Bids will be received online by Accepting Officer up to the date and time mentioned in the Notice Inviting Tender [NIT] i.e. 1800 Hours on 11 Dec 2017. 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. Bid 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, if any, on or before 28 Nov 2017. You are requested not to write piece meal points and forward your points duly consolidated before due date i.e. 28 Nov 2017.

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. [a] 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 dated & time fixed for this purpose. In case of failure to abide by any of these two requirements, the finance bid will not be opened.

   [b] Contractor having not executed Standing Security Bond and Standing Security Deposit in any MES formation would be required to deposit Individual Security Deposit on acceptance of tender which will be calculated with reference to the tendered cost as per scales laid down by MES for calculation of "Earnest Money" enhanced by 25% subject to maximum of Rs. 18,75,000.00 [Rupees Eighteen Lakh seventy five thousand only].
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.


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 contractors 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]. Incase 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 Tenders. 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.

Yours faithfully,

Signature of Contractor

Date:

Jt. Director [Contracts]

For Accepting Officer
INSTRUCTIONS ON FILLING AND SUBMISSION OF TENDER

1. **EARNEST MONEY DEPOSIT [EMD]:** Contractor[s] who are not enlisted with MES / who are enlisted but have not executed the Standing Security Bond shall submit Earnest Money Deposit as detailed in Notice Inviting Tender in one of the following forms, along with their tender/bid.

   [a] Deposit at Call Receipt from a Scheduled Bank in favour of Garrison Engineer concerned.

   [b] Receipted Treasury Challan, the amount being credited to the Revenue Deposit of Garrison Engineer concerned.

   It is advisable that Earnest Money is deposited in the form of Deposit at Call Receipt from an approved Scheduled Bank for easy refund. In case the tenderer/bidder wants to lodge "Earnest Money Deposit" in any other form allowed by MES, a confirmation about its acceptability will be obtained from the Accepting Officer well in advance of the bid submission end date and time. Earnest Money shall be submitted in the name of concerned Garrison Engineer.

   **Note:** Earnest Money Deposit [EMD] in the form of Cheque / Bank Guarantee etc. will not be accepted. Non-Submission of Earnest Money Deposit [EMD] [Scanned copy along with technical bid & hard copy before the date & time fixed for opening of T-Bid] WILL RENDER THE BID DISQUALIFIED FOR OPENING OF COVER – 2 [FINANCE BID].

2. **SECURITY DEPOSIT:** In case the tender / bid submitted by such contractor who is not enlisted with MES is accepted, the contractor will be required to lodge with the Controller of Defence Accounts, Individual Security Deposit calculated with reference to tendered cost as notified by the Accepting Officer subject to a maximum of Rs. 18,75,000.00. The amount is required to be lodged within 30 [Thirty] days of the receipt by the contractor of notification of acceptance of tender/bid, failing which the sum shall be recovered for the 1st RAR payment or from the Final Bill [See Condition – 22 of General Conditions of Contracts [IAFW – 2249]].

3. **CONTRACTORS ENLISTED WITH CHIEF ENGINEER EASTERN COMMAND AND WHO HAVE EXECUTED STANDING SECURITY BOND AND DEPOSITED STANDING SECURITY DEPOSIT BUT OF LOWER CLASS:** In case the tender / bid is accepted, the amount of Additional Security Deposit will be as notified by the Accepting Officer. The amount will be the difference between the "Individual Security Deposit" calculated with reference to the "Tendered Cost" and "Standing Security Deposit" lodged. The amount is required to be lodged within 30 [Thirty] days of the receipt by the contractor of notification of acceptance of tender / bid, failing which the sum shall be recovered for the 1st RAR payment or from the Final Bill [See Condition – 22 of General Conditions of Contracts [IAFW – 2249]].

4. **CONTRACTOR ENLISTED IN MES FORMATIONS OTHER THAN CHIEF ENGINEER EASTERN COMMAND:** Contractors whose names are on the approved list of any MES formation i.e. other than Chief Engineer Eastern Command and who have deposited Standing Security and have executed Standing Security Bond may tender / bid without depositing Earnest Money with the bid and if the Accepting Officer decides to accept the tender / bid, such tenderers will be required to lodge Security Deposit as notified by the Accepting Officer. The amount is required to be lodged within 30 [Thirty] days of the receipt by the contractor of notification of acceptance of tender / bid, failing which the sum shall be recovered for the 1st RAR payment or from the Final Bill.

5. **GENERAL INSTRUCTIONS FOR COMPLIANCE:**

5.1. The bids received only in the electronic form will be considered. All bids shall be submitted on www.eprocuremes.gov.in portal. Documents should be scanned and forwarded in pdf form and xls from as indicated.
INSTRUCTIONS ON FILLING AND SUBMISSION OF TENDER [Continued]

5.2. Bids shall be uploaded on www.eprocuremes.gov.in portal on or before the bid closing date mentioned in the tender. No tender / bid in any other electronic or physical form like e-mail / fax / by hand / through post will be considered.

5.3. Bid should be DIGITALLY signed using valid DSC. All pages of tender documents, corrections/alterations shall be signed / initialled by the lowest bidder after acceptance.

5.4. Drawings, if issued in physical form, must be returned duly initialled by the tenderer / bidder in separate envelope indicating his name and address.

5.5. The tender shall be signed, dated and witnessed at all places provided for in the documents after acceptance. All corrections shall be initialled. The contractor shall initial every page of tender and sign all drawings forming part of the tender. Any tender / bid, which proposes alterations to any of the conditions whatsoever, is liable to be rejected.

5.6. In the technical bid, a scanned copy of Power Attorney in favour of the person uploading the bid using his / her DSC shall be uploaded. In case the digital signatory himself is the sole proprietor, scanned copy of an affidavit on stamp paper of appropriate value to this effect, stating that he has authority to bind the firm in all matters pertaining to contract including the Arbitration Clause, shall be attached in pdf form. In case of partnership concern or a limited company, digital signatory of the bid / tender shall ensure that he is competent to bind the contractor [through partnership deed general power of attorney or Memorandum and Articles of Association of the Company] in all the matters pertaining to the contracts with Union of India including arbitration clause. A scanned copy of the documents confirming of such authority shall be attached with the tender / bid in pdf form, if not submitted earlier. The person uploading the bid on behalf of another partner[s] or on behalf of a firm or company using his DSC shall upload with the tender / bid a scanned copy [in pdf form] of Power of Attorney duly executed in his favour by such other or all of the Partner[s] or in accordance with constitution of the company in case of company, stating that he has authority to bind such other person of the firm or the Company as the case may be, in all matters pertaining to the contract including the Arbitration Clause.

5.7. Even in case of Firms or Companies which have already given Power of Attorney to an individual authorising him to sign tender in pursuance of which bids are being uploaded by such person as a routine, fresh Power of Attorney duly executed in his favour stating specifically that the said person has authority to bind such partners of the Firm or the Company as the case may be, including the condition relating to Arbitration Clause, should be uploaded in pdf form with the tender/bid unless such authority has already been given to him by the Firm or the Company. It shall be ensured that power of attorney shall be executed in accordance with the Constitution or the Company as laid down in its Memorandum & Article of Association.

5.8. Hard copies of all above documents should be sent by the Tender issuing authority well in advance to be received before the date & Time fixed for the same.

5.9. Bid [Cover – 1 & Cover – 2] shall be uploaded online well in time.

5.10. The contractor shall employ Indian Nationals after verifying their antecedents and loyalty. Attention is also drawn to Special Condition – 3 referred hereinafter and also Conditions 24 & 25 of IAFW – 2249 [General Conditions of Contracts].

5.11. Tenderers / bidders who uploaded their priced tenders / bids and are desirous of being present at the time of opening of the tenders / bids, may do so at the appointed time.
INSTRUCTIONS ON FILLING AND SUBMISSION OF TENDER [Continued]

5.12. The tenderer / bidder shall quote his rate on the BOQ file only. No alteration to the format will be accepted, else the bid will be disqualified and summarily rejected.

5.13. In case the tenderer / bidder has to revise / modify the rates quoted in the BOQ [Excel Sheet] he can do so only in the BOQ, through www.eprocuremes.gov.in site only before the bid closing time and date.

6. REVOCAION / REVISION OF OFFER UPWARD / OFFERING VOLUNTARY REDUCTION, AFTER OPENING OF FINANCIAL BIDS BY LOWEST BIDDER: In the event of lowest tenderer / bidder revoking his offer or revising his rates upward / offering voluntary reduction, after closing of bid submission date & time, his offer will be treated as revoked and Earnest Money deposited by him shall 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 tenderer / bidder for depositing the amount through MRO. Bids of such Contractors / bidders shall not be opened till the aforesaid amount equal to the earnest money is deposited by him in Government Treasury. In addition, bids of such tenderer / bidder and his related firm shall not be opened in second call or subsequently calls. Reduction offered by the tenderer / bidder on the freak high rates referred for review shall not be treated as voluntary reduction.

7. CPM [CRITICAL PATH METHOD]:

7.1. The project planning for work covered in the scope of tender is based on CPM.

7.2. The tenderer / bidder is expected to be fully conversant with the CPM technique and employ technical staff who can use the technique in sufficient details. Sufficient books and other literature on the subject are widely available in the market which the tenderer / bidder may make use of.

7.3. The tenderer’s / bidder’s attention is drawn to Special Condition of the tender regarding preparation of the detailed network analysis and time schedule for the work and his liability for employing sufficient resources to adhere to this schedule. Any inability on the part of the tenderer / bidder in using the technique will be taken as his technical inefficiency and will affect his class of enlistment and future prospect / invitation to tenders for future works.

8. Department may issue amendments / errata in from of CORRIGENDUM to tender / revised BOQ to the tender documents. The tenderer / bidder is requested to read the tender documents in conjunction with all the errata / amendments / corrigendum, if any issued by the department.

9. 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.

10. These instructions shall form part of the contract documents.

Signature of Contractor
Date:

Jt. Director [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, which will be about two weeks after the date of acceptance of the tender.

4. Normally contractors whose names are on the MES approved list for the area in which the work lies and within whose financial category the estimated amount would fall may tender / bid. But in case of term contracts, contractors in categories "SS" to "E" may tender / bid. In case, where the tender amount is in excess of the financial limit of the contractor [i.e. his class of enlistment] and the Accepting Officer decides to accept the tender / bid, in which event the tenderer / bidder would be required to lodge "Additional Security Deposit" as notified by the Accepting Officer in terms of conditions of Contract. Contractors 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 without depositing Earnest Money along with the tender / bid and if the tender / bid submitted by such a tenderer / bidder is accepted, the tenderer / bidder will be required to lodge with the Controller of Defence Accounts concerned the amount of "Individual Security Deposit" within thirty days of the receipt by him of notification of acceptance of his tender / bid, failing which the sum will be recovered from the first RAR payment or from the final bill. In the case of term/running contracts remaining sum shall be recovered from the subsequent bill[s] of the contractor. 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, Financial Bid & Price 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.eprocuremes.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"].

NOTICE INVITING TENDER [Continued]
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 but, if the Accepting Officer accepts the tender / bid, the tenderer will be required to lodge with the Controller of Defence Accounts concerned the amount of "Individual Security Deposit" for the specific work within thirty days of the receipt by him of notification of acceptance of his tender / bid, failing which the sum will be recovered from the first RAR payment or from the first final bill. In the case of term/running contracts, remaining sum shall be recovered from the subsequent bill[s] of the contractor.

6.4. A contractor who has executed Standing Security Bond but not corresponding to the appropriate class as mentioned above shall lodge with the Accepting Officer, "Additional Security Deposit" as notified by the Accepting Officer within thirty days of the receipt by him of notification of acceptance of his tender / bid, failing which this sum will be recovered from the first RAR payment or from the first final bill. In the case of term / running contracts remaining sum shall be recovered from the subsequent bill[s] of the contractor. However, in case, where any payment is made to the contractor within thirty days of the receipt by him of notification of acceptance of tender / bid, the amount of Additional Security Deposit shall be recovered from such payments.

6.5. 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.

6.6. The Garrison Engineer will either return the Earnest Money to the successful tenderer / bidder by endorsing an authority on the Deposit at Call Receipt for its refund on receipt of an appropriate amount of Security Deposit or will retain the same in part or full on account of Security Deposit if such a transaction is feasible.

6.7. 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.

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 reserves 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.eprocuremes.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 jtdgconteengrkl-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.

Signature of Contractor
Date: 

Jt. Director [Contracts]
For Accepting Officer
### APPENDIX "A" TO NOTICE INVITING TENDER

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<tr>
<th>No.</th>
<th>Description</th>
<th>Details</th>
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<tbody>
<tr>
<td>1</td>
<td>Name of Work</td>
<td>Setting up of 1.0 MW Solar Power Generation Project at Visakhapatnam [TENDER ID No. 2017_MES_155539_1]</td>
</tr>
<tr>
<td>2</td>
<td>Estimated Cost of Work</td>
<td>Rs. 650.00 Lakh [At par Market]</td>
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<td>3</td>
<td>Period of Completion</td>
<td>18 [Eighteen] Months</td>
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<td>4</td>
<td>Cost of Tender Documents</td>
<td>Rs. 3,000.00 in the shape of DD/Bankers Cheque from any Scheduled Bank in favour of Garrison Engineer [U-I], Visakhapatnam and payable at Visakhapatnam. Micro, Small and Medium Enterprises [MSMEs] are exempted from submission of Tender Fee.</td>
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<tr>
<td>5</td>
<td>Website / Portal Address</td>
<td><a href="http://www.eprocuremes.gov.in">www.eprocuremes.gov.in</a> &amp; <a href="http://www.mes.gov.in">www.mes.gov.in</a></td>
</tr>
<tr>
<td>6</td>
<td>Type of Contract</td>
<td>The tender shall be based in Drawings and Specifications [IAFW - 2159] [Revised 1947] and General Conditions of Contracts [IAFW - 2249] with Schedule &quot;A&quot; [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 &quot;A&quot; and quote rates against items of other parts of Schedule &quot;A&quot;.</td>
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<tr>
<td>7</td>
<td>Information &amp; Details:</td>
<td>Time &amp; Date of Publishing of NIT &amp; Tender Documents: By 1800 Hours on 04 Nov 2017 on website <a href="http://www.eprocuremes.gov.in">www.eprocuremes.gov.in</a></td>
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<td></td>
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<td>Start Time &amp; Date of Downloading of NIT &amp; Tender Documents: From 1800 Hours on 04 Nov 2017 from website <a href="http://www.eprocuremes.gov.in">www.eprocuremes.gov.in</a></td>
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<td>Start Time &amp; Date of Clarifications if any by the Bidders: N.A.</td>
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<td>Closing Time &amp; Date of Clarifications if any by the Bidders: N.A.</td>
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<tr>
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<td>Start Time &amp; Date of Submission of Bids: From 1000 Hours on 04 Dec 2017 on website <a href="http://www.eprocuremes.gov.in">www.eprocuremes.gov.in</a></td>
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<td>Closing Time &amp; Date of Submission of Bids: Up to 1800 Hours on 11 Dec 2017 on website <a href="http://www.eprocuremes.gov.in">www.eprocuremes.gov.in</a></td>
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<td>Time &amp; Date of opening of T-Bid of tender i.e. Documents other than Price Bid [Cover - 1]: After 1100 Hours on 12 Dec 2017</td>
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<td>Time &amp; Date of opening of Finance Bid / Price Bid [Cover - 2]: Shall be intimated online after opening and validation of T - Bid [Cover - 1].</td>
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<td></td>
<td></td>
<td>Time &amp; Date of Pre Bid Meeting: From 1500 Hours on 28 Nov 2017</td>
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<td>8</td>
<td>Eligibility Criteria:</td>
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<td></td>
<td>[A] For MES Enlisted Contractors</td>
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<td></td>
<td>: They should satisfy the following criteria:</td>
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<td></td>
<td>[i] Contractor of Class &quot;A&quot; and above eligible class shall be considered eligible.</td>
<td></td>
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<tr>
<td></td>
<td>[ii] Firm should have MoU with MNRE approved channel partners of rating 1A / 1B / 1C / 2A / 2B / 2C having experience as given at 8 [D] [ii].</td>
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<td>[iii] BLANK</td>
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<td></td>
<td>[iv] They should not have any adverse remark in Work Load Return of competent engineer authority.</td>
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<td></td>
<td>Enlisted contractors who are either MNRE approved Channel Partners themselves fulfilling the criteria laid down herein below or meeting the criteria laid down for un-enlisted contractors shall also be considered eligible.</td>
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<td>: They should satisfy the following criteria:</td>
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<td></td>
<td>[i] MNRE approved channel partners of rating 1A / 1B / 2A / 2B. MNRE approved Government Agencies having experience as given at 8 [D] [ii] and meeting the criteria of annual turnover, financial criteria, solvency, working capital, fixed assets commensurate with enlistment criteria of Class &quot;A&quot; contractor in MES.</td>
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<td>[ii] BLANK</td>
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<td></td>
<td>[iii] No recovery outstanding in Government Department.</td>
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<td></td>
<td>[iv] They should not have any adverse remark in Work Load Return of competent engineer authority.</td>
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<tr>
<td></td>
<td>Meeting engineering establishment criteria of Class &quot;A&quot; contractor of MES is not required.</td>
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</tbody>
</table>
### Eligibility Criteria:

<table>
<thead>
<tr>
<th></th>
<th>[C] For Un-enlisted contractors other than MNRE approved Channel Partners.</th>
<th>: The firms not enlisted with MES shall satisfy the following criteria:</th>
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</thead>
<tbody>
<tr>
<td>i</td>
<td>Contractors [other than approved channel partners] meeting the criteria of annual turnover, financial criteria, solvency, working capital, fixed assets, criteria of Class &quot;A&quot; contractor in MES.</td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>Firms should have MoU with MNRE approved channel partners of rating 1A/ 1B/ 1C/ 2A/ 2B/ 2C having experience as given at 8 [D] [ii].</td>
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<td>iii</td>
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<tr>
<td>iv</td>
<td>No recovery outstanding in Government Department.</td>
<td></td>
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<tr>
<td>v</td>
<td>They should not have any adverse remark in Work Load Return of competent engineer authority.</td>
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</tbody>
</table>

Meeting engineering establishment criteria of Class "A" contractor of MES is not required.

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<tr>
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<th>[D] For all Contractors</th>
<th>: [i] BLANK</th>
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</thead>
<tbody>
<tr>
<td>ii</td>
<td>Experience of having successfully completed Solar Power Plants in Government Department / PSU during last seven years ending last day of the month previous to the one in which applications are invited should be any of the following:</td>
<td></td>
</tr>
</tbody>
</table>

One work of capacity ≥ 80% of capacity of plant specified in NIT.
Or
Two works of capacity ≥ 50% of capacity of plant specified in NIT.
Or
Three works of capacity ≥ 40% of capacity of plant specified in NIT.

[iii] Contractor will not be allowed to execute the work by subletting or through power of attorney holder on his behalf to a third party / another firm except sons / daughters of Proprietor / Partner / Director, Project Manager as per contract conditions.
**APPENDIX "A" TO NOTICE INVITING TENDER [Continued]**

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| [D] | For all Contractors | [iv] In a tender, the MNRE approved channel partner can either bid as direct participant / bidder or under MoU with MES enlisted / un-enlisted contractor, but cannot bid simultaneously for the same tender as direct participant / bidder as also under MoU with MES enlisted/ un-enlisted contractor.  

[v] In case any violation of condition at [D] [iv] above is noticed, bids submitted directly by MNRE approved channel partner will be treated as invalid.  

[vi] MoU will be permitted between only one MNRE approved channel partner and one MES enlisted / un-enlisted contractor, bidding for the same tender. |
| 9  | Tender issuing and Accepting Officer | Chief Engineer [Navy], Visakhapatnam – 530 004 |
| 10 | Executing Agency | Garrison Engineer [U–I], Visakhapatnam – 530 014 |
| 11 | Earnest Money for DGNP enlisted and other Contractors | Rs. 6,50,000.00 in favour of Garrison Engineer [U–I], Visakhapatnam. MES Enlisted Contractors, Micro, Small and Medium Enterprises [MSMEs] are exempted from submission of EMD. |

**Notes:**

[a] The contractors enlisted up to One Class below eligible class may also apply / bid. Application / bids from One Class below eligible class applicants may be considered in the event of inadequate response / bids from the applicants of eligible class.

[b] Contractors enlisted with MES will upload following documents [Scanned copy in .pdf format] for checking eligibility:

[i] Application for the tender on Tenderer's Letter Head. In this, the contractor should explain with calculation details supported with documentary evidence as to how he is qualifying for this tender in terms of conditions given in Para 8 [A] [ii] above.

[ii] Enlistment Letter  

[iii] Scanned copy of DD towards cost of Tender  

[iv] GST Registration Number  

[v] BLANK

Hard copies of these documents will be submitted within 07 [Seven] Days from the last Date & Time of opening of Cover-1 of tender i.e. T-Bid.
APPENDIX "A" TO NOTICE INVITING TENDER [Continued]

[c] Contractors enlisted with DGNP will upload all the documents as specified in Para [b] above and shall also submit following documents [Scanned copy in .pdf format] for checking eligibility:

[i] Scanned copy of Earnest Money Deposit [EMD].

[d] Contractors not enlisted with MES will be required to upload the following:

[i] Application for the tender on Tenderer's Letter Head. In this, the contractor should explain with calculation details supported with documentary evidence as to how he is qualifying for this tender in terms of conditions given in Para 8 [A] [ii] above.

[ii] Necessary documents to prove their eligibility for enlistment in required Class & Category of work, including Affidavit for no recovery outstanding. List of documents required for enlistment in MES has been given in Para 1.5 of Section – 1 of Part – I of MES Manual on Contracts – 2007 [Re-Print 2012]. This will include the following amongst others:


[ab] Affidavits for possession of Movable & Immovable properties by Proprietor / Partner owning the immovable property along with Valuation Certificate form Registered Valuer in support of Movable & Immovable Properties. In case of Limited Company, the immovable property is required to be in the name of the company.

[iii] Scanned Copy of DD towards Cost of Tender and Earnest Money.

[iv] GST Registration Number.

Hard copies of these documents will be submitted within 07 [Seven] Days from the last Date & Time of opening of Cover-1 of tender i.e. T-Bid.

[e] [i] Application / bids not accompanied by scanned copies of requisite DD / Bankers Cheque towards Cost of Tender and Earnest Money [as applicable] shall not be considered for validation of T-Bid and their financial bids will not be opened.

[ii] Tender / Bidder to note that they should ensure that their original DDs and Earnest Money [as applicable] are received within 07 [Seven] Days from the Time & Date of opening of Cover-1 of tender i.e. T-Bid.

[iii] In case of applications / bids from enlisted contractors of MES, where scanned copies of requisite DD / Bankers Cheque towards cost of tender has been uploaded but physical copies are not received by the stipulated date, finance bids will be opened. However, non-submission of physical copies of cost of tender shall be considered as willful negligence of the bidder with ulterior motives and such bidder shall be banned from bidding for a period of Six Months commencing form date of opening of finance bid.

[iv] In case of applications / bids from un-enlisted contractors, where scanned copies of requisite DD / Bankers Cheque towards cost of tender has been uploaded but physical copies are not received by the stipulated date, finance bids 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 date of opening of finance bid.

[v] In case of applications / bids [Enlisted contractors / as well as Un-enlisted contractors], where scanned copies of requisite Earnest Money [as applicable] were uploaded but the same are not
received in physical form within stipulated time, such bids shall not qualify for opening of finance bid.

APPENDIX “A” TO NOTICE INVITING TENDER [Continued]

[f] In case of rejection of Technical / Prequalification Bid, contractor may appeal to Next Higher Engineer Authority i.e. HQ, Chief Engineer, Eastern Command, Kolkata – 700 001 on e-mail id jtdgcontceengrklmes@nic.in against rejection, whose decision shall be final and binding. However, contractor / bidder shall not be entitled to any compensation whatsoever for rejection of Technical / Prequalification Bid.

[g] 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 alongwith 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.

[h] 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.

Signature of the Contractor [G Krishna Murthy]
Date: EE [QS & C] [NFSG]
Jt. Director [Contracts]

85279 / E8
Date: Nov 2017

Chief Engineer [Navy]
Military Engineer Services
Station Road
Visakhapatnam – 530 004
TO BE USED IN CONJUNCTION WITH
GENERAL CONDITIONS OF CONTRACTS [IAFW – 2249]

Telephone: 0891 – 27 47 002 / 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

WORK REQUIRED IN THE EXECUTION OF LUMPSUM TENDER AND CONTRACT FOR
"SETTING UP OF 1.0 MW SOLAR POWER GENERATION PROJECT AT VISAKHAPATNAM"
[TENDER ID No. 2017_MES_155539_1]

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.eprocuremes.gov.in by 1800 Hours on 04 Nov 2017. The bid [Technical Bid i.e. Cover – 1] will be opened on or after 1100 Hours on 12 Dec 2017. Date and time of opening of Finance Bid / Price Bid i.e. Cover – 2 will be intimated online after completion of evaluation of Technical Bid / Cover – 1.

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: Jt. Director [Contracts]
Dated: Nov 2017
SCHEDULE "A"

LIST OF ITEMS OF WORK

Name of the Work: Setting up of 1.0 MW Solar Power Generation Project at Visakhapatnam.

[TENDER ID No. 2017_MES_155539_1]

Notes:

1. SCOPE OF WORK: This contract covers for all items of works described in BOQ [Schedule "A" Part – I to Schedule "A" Part – XI]. The buildings and all services described under BOQ [Schedule "A" Part – I to Schedule "A" Part – XI] 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:

[a] Schedule "A" Part – I : Buildings & Structures [Pre-Priced by the Department] [Serial Item No. 1 of BOQ]

[b] Schedule "A" Part – II : Site Clearance / Area Development / Earthwork Excavation [Pre-Priced by the Department] [Serial Item No. 2 of BOQ]

[c] Schedule "A" Part – III : Road / Path / Culvert [Pre-Priced by the Department] [Serial Item No. 3 of BOQ]

[d] Schedule "A" Part – IV : UG Sump [Pre-Priced by the Department] [Serial Item No. 4 of BOQ]

[e] Schedule "A" Part – V : Fencing & Gate [Pre-Priced by the Department] [Serial Item No. 5 of BOQ]

[f] Schedule "A" Part – VI : Sewage Disposal [Pre-Priced by the Department] [Serial Item No. 6 of BOQ]

[g] Schedule "A" Part – VII : Internal Water Supply [Pre-Priced by the Department] [Serial Item No. 7 of BOQ]

[h] Schedule "A" Part – VIII : Internal Electrification [Pre-Priced by the Department] [Serial Item No. 8 of BOQ]

[i] Schedule "A" Part – IX : External Water Supply [Pre-Priced by the Department] [Serial Item No. 9 of BOQ]

[j] Schedule "A" Part – X : External Electrification [Pre-Priced by the Department] [Serial Item No. 10 of BOQ]

[k] Schedule "A" Part – XI : Miscellaneous Items [Internal Water Supply, External Water Supply, Internal Electrification, External Electrification and Solar Power Plant] [To be quoted by the Tenderer in BOQ] [Serial Item No. 11 to 37.9 of BOQ]

2. Description of Buildings/Structures, works and services given in BOQ [Schedule "A" Part – I to Part – XI] 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.

**SCHEDULE "A"**

*LIST OF ITEMS OF WORK* (Continued)

3. **PERIOD OF COMPLETION:** The entire work under this contract including connected services as mentioned in BOQ [Schedule "A" Part – I to Part – XI] shall be completed in **18 [Eighteen] Months** from the date of handing over of site as mentioned in Work Order No. 1, which is about ten days from the date of acceptance of the tender.

4. In respect of **Schedule "A" Part – XI [Serial Item No. 11 to 37.9 of BOQ]** [which are not pre priced by department] the tenderer is required to insert their rates under Column – 6 of BOQ.

5. Works in respect of **Schedule "A" Part – I to Part –X** are pre-priced by MES and the total amounts as against each schedule are inserted in Column – 5 of BOQ. The unit rates inserted in these schedules are based on Unit rates given in MES Standard Schedule of Rates, Part – II including amendments / errata as indicated on tender page or at rates analogous there to. The tenderer shall work out total Lumpsum as against each **Schedule "A"** Part based on his own calculations and arrived the total Lumpsum for each part of schedule, which shall be quoted in Column – 6 of BOQ. The contractor shall have no claim whatsoever on account of any errors in the unit rates/prices as inserted by MES.

6. The Lumpsum / rates quoted by the tenderer shall be based on the description of items in **Schedule "A"**, Drawings, Specifications, Special Conditions, MES Schedule Part – I & Part – II. It is an express condition of the contract that the unit rates 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 Lumpsum amount quoted by the tenderer.

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.

8.1. 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 Lumpsum amount quoted, the decision of the Accepting Officer in this regard shall be final, conclusive and binding.

8.2. If certain details are missing, in that case, 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.
SCHEDULE "A"

LIST OF ITEMS OF WORK [Continued]

9. The Lumpsum 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-XI complete for entire completion of work, unless any items for work is specifically categorically excluded from scope of work.

10. 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.

11. 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. Contractor’s quoted rate shall also be deemed to include for these contingencies.

12. The following items of work shall also be deemed to be included in the Lumpsum quoted for Schedule "A" Part-I:

[a] Earth work including filling above MGL / disposal of surplus and/or unsuitable soil for buildings/structures.

[b] Surface excavation for buildings/structures portion and surface dressing up to 03 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.

[d] Anti termite treatment to buildings under 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 0.9 m 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 03 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 bldg shall be admissible.

[e] Further, if shaft is situated inside the building and covered from all 04 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 Lumpsum.

[f] 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 20 mm 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-XI.

[g] Fan hooks with box complete all as shown on drawings.
SCHEDULE "A"
[LIST OF ITEMS OF WORK] [Continued]

13. Tentative distribution of layouts of various items of internal /external services is indicated on drawings and are included in Schedule "A" Part – II to Part – XI. 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.

14. All items / quantities under Schedule "A" Part – II to Part – XI are "Provisional".

15. 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.

16. 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.

17. YARDSTICK:

17.1. Contractor shall submit the yardstick for each building / structures mentioned in 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. A sample of various stages of a building is specified hereinafter Particular Specifications for guidance. Yardsticks shall be approved by the CWE.

17.2. 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 and due to policy of department of withholding sufficient amount for later stages of the building. 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.

17.3. 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 yard stick 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.

18.1. 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.

18.2. For missing reinforcement details of RCC works, minimum reinforcement as required as per IS shall deemed to be included in the quoted Lumpsum. The decision of the Accepting Officer as regards minimum requirement as per IS shall be final and binding.

18.3. 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 Lumpsum. The decision of the Accepting officer as to the similar of beams, slabs, columns etc. shall be final and binding.

**SCHEDULE "A"**

**LIST OF ITEMS OF WORK** [Continued]

18.4. 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.

18.5. 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 lumpsum and submitting his tender.

19. Makes of various materials / items have been specified hereinafter in particular specifications. However makes specified in Schedule "A" shall only be provided when makes are mentioned in Schedule "A". Makes specified in Schedule "A" items shall take precedence over makes given in particular specifications. However in case no make is specified for a particular item in the tender document, the same shall be BIS marked / approved items from BIS approved manufacturers.

20. **REINFORCEMENT:** Pricing deviations involving high strength corrosion resistant TMT bars of grade Fe-500D shall be as per rates contained in MES Standard Schedule of Rates, Part – II for TMT bars enhanced by percentage quoted by the tender for Schedule "A" Part – I.

21. **COMPLETION DRAWINGS & PERIODICAL SERVICES MEASUREMENT BOOKS:** On completion of the work, 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 GE as directed. Lumpsum quoted shall be deemed to inclusive of this aspect.

22. The tenderer shall make all necessary arrangements to cover proposed buildings / structures with cladding sheets of 3m 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.

23. **GST is applicable for this work. Tenderer shall be quote the unit rates / amount accordingly.**

24. Certain taxes such as Central Excise Duty, Service Tax, Additional Custom Duty, State Level Value Added Tax, Octroi and other Levies which were applicable on interstate transportation of goods are subsumed by GST, thus Special Condition as per Serial Clause No. 32, 32.1, 32.2 [a] to 32.2 [d] on Serial Page No. 84 & 85 for Reimbursement / Refund on variation in prices in taxes directly related to contract value of tender shall be deemed to be amended incorporating GST in lieu of taxes mentioned in the condition but subsumed by GST as prevailing on the date of submission.
SCHEDULE "A"
LIST OF ITEMS OF WORK [Continued]

25. RULES FOR DEALING WITH FREAK LOW / FREAK HIGH RATES:

25.1. Freak Rate: Freak rate is a rate which exceeds 50% or falls below 50% of the estimated or market analysed rate by the Department at the time of acceptance of tender.

25.2. In case, rates quoted are considered freakishly low and where it is found inescapably necessary during execution to decrease the quantities of such items by more than 5% of quantities catered in the tender, the rates for the decreased quantities shall be adjusted as per actuals and regularised as a separate Deviation Order for the quantity not executed against such item(s) to avoid any unintended benefit to the contractor. This shall apply even in case the freak low item(s) is/are not operated at site.

25.3. In case, rates quoted considered freakishly high and where it is found inescapably necessary during execution to increase the quantities of such items by more than 5% of the quantities catered in the tender, the rates for the same shall be restricted as per actuals and regularised as a separate Deviation Order for the excess quantity executed against such item(s) to avoid unintended benefit to the contractor. This shall not apply in case the freak high item(s) is/are not operated at site.

25.4. In case, the quantities of freak low rate items increase beyond he quantities catered for in the tender and the quantities of freak high rate items decrease below the quantities catered in the tender, no price adjustment / restrictions shall be done.

25.5. Decision of the Accepting Officer with regard to Freak Low / Freak High Rates, restrictions / adjustments as mentioned above shall be final, conclusive and binding. No claim whatsoever shall be entertained by the Department.

26. NOTES FOR SOLAR POWER PLANT:

26.1. Scope of work under Schedule "A" i.e. Solar Power Plant Works caters for all work starting from photovoltaic modules up to connection of bus bar with bus bars at 11 KVA MRS [Main Receiving Station] complete including designing, supplying, installation, testing and commissioning of plant, designing & supplying of mounting steel structure, foundations, all connected civil works, excavation, earth work, control cables from various equipment of solar plant to SCADA system, SCADA system with data cables, designing & supplying of lightening protection including earthing, shadow analysis, comprehensive maintenance and outsourcing of operation of plant and SCADA system for 12 months after completion of Phase-I works.

26.2. The cost of outsourcing of operation of complete Solar Power Plant provided under this contract for One Year after certified date of completion shall be deemed to be included in rate quoted by the contractor against BOQ / Schedule "A". The outsourcing of operation shall be deemed to include for smooth & efficient functioning of Solar Power Plant and SCADA complete all as directed and specified hereinafter. 10% of the quoted amount of Solar Power Plant on account of outsourcing of operation of plant and SCADA for one year, in addition to other reserve / recoveries, shall be retained from the final RAR / Final Bill, which shall be released only after certification of satisfactory completion of outsourcing of operation for one year by the GE for the works included in BOQ / Schedule "A". The contractor may deposit FDR in lieu of 10% of the quoted amount in favour of GE for this period.
SCHEDULE "A"
[List of Items of Work] [Continued]

27. **COMPLETION:**

27.1. Work Order No. 1 indicating date of handing over site, date of commencement & completion of works shall be issued be GE after acceptance of tender. The works shall be taken over by the GE after certified date of completion and shall be handed over to contractor immediately for outsourcing of operation of complete plant. The cost of outsourcing of operation of Solar Power Plant installed under this contract for one year from certified date of completion of work shall be deemed to be included in the rate quoted against Solar Power Plant in item of BOQ / Schedule "A", for which no separate work order shall be issued, however the contractor shall carry out operation as per directions of Engineer-in-Charge/GE and as specified in tender documents hereinafter.

27.2. Solar Plant for outsourcing of operation will be handed over after physical completion of entire work. No claim on account of delay in completion of other works catered under subject tender resulting delay in commencement of outsourcing of operation of plant shall be entertained.

27.3. The Defects Liability Period of One Year shall commence after physical completion of entire work under this tender as certified by GE [Condition – 46 of IAFW – 2249 refers].

28. After acceptance of tender, contractor shall ensure to submit his Provident Fund Account No. to GE within a week’s period. Neither any work shall be allowed to be commenced nor shall any payment be released till EPF Code No. is submitted by the contractor to GE. No claim whatsoever shall be entertained due to delay in commencement of work on this account. In case contractor fails to submit EPF Code No. to GE, action for cancellation of contract shall be taken. It shall be ensured by contractor and GE that all provisions of EPF & MP Act 1952 are complied with in letter & spirit.

29. All designs, specifications, reports etc. submitted or used by the Contractor at any point of time shall first be approved by the GE and revised by GE, if required, prior to execution.

30. All construction, operation and maintenance shall be carried out as per appropriate relevant standards, regulations laid by MNRE / SECI / NVVN/ RERC / CEI / CEA and / or any other agency as applicable. Further, contractor shall comply with the applicable labour laws and take necessary safety measures during construction and O & M period.

31. Material warranty for 10 Years and performance warranty for 25 Years for PV Modules as specified hereinafter shall be obtained by contractor from manufacturers of PV modules and shall be submitted to GE before completion of work. Contractor as well as manufacturers of PV Modules shall be fully responsible for quality as well as performance of PV Modules. In case PV Modules are found defective / underperforming during these periods, same shall be replaced by the contractor without any extra cost to the Government. In case the manufacturer of PV Modules fails to replace the same, necessary case for action against the manufacturer shall be taken up by the department with MNRE / appropriate authority.

32. 10% of the quoted amount of Solar Power Plant shall be retained from contractor’s dues as Performance Warranty for 5 Years from date of completion of work. Alternatively the contractor may also submit the Security Deposit in the shape of FDR from a Scheduled Bank in favour of GE for equal amount of Performance Warranty.
SCHEDULE "A"

LIST OF ITEMS OF WORK [Continued]

33. For carrying out HT Electric works [new as well as maintenance / repair works], contractor shall employ person having electrical license from competent authority for carrying out 11 KV HT electric works. GE shall not allow the contractor to commence HT works without satisfying himself that contractor has employed such person[s] and necessary documents produced by contractor in this regard shall be kept on record.

34. After completion of works, the entire site of work shall be cleaned all as per provisions specified in MES Schedule Part – I [2009]. Contractor’s rates shall be deemed to include for levelling / cleaning of complete area, clearing of bushes/ shrubs and grass, removal of any debris as directed by Engineer-in-Charge, removing cement splashes, white wash splashes on floors, walls etc. Contractor shall handover the premises neat & clean.

35. Immediately after acceptance of tender, contractor shall submit the following:

35.1. Schematic diagram of the complete Solar Power Plant indicating various items / equipment to be provided, detailed technical specifications and make of each item / equipment [Viz PV Modules, SCB, PVC Pipe, DC Cables, Inverter, Panel, MCCBs, ACB, VCBs, Transformer, HT cables, Bus Bars, Structural steel, Cement, Steel Poles, GOD, LED Flood Lights, LT Cables, SCADA, Data Cables, Lightening Arrester etc.] which he proposes to provide in the work, to Accepting Officer for his approval. Procurement action and commencement of work shall be undertaken only after approval of scheme as well as other details by Accepting Officer.

35.2. The Contractor shall carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labour. The drawing given in the CA is tentative and shall be amended as designed by the contractor and approved by Accepting Officer. The Contractor shall submit the array layout drawings along with Shadow Analysis Report to Accepting Officer for approval. Accepting Officer reserves the right to modify the landscaping design, Layout and specification of sub-systems and components as per local site conditions/requirements.

35.3. The contractor shall submit preliminary drawings for approval based on any modification or recommendation, if any. The contractor shall submit Three Sets and Soft Copy in CD of Final Drawing for formal approval from Accepting Officer to proceed with construction work.

35.4. Design of Modules / Array Mounting Steel Structure with concrete foundation / grouting work shall be duly vetted from Government Engineering Colleges / IITs / NITs.

36. On receipt of PV Modules at site of work, GE shall select randomly minimum 50 Nos of PV Modules and will send for testing to labs as mentioned hereinafter so as to ascertain the quality of PV Modules. In case contractor brings PV Modules in different lots, suitable number of modules from each lot shall be selected by GE for carrying out testing. The cost of transportation, testing etc. shall be deemed to be included in the unit rates quoted by the contractor.

37. DRESS CODE: The staff engaged by contractor during execution [viz Supervisor, Site Engineer[s] and during maintenance and operation period [Supervisors, Technicians, Guards etc.] shall wear the dress as directed by Engineer –in-charge. The name plate in black background and name written in white letter
shall be worn by the staff on left side of the chest. The contractor shall be responsible to provide proper
dress to all staff employed.

**SCHEDULE "A"**

[List of Items of Work] [Continued]

38. **RECORD DRAWINGS:** On completion of work, the contractor shall submit the tracing [on cloth], three
copies of layout with details of equipments etc for record. The quoted rate shall be deemed to include
this provision.

39. Road / track cutting for laying/passing the pipes/cables if any required to be done by the contractor shall
be made good by him [as directed by the GE] using material obtained from cutting and the top surface
shall be finished to match with existing surfaces and as directed by Engineer-in-charge. The cost of
cutting, filling and finishing shall be shall be deemed to be included in the unit rates quoted by the
contractor.

40. **TRAINING OF PERSONNEL FOR OPERATION & MAINTENANCE:** The contractor’s quoted rate shall be
inclusive of the charges for imparting training of One Month to MES / User’s staff to run and maintain the
Plant and SCADA System.

41. **TECHNICAL SUPPORT:**

41.1. For technical support as well as execution of work of solar power plant, the contractor shall enter into
MOU with approved firm approved by Ministry of New & Renewable Energy [MNRE]/ firms accredited by
MNRE [hereinafter referred to as “Channel Partner”]. No additional payment on this account shall be
made to the contractor by the department.

41.2. The contractor shall ensure that the Channel Partner [to execute the work] shall be the one with whom
MOU has been submitted prior to receipt of tender. However, in case the said Channel Partner fails to
perform his obligations as per MOU, the contractor may be allowed to get the work executed through
any other Channel Partner approved by MNRE, after acceptance of tender with prior approval of
Accepting Officer. However in such cases, matter shall be taken up by the Accepting Officer / Department
with appropriate authority for disciplinary or other suitable action against the defaulting Channel Partner.
The contractor shall also be at liberty to take any action against such channel partner. No claim
whatsoever and / or extension of time on this account shall be admissible to contractor. Contractor shall
be responsible for completion of the project strictly as per the terms and conditions of the Contract
Agreement and no claim whatsoever on any account shall be entertained in this regard.

41.3. Irrespective of the fact that MOU is signed by contractor with a channel partner, contractor shall be fully
responsible for quality of all the materials /equipments used in the project as well as overall output of the
plant.

41.4. The rates quoted by the tenderer[s] against item of Schedule "A" shall be deemed to include for any item
/ part / equipment considered essential for achieving desired output of Solar Plant and/or workmanship
as per relevant codes though not specifically mentioned in BOQ/ Particular Specifications or shown on
drawing[s]. In case of difference of opinion as to whether or not such item of work included in the unit
rate, the decision of the Accepting Officer in this regard shall be final, conclusive and binding.

41.5. All items/ equipments provided shall be SCADA compatible.

41.6. The rates quoted by the tenderer[s] against item of Schedule "A" shall be deemed to include for
Excavation, Earthwork, Sand Cushioning, Cable Cover and Cable Route Indicator for HT Cable etc.
41.7. Before issuing completion certificate of Solar Power Plant work, the testing of complete plant shall be carried out by contractor in the presence of representative of Accepting Officer. All equipments etc. required for testing shall be arranged by the contractor.

**SCHEDULE "A"**

[List of Items of Work] [Continued]

41.8. Contractor shall be responsible for ensuring production of minimum electricity from the Solar Plant in the range of 18.00 Lakh units to 18.50 Lakh units after completion. In case output is less than 18.00 Lakh units, an amount @ prevailing rate of electricity per unit of Andhra Pradesh State Electricity Board during the period shall be levied as a penalty for the number of units less than 18.00 Lakh [Rate of electricity of Andhra Pradesh State Electricity Board as on date is Rs. 8.20/Unit]. However in case the output is more than 18.50 Lakh units during 1st year, an incentive of Rs. 0.50 per unit for the additional units of electricity produced during 1st year shall be given to the firm.

42. **NOTES APPLICABLE FOR OUTSOURCING FOR OPERATION OF 1 MW SOLAR PLANT AND SCADA FOR ONE YEAR AFTER COMPLETION OF ENTIRE WORK i.e. DURING DEFECT LIABILITY PERIOD:**

42.1. Scope of work under this contract comprises of outsourcing of operation of 1 MW Solar Plant and SCADA System. The Schedule "A" lists out the scope in brief and further amplified in succeeding Paras for efficient & smooth functioning of the system to meet the desired output of electricity and to have the requisite data. The cost of outsourcing of operation of Solar Power Plant installed under this contract for one year from certified date of completion of work shall be deemed to be included in the rate quoted against Solar Power Plant in item of BOQ / Schedule "A".

42.2. The contractor shall advise his operating personnel to take all precautions and always be alert so as to prevent any accident. In case of any accident / injury, or partial disability to his employee, the contractor shall be solely responsible for setting all claims / compensation. Department will have a right to recover any sum indicated/ penalty imposed by Labour Commissioner / Court directives. Contractor shall get his staff / labour insured.

42.3. Initially after completion of work, the installations shall be taken over by the department but immediately, the installation with an inventory of various items, equipment & electrical fittings will be handed over to contractor for proper maintenance & upkeep.

42.4. The tenderer shall submit names of the workers to be employed with their qualifications and police verifications for comprehensive maintenance and operation of the plant and SCADA system for providing security passes by Engineer-in-charge after necessary scrutiny / check by the Security Agency. Contractor's rate shall be deemed to include above aspect.

42.5. The installation standing orders and defence area's security rules as intimated by GE/ Engineer-in-Charge will be strictly adhered to by the contractor and his employees. Any violation by the contractor’s employees will be severely dealt with including handing over them to police custody especially if any individual is found in intoxicated condition. Contractor shall ensure compliance & strictly warn the individuals on this account.

42.6. The installation shall be totally under the control of contractor. Solar Plant & SCADA system shall be kept fully functional and contractor shall ensure repair / replacement of equipment / part thereof if any, immediately at no extra cost to department.

42.7. The installation shall be frequently visited by the MES officers. It shall be contractor’s responsibility for proper upkeep of the area in a presentable state all the time. Surrounded areas up to the fencing of Solar Plant shall be kept clean and cleared of bushes / shrubs and grass all the time to give a neat & clean appearance of the area.
42.8. It shall be contractor’s responsibility to guard complete premises as well as installation against any theft, damages by animals/ unwanted elements round the clock on all days including Sunday and Holidays. It shall be ensured by the contractor that no unauthorised person is allowed to enter the premises. Contractor’s quoted rates shall be deemed to include for the same.

42.9. Outsourcing for operation shall be got done through trained and skilled staff for effective & safe working of the solar system plant. In case any laxity is noticed by the GE on the part of contractor in operation of plant efficiently and which in the opinion of GE, may affect output of the plant and/ or safety of electrical installations, immediate corrective action[s] as directed by GE shall be taken by the contractor. GE’s decision in this regard shall be final and binding.

42.10. During the operation and Defect Liability Period of Solar Plant, MNRE / MES / Users will have all the rights to cross check the performance of the Solar PV Power Plant. In case any PV module[s] is found under-performing, the same shall be replaced without any extra cost. GE may also randomly pick up PV modules to get them tested at Government / MNRE approved any test centre at the expense of contractor. If during such tests these are not found as per the specified technical parameters, GE will take necessary action to recover the losses and to blacklist the manufacturer of PV Modules firm and the same shall be communicated to MNRE and other nodal agencies. The decision of Accepting Officer in this regard will be final and binding on the tenderer. Cost of the same shall be deemed included in the quoted rates of contractor.

42.11. The maintenance / up keeping of of solar plant provided under this contract shall be done all as given in tender documents and as per schedule given in Annexure – I of Particular Specifications hereinafter and as directed by the Engineer-in-Charge and GE.

42.12. The contractor shall be liable to obtain an undertaking from the Channel Partner with regard to carrying out comprehensive maintenance for five year after completion of installation of solar plant.

42.13. The maintenance / up keeping shall be carried out by the contractor after the installation and testing of solar plant under the supervision of channel partner.

42.14. The contractor shall be fully responsible for maintaining the solar plant in operational condition in consultation with channel partner and the Engineer-in-Charge.

42.15. Any damage caused to the solar plant or any part thereof except for the accepted risks as per Condition – 48 of IAFW – 2249, shall be made good by the contractor under his own arrangement as per the specifications given in the contract without any extra cost to the Government.

42.16. The contractor shall be responsible for any claim whatsoever arising due to any reason for the workmen employed by him.

42.17. The contractor shall be responsible to verify the antecedents of the workmen employed by him and shall submit the copy of police verification to GE before employing them for the subject work/comprehensive maintenance and operation of solar plant.

42.18. The cost of Supply and replacement of worn out/defective parts, each and every type of repairs, renewals, servicing as per Annexure – I & submitting report as per Annexure – III for efficient, smooth and continuous functioning of solar plant shall be deemed to be included in the unit rates of Schedule of works / BOQ.
42.19. Repair / replacement of any equipment/machinery or part thereof provided under this contract shall be
got done under the supervision of channel partner and record thereof shall be maintained.

42.20. Sufficient reserve for required parts/spares and T & P shall always be kept at site all the time by
contractor for smooth & continuous functioning of solar plant.

42.21. Major repairs / overhauling etc. shall be notified to the GE immediately on occurrence. The cost of each
part / equipment replaced shall be deemed to be included in the unit rates quoted by the contractor. The
rates quoted under Schedule “A” shall be deemed to include for all materials and labour required for
comprehensive maintenance including repairs / renewal of all the components / equipments for keeping
the solar plant in operational condition.

42.22. The contractor’s staff deployed shall be fully conversant with various checks / maintenance needs of
various equipments installed including its frequency.

47.23. Contractor shall ensure that print out of complete data shall be taken out from SCADA once daily and a
copy of the same shall be submitted to the Engineer-in-Charge for record. Contractor’s unit rate shall be
deemed to be include all expenditure involved thereof.

Signature of Contractor
Date:

Jt. Director [Contracts]
For Accepting Officer
### SCHEDULE "B"
**ISSUE OF MATERIAL TO THE CONTRACTOR**

*See Condition – 10 of IAFW – 2249*

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Particulars</th>
<th>Rates at which stores will be issued to the contractor</th>
<th>Place of issue [by name for all items]</th>
<th>Remarks</th>
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</thead>
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<td></td>
<td>Unit</td>
<td>Rate in Rs.</td>
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<td>3</td>
<td>4</td>
<td>5</td>
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</tbody>
</table>

Nil

**Signature of Contractor**

Jt. Director [Contracts]

**Date:**

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*

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Quantity</th>
<th>Particulars</th>
<th>Details of MES crew supplied</th>
<th>Hire charges per unit per working day</th>
<th>Standby charges per unit per off day</th>
<th>Place of issue [by name]</th>
<th>Remarks</th>
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</thead>
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<tr>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

Nil

**Signature of Contractor**

Jt. Director [Contracts]

**Date:**

For Accepting Officer

### SCHEDULE "D"
**TRANSPORT TO BE HIRED TO THE CONTRACTOR**

*See Condition – 16 & 35 of IAFW – 2249*

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Quantity</th>
<th>Particulars</th>
<th>Rate per unit per working day</th>
<th>Place of issue [by Name]</th>
<th>Remarks</th>
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<tbody>
<tr>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Nil

**Signature of Contractor**

Jt. Director [Contracts]

**Date:**

For Accepting Officer
TENDER

To

The President of India

Having examined and perused the following documents:

1. Specifications signed by the Jt. Director [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 No. 1 to 3 and MES Standard Schedule of Rates 2010 [Part – II] "Rates" together with Amendments No. 1 to 41 [a], 42, 42 [a] to [k], 43, 43 [a] to [h], 44, 45, 45 [a] & [b], 46, 46 [a] & [b], 47, 47 [a] to [t], 48, 48 [a] to [h], 49, 49 [a] to [l], 50, 50 [a] to [r], 51, 51 [a], 52, 52 [a] to [h], 53, 53 [a] to [f], 54, 54 [a] to [z], 55, 55 [a] to [m], 56, 57, 58 & 59 for Part – II hereinafter referred as the MES Schedule.
5. General Conditions of Contracts IAFW – 2249 [1989 Print] together with Amendments No. 1 to 40 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 @ Rs. 76.79 per every One Thousand Litres of water consumption. Refer Special Condition No. 8 hereinafter.
7. Should this tender be accepted I / We agree:

[a] That the sum of Rs. 6,50,000.00 [Rupees six fifty thousand only] forwarded as Earnest Money shall be retained as part of Security Deposit or be refunded by the Government on receipt of the appropriate amount of Security Deposit all as per Condition – 22 of IAFW – 2249.

[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 the General Summary and to carry out such deviations as may be ordered vide Condition – 7 of IAFW – 2249 up to a maximum of 10% [Ten Percent] and further agree to refer all disputes as required by Condition – 70 of IAFW – 2249 to the Sole Arbitration of serving Officer having degree in Engineering or equivalent or having passed final / direct final examinations of Sub Division II of Institution of Surveyors [India] recognised by Government of India to be appointed by Engineer-in-Chief, Army Headquarters, New Delhi – 110 011 or in his absence the officer officiating as Engineer-in-Chief or Director General of Works if specifically delegated in writing by Engineer-in-Chief, Army Headquarters, New Delhi – 110 011 whose decision shall be final, conclusive and binding.

[c] Further agree to refer all the disputes to the extent restricted vide Special Condition No. 26 of tender documents to the Sole Conciliator viz., serving officer not below the rank of Superintending Engineer / Superintending Engineer [QS & C] having Degree in Engineering or equivalent or having passed final / direct final examination of Sub Division II of Institution of Surveyors [India] to be appointed by Engineer-in-Chief, Army Headquarters, New Delhi – 110 011 or in his absence the officer officiating as Engineer-in-Chief or Director General of Works if specifically delegated in writing by Engineer-in-Chief, Army Headquarters, New Delhi – 110 011 whose decision shall be final, conclusive and binding.

* To be deleted where not applicable.
TENDER [Continued]

Brought forward from BOQ on Serial Page No. 70, 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 Shri G Krishna Murthy, Joint Director [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 ____________________ 2017 on behalf of The
President of India for the Lumpsum of Rs. ________________________ [Rupees __________________
________________________________________________
________________________________________________ only].

Signature _________________________ Dated this ______________ Day of ______________ 2017.

Appointment: Chief Engineer [Navy]
Military Engineer Services
Station Road
Visakhapatnam – 530 004
For and on behalf of the President of India
1. A copy of the General Conditions of Contracts [IAFW – 2249], 1989 Print, with Errata 1 to 20 and Amendments No. 1 to 40 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 No. 1 to 40 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:

Jt. Director [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 10 March 1992 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

Jt. Director [Contracts]

Date:

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. Chases/holes, etc, made in concrete, brick work, stone masonry, floors and in any other situations for carrying out the various items of work as required or as directed by the Engineer-in-Charge shall be made good in the same mortar/concrete as specified for that portion of the work.

1.6. SITE CLEARANCE: Refer Condition – 49 of IAFW – 2249, General Conditions of contract. 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 lump sum quoted shall 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: THIS WORK LIES IN RESTRICTED AREA.

4.1. 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.

4.2. 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.

4.3. 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.

4.4. 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.

4.5. 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.
4.6. **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 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.

4.7. **WORKING HOURS:**

4.7.1. 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.

4.7.2. 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.

4.7.3. 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.

4.7.4. 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.

4.8. **WORKS ON HOLIDAYS:** The contractor shall not carry out 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.

4.9. **ACCESS TO RESTRICTED 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.

4.10. **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.

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 payable 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/- 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:


8.2. Water will be supplied by MES at the point[s] marked on site plan / as decided by the GE. 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 at Rs. 76.79 [Rupees seventy six and paise seventy nine only] per 1000 litres of water consumed.

8.3. The contractor shall ensure safety of water meter by providing necessary meter box with locking arrangement at his own cost. The key of the meter box shall be kept with the concerned AGE E/M for the subject work. Initial reading of water meter shall be recorded and signed jointly by the rep of the contractor and Engineer-in-Charge E/M in a pucca bound register. Necessary interim readings shall be recorded during the progress of work, duly signed by Engineer-in-Charge E/M and contractor's representative, so that the recovery towards water charges are made from each RAR payments.

8.4. As the water supply by MES is likely to be intermittent, the contractor shall make his own arrangements for storing the water required for the works, labour and workmen, etc. at his own expense. In the event of breakdown of MES supply of water or in the event of the said supply of water becoming intermittent and during summer season there is likelihood of no supply of water, the contractor shall make his own arrangements to bring water from his own source without stopping progress of work. The water so arranged shall be got tested from Govt. Engineering College / Govt. lab and got approved from GE before using in the work. The contractor shall have no claim whatsoever on account of extra expenditure incurred in bringing water from outside due to shortage of water with MES including testing of the same and his unit rate shall be deemed to include this aspect.”

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 carry out their part of the work, if any, under separate arrangements.
SPECIAL CONDITIONS [Continued]

10. **ELECTRIC SUPPLY:**

10.1. Electric supply required for the work shall be made available by MES at point [S] shown on site plan up to 50 KVA only. 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. 14.54 per unit for Lighting.

[b] At Rs. 14.54 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. **NET WORK ANALYSIS:**

11.1. 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.

11.2. 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.

11.3. 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.

11.4. The contractor shall mobilize and employ sufficient resources to achieve the detailed schedule daily within the broad framework 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.
11.5. The contractor shall provide CPM chart and revised CPM chart as and when required using appropriate management software. The contractor shall show the revised CPM chart along with all requisite details viz., material and labour etc., on computer / laptop at work site as and when required / demanded by the Garrison Engineer.

12. **SAMPLE OF MATERIALS:**

12.1. Refer Condition 10 of IAFW – 2249 and Clause 1.6 & 1.7 of MES Schedule Part – I. Add following at the end of Clause 1.7.3 of MES Schedule:

"Unless otherwise mentioned in the contract documents".

12.2. Materials provided by the contractor for incorporation in the works shall bear IS certification work. IS means Indian Standards as issued by the Bureau of Indian Standards. Wherever in the specification "IS" is referred to, it means the edition with all amendments, current on the due date of receipt of the tender documents. The materials listed hereinafter shall be out of the makes as specified therein and as approved by GE.

12.3. The tenderer is advised to inspect other materials which are displayed in the office of GE, before submitting his tender. The tender shall be deemed to have inspected the samples and satisfied himself as to the nature and quality of materials, required to incorporate in the work once he submits his quoted tender irrespective of whether he has actually inspected them or not. The materials to be incorporated in the work by the contractor shall be ISI marked or shall be superior in quality to sample displayed and shall comply with the specifications given hereinafter.

12.4. The contractor shall not procure materials unless the samples are first got approved from the Garrison Engineer in writing.

12.5. Samples of all the materials required from completion of for entire contract shall be produced by the contractor to GE in stages for approval within a period of one month from the date of commencement of work as per Work Order No. 1. Accordingly, CPM chart shall reflect the target date by which samples are to be produced by the contractor.

12.6. The contractor shall submit a list of various materials / equipment to the GE within 02 weeks of acceptance of tender, for which samples are required to be got approved from GE in this work and the list shall be returned to contractor duly approved by GE immediately but not later than 07 days of receipt of the same with a copy to Accepting Officer. The list so approved by GE shall not be final but will serve as a guide only. It is contractor’s responsibility to produce samples of all the materials for approval of GE before incorporation of the materials in the work. If it is found that any material has been incorporated in the work by the contractor without getting the sample approved from GE, GE shall be at liberty to reject the same at any time without assigning any reason. Contractor shall have to remove / demolish the same without any extra cost. No claim of contractor shall be entertained on this account.

12.7. **PROPRIETARY MATERIALS:**

12.7.1. The contractor shall ensure that proprietary materials such as paint, Water proofing compound and chemical for Anti Termite Treatment and the like 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.
SPECIAL CONDITIONS [Continued]

12.7.2. 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.

12.7.3. 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 effect 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 contractors 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.

12.7.4. When the cost of each category of materials is less than Rs. 500.00, production of vouchers may not be insisted upon if the GE is otherwise satisfied with the quality of materials.

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

12.7.6. 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.

13. RECORD OF CONSUMPTION OF CEMENT:

13.1. The contractor shall maintain a pucca bound register with serially numbered pages with all pages initialed by Engineer-in-Charge against numbering, 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.

13.2. 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].

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

14. PERIOD OF KEEPING THE TENDER OPEN: The tender for the works shall remain open for acceptance for a period of 60 [Sixty] Days from the next date subsequent to last date of bid submission.
SPECIAL CONDITIONS [Continued]

15. ADVANCE ON ACCOUNT OF MATERIAL WHICH DOES NOT LOOSE IDENTITY [Condition 64 of IAFW – 2249 – Advance on account]:

15.1. Add the following in continuation of Para 8 of Condition 64 of IAFW – 2249 "provided further the contractor may be paid advance on account of the full value of the under mentioned materials brought on the site, on his furnishing guarantee bonds from a schedule bank for the amount of Retention Money which should otherwise be recoverable from him under the contract":

[a] Factory made Door, Window, Ventilator, Chowkats and Shutters
[b] Builders Hardware
[c] Sanitary fittings
[d] Electrical fittings & fixtures
[e] Water supply pipes, fittings & fixtures
[f] LT Cables
[g] Any non perishable materials which do not loose its identity, at the discretion of GE.

15.2. The Bank Guarantee Bonds shall be executed 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 if and when necessary, as directed by the Accepting Officer or shall furnish fresh guarantee bond of similar value.

15.3. It may be noted that the advance on account to the full value of materials brought on the site is permissible only in respect of fittings and fixtures and other manufactured items which do not loose their identity. Materials like bricks, aggregate, cement, paints, pre cast-concrete and similar items shall not be taken in the list.

16. SECURITY OF CLASSIFIED DOCUMENTS: Contractor’s special attention is drawn to Condition 2A and 3 of IAFW – 2249 [General Conditions of Contracts]. The contractor shall not communicate any classified information regarding the work either to sub-contractor or other 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 work and shall return all documents on completion of the works or earlier on termination of the contract. The contractor shall along with the final bill attach a receipt of his having returned the classified documents as per Condition 3 of IAFW – 2249 [General Conditions of Contracts].

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

18. RECORD OF MATERIALS:

18.1. The quantity of materials such as paints, bitumen, bituminous felt, water proofing compound, chemical for anti-termite treatment and the like, as directed by the Engineer-in-Charge [The quantity of which cannot be checked after incorporation in the work] 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. Batch No./ Lot No. mentioned on packing of the items shall also be recorded in the MB.

18.2. 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.

18.3 The contractor shall produce to the GE, original receipted vouchers/invoices in respect of the supplies. The vouchers / invoices so produced and verified shall be stamped by Engineer-in-Charge indicating contract number, name of work under his dated signature. The contractor shall ensure that the materials are brought to site in original sealed containers / packing, bearing manufacturer marking except in the case of the requirement of material being less than smallest packing.
18.4 Contractor shall produce vouchers / invoices in original from the manufacturers and / or their authorised distributors only for the full quantity of the following materials as applicable and any other item as asked by Accepting Officer / GE as pre-requisite before submitting claims for payment of advances on account of the work done and / or materials collected in accordance with Condition 64 of General Conditions of Contracts IAFW – 2249:

[a] Water proofing compound  
[b] Chemical for anti termite treatment  
[c] Synthetic enamel Paint, Bitumen, Distemper and Cement based Paint  
[d] UPVC pipes and fittings  
[e] Sanitary fittings  
[f] Factory made Door, Window and Ventilator, Chowkats & Shutters  
[g] Builders Hardware  
[h] Sheet glass  
[i] Polished Cuddapah stone  
[j] RCC Jali  
[k] Electrical and water supply fittings and fixtures.  
[l] Floor and wall tiles  
[m] Cables / wires  

19. **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. For the purpose of the condition, Plant / equipment, vehicle No. i.e. of trucks and lorries but neither the work-man's tools nor any manually operated tools/equipment shall 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.  

20. **RELEASE OF ADDITIONAL SECURITY DEPOSIT:** Refer Condition 22 and 68 of IAFW – 2249.  

20.1 The contractor, in case he has to deposit additional security for the contract, is advised to deposit the additional security in two equal parts so as to facilitate its release in accordance with Condition 68 of IAFW – 2249.  

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.
SPECIAL CONDITIONS [Continued]

22. **GST ON WORKS CONTRACTS BY STATE GOVERNMENT**: The tenderers Lumpsum shall deemed to include the GST levied by the State Government as fixed from time to time and no claim on account of GST shall be admissible. Tender will be considered non-bona fide if any stipulation is made by the tenderers in this regard and tender will be liable for rejection. As per State Government GST Act, tax at applicable percent will be deducted at source by GE as per State Government Orders issued from time to time. Contractor’s unit rate / Lumpsum amount shall be deemed to include this aspect and nothing extra shall be payable to contractor on this account.

23. **LABOUR WELFARE TAX / CESS**: The Lumpsum 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 equipments 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.

24.2. In addition to the above equipments/ 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 equipments / 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 equipments / 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 equipments / 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 equipments shall be carried out only after taking written approval from GE.

24.5. The above said equipments/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 equipments / instruments from the site.
SPECIAL CONDITIONS [Continued]

24.7. All equipments / 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 equipments 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 equipments/instruments including calibration etc, as specified above shall be included in the lump sum and no extra payment for any deviation on this account shall be paid to the contractor.

24.9. For further details refer Clause No. 45.4 of Particular Specifications.

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 unsatisfactory 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. 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. CONCILIATION:

26.1. SCOPE OF CONCILIATION: The scope of conciliation shall be restricted to the following types of disputes with financial limits as indicated therein:

[a] Disputes relating to levy of compensation for delay in completion – Actual amount of compensation.
[b] Disputes relating to technical examination of works.
[c] Disputes relating to interpretation of the provisions of the contract with reference to their application to parties.
[d] Disputes relating to non-return of Schedule "B" stores over issued to contractor.
[e] Any other disputes having fair chances of being resolved by conciliation and considered fit to be referred to conciliation by the parties.

For item [b], [c], [d] and [e] each as stated above the financial limit shall be Rupees two lakh or one percent of the contract amount whichever is less.

26.2. COMMENCEMENT OF CONCILIATION PROCEEDINGS:

26.2.1. The party initiating conciliation shall send to the other party a written invitation to conciliate briefly identifying the subject of the dispute.

26.2.2. Conciliation proceedings shall commence when the other party accepts in writing the invitation to conciliate.
26.2.3. If the other party rejects the invitation, there will be no conciliation proceedings. If the party initiating conciliation does not receive a reply within 30 days from the date on which he sends or within such other periods of time as specified in the invitation, he may elect to treat this as a rejection of the invitation to conciliate and if he so elects, he shall inform in writing the other party accordingly.

26.3. **NUMBER OF CONCILIATORS:** There shall be a Sole Conciliator.

26.4. **STATUS OF EFFECT OF SETTLEMENT AGREEMENT:** The settlement agreement signed by the parties as a result of conciliation proceedings shall have the same status and effect as it is an arbitral award on agreed terms.

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 shall 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.

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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 finalisation 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/ finalisation 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 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:

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>[a]</td>
<td>Job No.</td>
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<tr>
<td>[b]</td>
<td>C. A. No and Year</td>
</tr>
<tr>
<td>[c]</td>
<td>Amount of CA</td>
</tr>
<tr>
<td>[d]</td>
<td>Name of the Work</td>
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<td>[e]</td>
<td>Name of Contractor</td>
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<td>[f]</td>
<td>Name of GE</td>
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<tr>
<td>[g]</td>
<td>Name of Engineer-in-Charge / JE</td>
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<tr>
<td>[h]</td>
<td>Date of Commencement</td>
</tr>
<tr>
<td>[i]</td>
<td>Date of Completion Phase wise</td>
</tr>
<tr>
<td>[j]</td>
<td>Date of Expiry of Defects Liability Period</td>
</tr>
<tr>
<td>[k]</td>
<td>Date of Expiry of Warranty period given for works like ATT/ Water Proofing.</td>
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</table>
31. **PROJECT SIGN BOARD:** Project sign board of size 1200 mm X 900 mm 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 45 X 45 X 5mm, 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 0.30 X 0.30 X 0.20 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 Lumpsum 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 Sales Tax / VAT on Materials, Sales Tax / VAT on Works Contract, Turnover Tax, Service Tax, Labour Welfare Cess / Tax etc.], Duties, Royalties, Octroi & 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 32.2 herein below.

32.2. **[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 Sales Tax / VAT on Works Contracts, Turnover Tax, Service Tax, Labour Welfare Cess / Tax 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.
SPECIAL CONDITIONS [Continued]

[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. OUTPUT OF ROAD ROLLERS:

33.1. [Refer Condition – 15 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.

33.2. 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.

33.3. 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] 23/20 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] : 175 Sq.m

[iii] 11.5 cm [Compacted Thickness] : 248 Sq.m

[d] Consolidation of Premixed Carpet Including Seal Coat:

[i] 20 mm thick [Compacted Thickness] : 744 Sq.m
SPECIAL CONDITIONS [Continued]

[ii] 25 mm thick [Compacted Thickness] : 600 Sq.m
[iii] 40 mm 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] 4.0 cm [Compacted Thickness] : 372 Sq.m
[e] Consolidation of 15 cm thick [Spread Thickness] Earthen / Moorum Berms : 1800 Sq.m
[f] Premixed Bituminous Macadam : 15 Cu.m
[g] Semi Dense Asphaltic Concrete : 18.40 Cu.m

Note: 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 trail area which will be the basis for the corresponding works.

33.4. 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.

33.5. 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.
PARTICULAR SPECIFICATIONS

1. WORK IN ACCORDANCE WITH DRAWINGS AND SPECIFICATIONS:

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 [2010] [Rates] [hereinafter 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 hereinbefore 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.

1.4. The Particular specifications shall be read in conjunction with special conditions and general conditions of contracts [IAFW-2249] and IAFW-2159 including errata and amendments thereof. If any provision in these particular specifications is at variance with that of the aforesaid documents, the former shall be deemed to take precedence there over.

1.5. MAKING CHASES / HOLES, ETC IN WALLS AND OTHER SITUATIONS: Chases/holes, etc, made in concrete, brick work, stone masonry, floors and in any other situations for carrying out the various items of work as required or as directed by the Engineer-in-Charge shall be made good in the same mortar/concrete as specified for that portion of the work.

1.6. SITE CLEARANCE: Refer Condition 49 of IAFW-2249, General Conditions of Contracts. The contractor shall remove from the site all unused stores and materials, tools and plants, equipment, scaffolding, temporary buildings, huts and like belonging to the contractor provided for the execution of the work under this contract and the site of work shall be cleared off 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 shall be paid to the contractor for such clearance of site and the lump sum quoted shall deem to be including the same.

2. EXCAVATION AND EARTH WORK [FOR SCHEDULE “A” PART – I]

2.1 PREPARATORY WORK:

2.1.1. 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.

2.1.2. 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. The depth of foundation shown in drawing shall be after surface excavation only. The lump sum quoted by the contractor for Schedule “A” Part – I shall include for this provision.
PARTICULAR SPECIFICATIONS [Continued]

2.1.3. **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. Area around outer edge of building / structure shall be dressed to slope away from the buildings as directed by Engineer –in-Charge. The lump sum quoted by the contractor for Schedule “A” Part – I shall include for this provision.

2.2. Unit rates in Schedule “A” Part – I are to be arrived at 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 order 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 arrived based on the Lumpsum quoted by the tenderer for Schedule “A” Part – I for valuation of deviations.

2.3. 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 without any extra cost to Department.

2.4. BLANK.

2.5. Boulders and stones obtained from excavation shall be sorted out and neatly stacked as directed by Engineer-in-Charge, without any extra cost to the Government. These boulders and stones in stack shall be handed over to MES store yard and it shall become the property of the Government or the same shall be offered to the contractor under Schedule of Credit.

2.6. If rock [soft / disintegrated and or hard] is met with at site, contractor shall immediately notify the fact to the GE in writing, who will after due verification, regularize the change through a proper deviation order / new item. The nature and type of rock met with, will be decided by the GE whose decision shall be final and binding. If the nature of rock met with is “Hard rock “, the rock so obtained shall be neatly stacked as directed by the Engineer-in-Charge, without any extra cost to Government. These rocks shall be handed over to MES store yard and it shall become the properties of Government and shall be entered in the measurement book duly signed by the contractor and Engineer-in-Charge.

2.7. When expansive or other unsuitable soil is met within foundations, the matter shall be brought immediately to the notice of GE by the contractor. Any additional work considered necessary as a consequence there of viz, strengthening of soil etc, shall be ordered in writing as a deviation / new item.

2.8. **DEWATERING**

2.8.1. No extra payment over the lump sum amount quoted for buildings and services 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.

2.8.2. In the event of deviation, no price adjustment shall be made for cost of bailing, pumping etc, and dewatering as specified herein before whether these are actually required and done at site or not.

2.9. **DISPOSAL OF SOIL**: Surplus soil / useless soil obtained from surface dressing shall be removed, deposited and leveled at places, distance not exceeding 50m as directed by the Engineer-in-Charge, without any extra cost to Department.

2.10. **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. 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.
2.11. **FILLING UNDER FLOORS:**

2.11.1. 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.

2.11.2. 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 earth from the places approved by the Engineer-in-Charge, without any extra cost to the Government.

3. **PRE-CONSTRUCTION ANTI TERMITE CHEMICAL TREATMENT:**

3.1. 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 buildings covered under Schedule "A" Part – I. 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.

3.2. Anti termite treatment shall be carried out with emulsion of chemical Chloropyrifos 20 % EC [IS – 8944], as per IS – 6313 Part – I & II. 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.

3.3. 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.

3.4. 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.,

3.5. 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.
PARTICULAR SPECIFICATIONS [Continued]

3.6. 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 Lumpsum quoted for the buildings.

3.7. 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.

3.8. [a] The chemical shall be procured only from manufacturers or their authorised agents/dealers.

[b] Chemicals brought to site in sealed containers bearing ISI Certification Marks shall only be permitted to be used.

[c] Chemicals shall be stored carefully at site. Seal of the containers shall be broken only in the presence of the Engineer-in-Charge. Empty containers should be got removed off the site promptly. If on any particular day the contents of full containers could not be used in the work, the containers should be got sealed at the end of the day in the presence of Engineer-In-Charge and opened when required, also in the presence of the Engineer-In-Charge.

[d] The Engineer-in-Charge should ensure that paid voucher for the full quantity of chemicals required are brought to site and a record of such vouchers should be kept by the Engineer-In-Charge.

[e] Tests may be carried out in a recognised laboratory or test house at the discretion of the GE, of the chemical brought by the agency executing the work, to satisfy that spurious materials are not being used.

[f] Copy of IS – 6313 Part – I & II of 2001 should be available at site.

3.10. The amount of security deposit for anti-termite-treatment to be carried out for the buildings included in Schedule "A" Part – I against guarantee period for Anti-termite-treatment shall be 3% of the cost of the anti-termite-treatment as decided by the GE which 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 in which case the amount if any, deducted from the dues/final bill shall be refunded.

4. CONCRETE:

4.1. 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 manufactures certificate for material.
[b] Concrete mix design details.
PARTICULAR SPECIFICATIONS [Continued]

[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.

4.2. **COARSE AGGREGATE:**

4.2.1. 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, Stone for coarse aggregate shall be obtained from quarries approved by the Garrison Engineer. Mixture of two types shall however, not be used. Nominal sizes of graded stone aggregate in various situations shall be as indicated hereinafter.

4.2.2. 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.

4.3. **FINE AGGREGATE:**

4.3.1. 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. Sand shall be obtained from the riverbeds approved by the GE.

4.3.2. 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.

4.4. **WATER:** Water used in the work shall be clean, fresh, potable and non-saline all as specified in IS – 456 and in clause 4.9 of MES Schedule Part – I.

4.5. **CEMENT:**

4.5.1. **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.

4.5.2. Type of cement for the subject work shall be Ordinary Portland Cement Grade 43 [Forty Three] in accordance with IS – 8112 or Portland Slag cement conforming to IS – 455 or Portland Puzzolona Cement [PPC] as per IS – 1489 [subject to conditions mentioned hear-in-after] at the option of contractor without any price adjustment unless otherwise mentioned in structural drawings forming part of the tender documents. However one type of cement shall only be used in the entire work.

4.5.3. When the contractor opts for using PPC in the work, GE can allow incorporation of PPC subject to following:

[a] GE is required to ensure that PPC meets the strength criteria of 43 Grade OPC as laid down in IS – 1812.

[b] The minimum period before striking formwork given in clause 11.3.1 of IS – 456 is to be suitably modified at sites by the GE.
PARTICULAR SPECIFICATIONS [Continued]

c] The contractor shall give an undertaking that he shall not claim anything extra whatsoever on account of extra time for stripping form work etc while using PPC in lieu of OPC.

d] In cold climate regions where temperature is lower than 15˚C and important structures like Over Head Reservoirs, Under Ground Sumps and Buildings with spans 10m or more only OPC shall be used.

e] Mixing of OPC and PPC shall not be allowed in work except for plaster and mortar.

f] 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.

4.5.4 SOURCES OF PROCUREMENT:

4.5.4.1. Cement shall be procured by the contractor from any of the following main producers:

[i] M/s. Cement Manufacturing Company Ltd. [OPC 43 Grade & 53 Grade & PPC]

[ii] M/s. Ultra Tech Cement Ltd. [OPC 43 Grade & PPC & PSC]

[iii] M/s. OCL India Ltd. [OPC 43 Grade & PPC]

[iv] M/s. Dalmia Cement [Bharat] Ltd. [OPC 43 Grade & PPC]

[v] M/s. Chettinad Cement Corporation Ltd. [OPC 43 Grade & PPC & PSC]

[vi] M/s. Heidelberg Cement India Ltd. [PPC]

[vii] M/s. My Home Industries Ltd. [OPC 43 Grade & PPC & PSC]

[viii] M/s. Parasakti Cements Ltd. [OPC 43 Grade & PPC]

[ix] M/s. Zuari Cement Ltd. [OPC 43 Grade & PPC]

[x] M/s. Toshali Cements Pvt. Ltd. [OPC 43 Grade & PPC & PSC]

[xi] M/s. Saizfoo Cement Pvt. Ltd. [OPC 43 Grade]

[xii] M/s. Prism Cement Ltd. [OPC 43 Grade & PPC]


[xiv] M/s. Barak Valley Cements Ltd. [OPC 43 Grade]

[xv] M/s. Dhruv Industrial Company Ltd. [OPC 43 Grade]

[xvi] M/s. Madras Cement Ltd. [OPC 43 Grade & PPC]

[xvii] M/s. Saurashtra Cement [OPC 43 Grade & PPC]

[xviii] M/s. Lafarge Cement [OPC 43 Grade & PPC]

[xix] M/s. Associated Cement Companies Ltd. [OPC 43 Grade & PPC]

[xx] M/s. Grasim Industries Ltd. [OPC 43 Grade & PPC]

[xxi] M/s. The India Cement [OPC 43 Grade & PPC]

[xxii] M/s. Andhra Cement Ltd. [OPC 43 Grade & PPC]

[xxiii] M/s. Century Cements [OPC 43 Grade & PPC]

[xxiv] M/s. Binani Cement [OPC 43 Grade & PPC]

[xxv] M/s. Mangalam Cement [OPC 43 Grade & PPC]

[xxvi] M/s. Birla Corporation Ltd. [OPC 43 Grade & PPC]

[xxvii] M/s. Orient Cement [OPC 43 Grade & PPC]
PARTICULAR SPECIFICATIONS [Continued]

[xxviii] M/s. Shree Cement [OPC 43 Grade & PPC]
[xxix] M/s. JK Cement [OPC 43 Grade & PPC]
[xxx] M/s. JK Lakshmi Cement [OPC 43 Grade & PPC]
[xxxi] M/s. Jaypee Rewa Cement [OPC 43 Grade & PPC]
[xxxii] M/s. Ambuja Cement Ltd. [OPC 43 Grade & PPC]
[xxxiv] M/s. Sanghi Industries Ltd. [OPC 53 Grade & PPC]

4.5.4.1.1. Where total estimated requirement of cement in the work is less than 1200 bags, contractor can procure cement from the authorised dealers of the main producers as mentioned in clause 4.5.4.1 hereinbefore.

4.5.4.2. The contractor shall furnish the particulars of the manufacturer / main producers of cement along with the date of manufacture to the Garrison Engineer for every lot of cement separately. The cement so brought shall be fresh and in no case older than 60 days from the date of manufacture. The Garrison Engineer shall verify the documents in support of the purchases of cement. Before placing the order for supply of cement by the contractor, he shall obtain written approval from the GE regarding name of manufacturer, quantity of cement etc. Cement shall be procured for minimum requirement of one month and not exceeding the requirement for more than two months at a time. The cement shall be consumed in the work within three months after receipt. Cement shall conform to the requirement of Indian Standard specification and each bag of cement shall bear relevant ISI mark. The weight of each consignment shall be verified by the GE and recorded. The content of cement shall be checked at random to verify the actual weight of cement per bag. However, each bag of cement shall be of nominal average net mass of 50 KGs, subject to tolerance given in clause 9.2 and Annexure “B” of IS – 8112 and in relevant clause of IS – 1489.

4.5.4.3. If due to some unforeseen circumstances which are beyond the control of the contractor, cement is not used within 03 months, the same shall be retested and shall be used in the work only after taking prior approval of Accepting Officer. Permission to use cement more than 03 months old shall be given only in exceptional cases where Accepting Officer is satisfied with the grounds put up by the contractor and cement still meets all the requirements of IS. No claim whatsoever shall be entertained if permission to use cement more than 3 months old is not given to contractor.

4.5.5. TESTING OF CEMENT:

4.5.5.1. The contractor shall submit the manufacturer’s test certificate in original along with test sheet giving the result of each physical test as applicable in accordance with the relevant IS provision and the chemical composition of cement or authenticated copy thereof, duly signed by the manufacturer with each consignment, as per the following IS provision:

[a] Method of sampling hydraulic cement as per IS – 3535.
[b] Methods of physical test for hydraulic cements as per IS – 4031.
[c] Method of chemical analysis of hydraulic cement as per IS – 4032.

The test sheet should include results of the following mandatory tests:

[i] Specific surface by Blains air Permeability method
[ii] Soundness Test by Le’Chatlier method
[iii] Initial setting time
[iv] Final Setting time
[v] Compressive strength test at 3, 7 & 28 days as specified in the relevant IS code.
[vi] The test report should also show the chemical properties of the cement as per relevant IS codes.
4.5.5.2 The test certificate and test sheet shall be furnished with each batch of manufacture. The Engineer-in-Charge shall record these details in the cement acceptance register to be maintained by him which will be signed by JE [Civil], Engineer-in-Charge, Garrison Engineer and the contractor as given in the format hereinafter for verification.

4.5.5.3 The contractor shall however, organise setting time and a compressive strength test of cement through designated laboratory on samples collected from the lot brought at site before incorporation in work. The contractor will be allowed to use the cement only after satisfactory compressive strength of seven days. To meet this requirement contractor is required to keep minimum 10 days stock before any new lot brought at site, which can be used, in the work. The contractor shall be required to remove the cement not meeting the requirement from site within 24 hours. Seven days strength test will be relied upon to accept the lot of cement to commence the work. 28 days compressive strength test will be the final criteria to accept/reject the lot.

4.5.5.4 The GE shall carry out independent testing as per the tests mentioned in the “CEMENT SUPPLY / ACCEPTANCE FORM” of random samples of cement drawn from various lots, if sample fails in 7 days compressive strength. The testing shall be carried out through National Test House / SEMT Wing / Government Approved Laboratories / NABL Accredited Laboratories / Regional Research Laboratories / IIT / National Institute of Technology / Command Testing Lab as per IS – 3535 [Method of sampling Hydraulic Cement], IS – 4031 [Method of Physical Test for Hydraulic Cement] and IS – 4032 [Method of Chemical Analysis of Hydraulic Cement] referred to above. The decision as to where the testing of cement is to be done shall be taken by GE. In case the cement is not of requisite standard despite manufacturer's test certificate, the contractor shall remove the total consignment from the site at his own cost after written rejection order of the consignment by the GE. The cost of test shall be borne by the contractor irrespective of the results of testing.

4.5.5.5 The random samples as per relevant IS shall be selected by GE before carrying out testing. The record of such samples selected by the GE for testing shall be properly maintained in the 'Cement Testing Register' giving cross reference to relevant consignment of cement and quantity received etc.

4.5.5.6 Cost of transportation of samples to the approved laboratory / test house and all testing charges including cost of sample shall be borne by the contractor.

4.5.5.7 The contractor shall be required to set up adequate testing facilities at site to the entire satisfaction of Garrison Engineer for conducting setting time test and compressive strength test as per IS codes referred to hereinbefore for the samples collected from the lot brought at site. These tests shall be carried out within 7 days of receipt of cement at site. The tests can alternatively be carried out at the Command Testing Lab, or any other recognised laboratory so designated by GE.

4.5.5.8 The contractor shall submit original purchase vouchers for the total quantity of cement supplied under each consignment to be incorporated in the work. All consignments received at the work site shall be inspected by the GE along with the relevant documents to ensure the requirements as mentioned herein before, before acceptance. The original purchase vouchers and the test certificates shall be verified for subject contract and defaced by the Engineer-in-Charge and kept on record in the office of the Garrison Engineer duly authenticated and with cross reference to the consignment/control number recorded in the Cement Acceptance Register. The cement acceptance register shall be signed by the JE [Civil], Engineer-in-Charge, GE and the Contractor. The contractor shall maintain schedule of supply of cement for each consignment.

4.5.5.9 The Accepting Officer may order a board of officers for random check of cement and verification of connected documents during the currency of contract.
4.5.6. STORAGE/ACCOUNTING/PRESERVATION OF CEMENT:

4.5.6.1. Cement shall be stored in covered godown over dry platform at least 20 cm high in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter. In case of store room, the stack should be at least 20 cm away from floors and walls. The stacking of cement shall be done as specified in relevant IS. The storage accounting and preservation of cement supplied by the contractor shall be done as per standard engineer practice till the same is incorporated in the work and the cost of the same shall be deemed to be included in the unit rate/amount quoted by the tenderer. The Engineer-in-Charge shall inspect once a day to verify that cement lying at site is stored, accounted, preserved and maintained as per the norms. The cement shall be stored so as to differentiate each tested and untested consignment separately with distinct storage/preservation of cement, he may order for any test[s] of cement as applicable for that consignment to ensure its conformity to the quality mentioned in the manufacturer’s test certificate. The contractor shall bear the cost of necessary testing[s] in this regard and no claim whatsoever shall be entertained.

4.5.6.2. Stacking of cement shall be done as per relevant IS and as under:

[a] Each cement consignment shall be stacked separately and removal shall be made on the basis of “First in First out”.

[b] Adequate top cover will be provided.

4.5.6.3. Cement godown shall be provided with two locks on each door. The key of one lock at each door shall remain with the Engineer-in-Charge or his representative and that of the other lock with the contractor’s authorised agent at site of works so that cement is removed from the godown only according to daily requirement with the knowledge of both the parties. During the period of storage, if any cement bag[s] found to be in damaged condition due to whatsoever reason, the same shall be removed from the cement godown on written orders of the GE and suitable replacement for the cement bag[s] so removed shall be made and no claim whatsoever shall be admissible on this account.

4.5.6.4. Cement shall be removed from the store only according to daily requirement with the knowledge of both the parties and daily consumption of cement shall be recorded in cement consumption register which shall be signed by the Engineer-in-Charge and the contractor. Cement constants given in Appendix “A” to E-in-C’s Branch letter No. 19280 / E8 dated 03 May 1976 shall form the basis of consumption of cement for various items of works unless specifically indicated otherwise.

4.5.6.5. 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.

4.5.7. SCHEDULE OF SUPPLY: The contractor shall procure the cement timely as required in accordance with CPM chart agreed between GE and the contractor. The contractor will forfeit his right to demand extension of time if the supply of cement got delayed due to his failure in placing order in time to the manufacturer.

4.6. MEASUREMENT AND PAYMENT OF CEMENT:

4.6.1. The entire quantity of cement shall also be suitably recorded in the Measurement Book for record purposes as "Not to be Abstracted" before incorporation in the work and shall be signed by the Engineer-in-Charge and the contractor.
PARTICULAR SPECIFICATIONS [Continued]

4.6.2. The payment shall only be allowed after production of original purchase vouchers, certified copies of test certificates from manufacturer for each consignment and results of testing carried out in laboratory on receipt of cement [7 Days Compressive Test] are found satisfactory after testing as specified herein before. Cement shall be paid as material lying at site as per Condition 64 of IAFW – 2249. Rate of cement given in MES Schedule shall be applicable for cement irrespective of grade of cement specified for use in the work.

4.7. DOCUMENTATION:

4.7.1. The following documents will be maintained by the Engineer-in-Charge / GE for cement supplied by the contractor in addition to the documents specified in the contract:

[a] Original vouchers of cement shall be kept in the concerned file of the contract in GE Office, serially numbered on each page.

[b] Original test certificates and test sheet should also be kept in the concerned file of the contract duly numbered.

[c] Cement acceptance register as per Annexure “A” & Annexure “B”.

[d] In / Out Register for cement as per Annexure “C”.

[e] Register containing results of independent and additional testing by GE.

[f] Register containing records of surprise checks and BOO.

[g] Inspection Register.

4.8. CEMENT CONCRETE:

4.8.1. 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:

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>[a]</td>
<td>PCC in Foundation &amp; PCC in Foundation of Dwarf Wall</td>
<td>PCC 1:4:8 Type D2 [using 40 mm graded stone aggregate] by volume</td>
</tr>
<tr>
<td>[b]</td>
<td>Concrete Pre-Cast Blocks, Padding and Coping.</td>
<td>PCC 1:3:6 Type C1 [using 20mm Graded stone aggregate] by volume</td>
</tr>
<tr>
<td>[c]</td>
<td>PCC in all Other Situations</td>
<td>PCC 1:2:4 Type B1 [using 20mm graded stone aggregate] by volume</td>
</tr>
<tr>
<td>[d]</td>
<td>RCC works in Foundation, Columns, Beams and Slabs casted monolithically.</td>
<td>Design Mix controlled concrete of Grade M30 or contractor may use RMC-M30 Design Mix without any extra cost</td>
</tr>
<tr>
<td>[e]</td>
<td>All RCC works except mentioned in Para [d] above</td>
<td>Design Mix controlled concrete of Grade M30 or contractor may use RMC-M30 Design Mix without any extra cost</td>
</tr>
</tbody>
</table>

4.8.2. BATCHING, MIXING, DEPOSITING AND RAMMING:

4.8.2.1. 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 mini batching plant provided at site shall be adequate enough to execute the work as per the CPM, or otherwise the contractor shall provide single batching plant of higher capacity or more number of batching plants of adequate capacities as required at site, as asked by the GE. No claim what so ever arising out on this account is admissible. The decision of GE in this regard shall be final and binding. The plant/plants shall have the digital system of adding specified quantity of water into concrete mix as per the design mix requirement.
PARTICULAR SPECIFICATIONS [Continued]

4.8.2.2. 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.

4.8.2.3. 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.

4.8.2.4. The mixing shall be done for at least 2 minutes and until a uniform colour and consistency is achieved.

4.8.2.5. 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 for any other purpose. On ceasing of work and other stoppage 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.

4.8.2.6. 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.

4.8.2.7. 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.

4.8.3. DESIGN MIX CONCRETE [CONTROLLED CONCRETE]:

4.8.3.1. Grade of design mix concrete shall be as specified hereinbefore 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].

4.8.3.2. The requirement of cement per cubic meter of controlled concrete of Grade M30 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 and 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 incorporate in the work on account of design mix is admissible.

4.8.3.2.1 [a] 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 approved by the tenderer as given below:

[i] FOSROC Chemicals [India] Ltd.
[ii] Roffe Construction Chemicals Pvt. Ltd.
[iii] STP Specialty Chemicals Ltd.
[iv] CICO Technologies Ltd
PARTICULAR SPECIFICATIONS [Continued]

[b] Para 5.5 of IS – 456 be also referred for quality of admixtures.

[c] For maximum dose of admixtures, please refer para 10.3.3 of IS – 456.

[d] Various tests as specified in IS – 9103 shall be carried out for each batch of Admixtures at contractor’s cost.

[e] 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.

[f] 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.

4.8.3.3. 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 carryout the design mix and preliminary tests RCC M30 grade concrete:

[i] College of Engineering, Andhra University

[ii] College of Engineering, GITAM University


[iv] Regional Research Laboratory

[v] Government Approved Laboratory

[vi] NABL Accredited Laboratory

4.8.3.4. The cement used in the work shall be as specified here in before. Coarse aggregate shall be crushed stone aggregate. The gradation shall be followed as per clause 4.2 table 2 of IS – 383 to obtain maximum density.

4.8.3.5. 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.

4.8.4. PRELIMINARY TESTS:

4.8.4.1. 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 day

4.8.4.2. 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 7 cubes of size 150 mm x 150 mm x 150 mm and one slump test. Three cubes shall be tested at 7 days to get indication of minimum strength of 28 days. Other 03 cubes shall be tested at 28 days and 01 cube shall be preserved for Government 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,
GE / GE's representative and representative of Accepting Officer. 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 trail 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 testing charges for the design mix and the tests conducted shall be borne by the contractor. The cost of materials, labour and transport shall also be borne by the contractor.

4.8.5. WORK TEST:

4.8.5.1. The work tests shall be carried out at Site Lab / Command Testing Lab situated in the premises of Chief Engineer [Navy], Visakhapatnam Zone.

4.8.5.2. 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.

4.8.5.3. From each of these samples, 7 test cubes of size 150 x 150 x 150 mm shall be taken to test 3 specimens at 7 days and 3 specimens at 28 days in Command Testing Lab. C. A. No., date of casting and location where concrete is being used shall be marked on each concrete cube. One test cube of preliminary and work test shall be preserved duly marking the date of casting and CA No. for verification / subsequent testing, if required. The cube shall be preserved by the GE / Engineer-in-Charge until the defects liability period of the work is over.

4.8.5.4. 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 and transport shall be borne by the contractor. The lump sum quoted shall include the cost of testing the concrete cubes both for design mix / volumetric mix.

4.8.5.5. In the event of contractor setting up the laboratory at site as specified here in before in Special Conditions, the contractor shall carry out cube testing in site lab, in presence of Engineer-in-Charge and as specified here in before. 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. Contractor shall include this aspect in his Lumpsum while quoting his rates.

4.8.5.6. The Engineer-in-Charge shall maintain the record for all the tests carried out in Site Lab / Command Testing Lab separately. The cost of testing including material, labour etc., incurred shall be borne by the contractor and the Lumpsum quoted shall be deemed to include this.

4.8.6. MIXING:

4.8.6.1. 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.

4.8.6.2. 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.
4.8.6.3. The contractor during the progress of work shall not change the mix design without the prior approval of the GE.

4.8.6.4. 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 issued to 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.

4.8.7. WATER CEMENT RATIO:

4.8.7.1. It is most important to maintain the water cement ratio constant and to it’s 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 any variations in the aggregate, IS – 2390 [Part – III] method of test for aggregate, for concrete, Part II 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 to be carried out as specified hereinbefore.

4.8.7.2. Workability of concrete shall be checked at frequent intervals. The slump test or where facilities exists the compacting factor test in accordance with IS – 1199 may be adopted for this purpose.

4.8.7.3. The slump for M30 grades concrete [except for piles] 50mm to 100mm for medium degree workability as given in Clause 7 of IS – 456.

4.8.7.4. Curing shall be carried out all as specified in MES Schedule Part – I.


4.9. READY MIXED CONCRETE [RMC]:

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

<table>
<thead>
<tr>
<th>[a]</th>
<th>IS – 4926</th>
<th>Ready Mixed Concrete</th>
<th>Code of Practice</th>
</tr>
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<tbody>
<tr>
<td>[b]</td>
<td>IS – 9103</td>
<td>Concrete Admixtures</td>
<td>Specifications</td>
</tr>
<tr>
<td>[c]</td>
<td>IS – 8112</td>
<td>OPC Grade 43 or Portland</td>
<td>Specifications or</td>
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<tr>
<td>IS – 455</td>
<td>Portland Slag Cement</td>
<td>Specifications</td>
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<tr>
<td>IS – 1489</td>
<td>Portland Puzzolona Cement</td>
<td>Specifications</td>
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<tr>
<td>[d]</td>
<td>IS – 456</td>
<td>Plain and Reinforced concrete</td>
<td>Code of Practice</td>
</tr>
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</table>

4.9.2. 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.

PARTICULAR SPECIFICATIONS [Continued]

4.9.3. **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.

4.9.3.1. Even though the firm for manufacturing and supply of RMC to site of work is approved by the CWE / GE, the responsibility to maintain quality and grade of concrete fully rests with the contractor.

4.9.4. **MATERIALS:**

   [a] **Cement:** Cement shall conform to specifications as specified herein before.

   [b] **Fine Aggregates:** Fine aggregates shall be as specified herein before.

   [c] **Coarse Aggregate:** The coarse aggregates shall be as specified herein before.

   [d] **Water:** Water shall comply with the requirements as per IS – 456 and IS – 3025.

   [e] **Admixtures [Liquid type only]:**

      [a] Admixture shall be retarding super plasticizing type and shall conform to IS – 9103 and of approved manufacturers as given below:

      [i] Fosroc Chemicals [India] Ltd, Hafeefa Chambers, 2Nd Floor, 111 / 3, KH Road, Bangalore – 560 027

      [ii] Roffe Construction Chemicals Pvt Ltd, 12 – C, Vikas Centre, S V Road, Santa Cruz [W], Mumbai – 400 054.


      [iv] CICO Technologies Ltd, A – 9, Chitranjan Park [LGF], Outer Ring Road, New Delhi.

      [b] Admixture shall not exceed 1.5% of cement contents by volume in any case.

4.9.5. **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.

4.9.6. 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.
PARTICULAR SPECIFICATIONS [Continued]

4.9.7. 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 Annexure – G of IS – 4926]:

[i] Time of mixing of each batch.
[ii] No. of batches in each delivery.
[iii] Location where used in the work and reference to cube test register.

4.9.8. 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.

4.9.9. If the condition of RMC delivered at site is not acceptable to the Engineer-in-Charge it shall be taken back and 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. RMC shall be delivered at site of work within 2½ hours of mixing of first batch of concrete.

[b] Segregation of aggregate due to excessive rotation of mixer during transit.

4.9.10. 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 without 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.

4.9.11. 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 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. Concrete shall be transported by transit mixers.
[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 Cu.m 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 cannot 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°C, 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:
PARTICULAR SPECIFICATIONS [Continued]

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. The concrete shall be placed in position within the designed initial setting time. At the end of initial setting time, the unused concrete shall be rejected.

[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 [Durability Criteria].

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

4.9.13. SAMPLING AND TESTING OF READY MIX CONCRETE:

[a] Allow at least the first ⅓ Cu.m 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:

<table>
<thead>
<tr>
<th>Place Of sample</th>
<th>Quantity of Concrete</th>
<th>No of Samples</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>At RMC Plant</td>
<td>For every 6 Cu.m or part thereof</td>
<td>1</td>
<td>One sample will comprise of 4 test specimens. 3 specimens for testing and one for preservation.</td>
</tr>
<tr>
<td>At Site</td>
<td>For every 6 Cu.m or part thereof</td>
<td>1</td>
<td>[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.</td>
</tr>
</tbody>
</table>

Note: [i] At least one sample shall be taken from each delivery.
[ii] 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.

4.9.14. PRICING DEVIATIONS: Pricing of any deviations involving M30 [Design Mix] Ready Mixed Concrete [RMC], shall be as per rates of M30 [Design Mix] concrete given in MES Schedule Part – II subject to percentage quoted by the tenderer.
4.9.15. **GENERAL:**

4.9.15.1. Clause for cement given in Para 4.5 hereinbefore shall be applicable for cement used in RMC also. All these documents shall be obtained by contractor from the RMC manufacturer and shall be submitted to the Department in original / CTC duly signed by the RMC manufacturer.

4.9.15.2. All other requirements as specified in Clauses 4.8.5 to 4.8.8 hereinbefore shall be applicable in this case also.

4.9.15.3. Details of the admixture used for the RMC viz., Name of manufacturer, Brand Name of Admixture, Quantity, Paid Voucher and Test Certificate shall be obtained by the contractor from RMC manufacturer and the same shall be submitted to Engineer-in-Charge. Engineer-in-Charge will keep the same on record duly defaced. Total quantity of admixture used shall be entered in MB as “Not to be Abstracted”.

4.9.15.4. The contractor should enter into an agreement with the approved RMC manufacturer to ensure compliance of the above aspects.

4.10. **FINISH TO CONCRETE SURFACES**

4.10.1. 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, distempering, 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.

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

4.11. **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.

4.12. **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.

4.13. **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 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.

4.14. **PCC PLINTH PROTECTION:** Plinth protection shall be 50 mm thick in PCC 1:3:6 type C-1 using 20mm graded stone aggregate over 75 mm thick hard core gauge not exceeding 63 mm, over rammed earth as shown on drawings. 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].
5. **FLY ASH BRICK WORK:**

5.1 Irrespective of whatever shown on drawing brick work indicated in the drawing shall be using Fly Ash Brick. Fly ash brick shall be locally available best quality brick, as approved by GE.

5.2. Fly ash blocks [Solid] will be of size 400 x 200 x 200 mm / 400 x 200 x 100 mm / 400 x 200 x 150 mm / 230 x 110 x 70 mm as approved by GE with 28 days average wet compressive strength not less than 50 Kg / Sq.cm when tested as per procedure laid down in IS – 3495 [Part – I] and water absorption not more than 15% by mass when tested as per procedure laid down in IS – 3495 [Part – II] after immersion in cold water for 24 hours. Average drying shrinkage of the blocks will not be more than 0.15% when tested as per IS – 4139. However, the contractor will be allowed to use fly ash brick of smaller size as per site condition with prior approval of GE with out any extra cost on plus side. The fly ash used in the process of making blocks should confirm to Grade II of IS – 3812. The tolerance on dimension of the blocks will be taken as per clause 5.2 of IS – 12894. The Fly ash brick / block shall conform to IS – 12894.

5.3. 200 / 300 / 400 mm thick [as applicable], brick wall shall be built in CM 1:6 and 100 mm thick brick wall shall be built in CM 1:4.

5.4. The entire workmanship shall conform to relevant clauses as applicable for brick work in section 5 of MES Schedule Part – I. The thickness of joint in Fly Ash brick work shall not be more than 6 mm.

5.5. Provide horizontal RCC lintel band at 2.10 Metres height / lintel level over 115 mm thick brick wall / half brick wall and hidden beam as specified in Note No. 7 of Drawing No. TD – 312 [S] Sheet 9 / 17 & 10 / 17.

5.6. The brick shall be procured from any one of the manufacturers enlisted as a member of **Fly Ash Building Materials Manufacturers Association [FABMAS]** and as approved by the GE [Approved list of manufacturers available with GE].

5.7. Fly ash bricks should be adequately cured and stored for six weeks before incorporating in the masonry works in both load bearing and partition walls.

5.8. The record of above action shall be maintained meticulously at site of work.

5.9. **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.

6. **STONE MASONRY:**

6.1. Stone for stone masonry shall be from the approved quarry and shall conform to or superior to the samples kept in the office of the Garrison Engineer.

6.2. Stone masonry where indicated in drawings shall be of random rubble uncoursed masonry built in cement mortar [1:6] and levelled at top. Mortar joints on buried faces shall be finished flush as the work proceeds.

6.3. The undulations from the straight edge held against the face of wall shall not be more that 40mm on pointed surfaces and 20mm on surfaces to be plastered.
6.4. For provisions of bond / through stones, hearting and jointing etc., Para 6.10.1 of MES Schedule Part – I shall be referred to. However, PCC bond stones of size 20 cm x 20 cm x full thickness of wall with mix PCC 1:3:6 type C1 may be provided in lieu of bond/through stones at the discretion of contractor at no extra cost.

6.5. The thickness of mortar in beds and joints upto 30mm will be permitted without any price adjustment.

6.6. Quoins and jambs shall be provided all as described in clause 6.10.1.6 of MES Schedule Part – I.

7. **FORM WORK:**

7.1. Form work shall be of steel plates stiffened by steel angles.

7.2. 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]

7.3. 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]

7.4. 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.

7.5. In case of any deviation involving form work, to surface exposed to view, the pricing shall be done at the rates of timber form work, for fair finish and in case unexposed concrete surface the pricing shall be done at the rates of timber form work for rough finish subject to contractor’s percentage for relevant Parts of the Schedule “A”.

8. **WOOD WORK/JOINERY:**

8.1 Provide wooden doors, windows and ventilators at locations shown on drawings. Wooden doors, windows and ventilators shall be of factory made. Unless otherwise specified hereinafter 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], Haldud [Kambha] for shutters. All other timber required for the work unless otherwise specified shall be 2nd class hard wood kiln seasoned, free from defects such as Sal, Bijasal [Venga], Laurel [Nalla Maddi] or Haldud [Kambha]. The timber shall be treated with organic solvent type 2 as specified in clause 5.1 of IS-401.

8.2 **MOISTURE CONTENT:**

8.2.1 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. Test result shall be handed over to Engineer-in-Charge.

8.2.1.1 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.

8.3 **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 12 mm.
PARTICULAR SPECIFICATIONS [Continued]

8.4 SURFACE FINISH:
8.4.1 Surface of timber in contact with or buried in masonry, concrete and plaster shall be clean sawn.
8.4.2 All other timber surfaces unless otherwise specified shall be wrought on all faces.

8.5 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.

8.6 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.

8.7 FACTORY MADE CHOWKATS AND SHUTTERS:

8.7.1 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]. 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. 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 class hard wood joinery enhanced by the percentage quoted by the tenderer for Schedule “A” Part – I.

8.7.2 Irrespective of what is shown on drawing 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.

8.7.3 PLY WOOD, PARTICLE BOARD & PRE-LAMINATED PARTICLE BOARD:

[a] Un-veneered particle board where indicated 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.

[b] Veneered particle board where indicated shall be three layered flat pressed with commercial or teak veneer [one side or both sides] as indicated on drawing/specified 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.

[c] Plywood where indicated 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.

[d] The prelaminated particle board in all situations shall be flat pressed three layered exterior grade ISI marked [IS-12823] Grade I, Type II with Prelamination of approved shade on one side and balancing white on other side bonded with phenol formaldehyde synthetic resin adhesive.
PARTICULAR SPECIFICATIONS [Continued]

Note:  
[i] 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 irrespective of whatever shown on drawing. Wherever 20mm thick block board is shown on drawing pre laminated particle board 18mm thick shall be provided all as specified herein before.

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

[iii] Particle board pre laminated particle Board and Plywood shall be any one of the makes specified hereinafter.

8.8. POWDER COATED ALUMINIUM DOORS, WINDOWS, VENTILATORS AND PARTITIONS: 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 1.5mm 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 50micron thick. 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 side hung / sliding 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.

8.9. 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 50micron 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.

8.10. The Aluminium window ALW12 as per TD No. 264, Sheet No. 1/2 & 2/2 shall be provided in lieu of ALW10 shown in drawings in all toilets of Servant Room. Aluminium ventilator V6F as per TD No. CEDD / 86 / TD / 3 / J shall be provided in lieu of Aluminium window ALW10 as shown in drawings in all Cooking rooms of Servant Room. Mosquit proof shutter shall be placed in side and glazed shutter shall be placed out side. Similarly, Aluminium ventilator ALVW12 as per TD No. 264, Sheet No. 1/2 & 2/2 shall be provided in lieu of ALV12 shown in drawings in Ground Floor toilets.

9. BUILDERS HARDWARE:

9.1 Provide builders hardware articles for doors/windows/ventilator/cupboards etc all as per details in Schedule of fittings shown on drawings.
9.2 Unless otherwise specified hereinafter, the articles of builder’s hardware shall be anodized [anodic film transparent] aluminium materials except for butt hinges. The butt hinges shall be of Stainless steel. The screws, bolts, nuts to be used for fixing shall be cadmium plated iron screws for anodized aluminium articles and GI for MS articles.

9.3 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.

9A. FALSE CEILING:

9A.1. False Ceiling shall be provided all as shown on drawings and as per details given in drawing. The workmanship and fixing shall be all as specified in clause 12.19, 12.20 and 12.31 of MES Schedule Part – I [Specifications].

9A.2. Irrespective of whatever is shown on drawings, 12mm thick Gypsum Board shall be provided at locations shown on drawings. 12mm thick Gypsum Board as approved by GE shall be provided on aluminium frame work all as shown on drawing and as specified hereinafter.

9A.3. Fibre cement Ceiling boards shall be of uniform thickness, free from warp, cracks and other damages. Ceiling board shall be painted with two coats of oil bound distemper of approved shade over a coat of alkali resistant primer on exposed surface and other surface shall be applied one coat of alkali resistant primer. All other details i.e. fixing of ceiling boards, aluminium frame work etc., shall be all as directed.

9A.4. False ceiling shall be with aluminium snap grid system irrespective of whatever is shown on drawing and grid size shall be 600 X 600mm if not shown on drawing. Size of grid at the edges/perimeter may however vary to suit the geometric shape of the building all as shown on drawing. Size of aluminium main Tee, cross tee, aluminium angle, ceiling cleats and GI wire suspenders to achieve the height[s] of false ceiling shall be as directed. Aluminium wall angle shall be fixed to the wall using teak wood plugs embedded in wall. Wooden plugs shall be treated with tar as specified.

9A.5. The aluminium section shall be of standard aluminium section manufactured by Jindal / Hindalco / Indal and shall confirm to IS and shall be got approved from GE before incorporation in work.

9A.6. In case the sizes of various members of false ceiling not shown on drawings the same shall be as per manufacturer’s instructions and the false ceiling shall be fixed to ceiling/wall all as directed.

10. STEEL AND IRON WORK:

10.1. 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.

10.2. GRADES AND QUALITY:

10.2.1. Steel supplied by the contractor shall conform to the following grades and quality:

[a] Steel for Concrete Reinforcement:

[i] High strength corrosion resistant deformed steel bars produced by Thermo Mechanical Treatment process [TMT] steel bars of grades Fe-500D, meeting all other requirements of IS – 1786. Minimum elongation shall be 18%. Please note that the steel bars of grade Fe-415 stand discontinued for use.
PARTICULAR SPECIFICATIONS [Continued]

[ii] Mild steel bars shall conform to IS – 432 [Part-I] and Grade – I.

[b] Structural Steel [Refer Clause 10.4 of MES Schedule Part – I]:

[i] 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.

[ii] 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.


[d] Hard drawn Steel Wire Fabric for Concrete Reinforcement: Fabric reinforcement shall conform to IS – 1566.

[e] Steel Tubes for Structural Purposes: Steel tubes for structural purposes shall conform to IS – 1161 and shall be of grade YST-240.

10.2.2. SOURCE OF PROCUREMENT:

10.2.2.1. High strength corrosion resistant deformed TMT Steel Bars of Grade Fe-500D & Structural Steel of all sizes supplied by the contractor shall be procured directly from Steel Authority of India Limited [SAIL] / Rashtriya Ispat Nigam Ltd [RINL] / Tata Iron & Steel Company [TISCO or Tata steel] or from the following approved primary producers:

[i] M/s. Jai Balaji Industries Ltd. [For Fe 500 & Fe 500 D]
[ii] M/s. Shyam Steel Industries Ltd. [For Fe 500 & Fe 500 D]
[iii] M/s. SPS Steels Rolling Mills Ltd. [For Fe 500, Fe 500 D & Fe 550]
[iv] M/s. Steel Exchange India Ltd. [For Fe 500 & Fe 500 D]
[v] M/s. Jindal Steel & Power Ltd. [For Fe 500, Fe 500 D, Fe 550, Fe 550D & Structural Steel [Angle, Beam, Column, Channel, Plate]]
[vi] M/s. SRMB Srijan Ltd. [For Fe 500, 500 D, Fe 550 & 550D]
[vii] M/s. Concast Steel & Power Ltd. [For Fe 500]
[viii] M/s. Adhunik Metaliks Ltd. [For Fe 500 & Fe 500 D]
[ix] M/s. Shri Bajarang Power & Ispat Ltd. [For Fe 500 & Fe 500 D]
[x] M/s. JSW Steel Ltd. [For Fe 500 & Fe 500 D]
[xi] M/s. Electrosteel Steels Ltd. [For Fe 500 D]
[xii] M/s. Shyam Metalics & Energy Ltd [For Fe 500]
[xiv] M/s. BDG Metal & Power Ltd Brand: BDG6
[xv] M/s. Gallantt Metal Ltd., Gujarat

10.2.2.2. In no case TMT steel bars of all sizes shall be allowed to be procured from other than the above mentioned producers.
PARTICULAR SPECIFICATIONS [Continued]

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

10.3. 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 MES Schedule Part – I and as specified in IS – 1786 and IS – 2062 and as per relevant IS codes.

10.4. TESTING OF STEEL:

10.4.1. [a] 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 only 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 or authenticated copy with 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 as Annexure “D” & Annexure “E” hereinafter, after due verification and Engineer-in-Charge shall send a certified true copy of test sheet to GE for his records.

[b] Independent testing of steel / structural steel / GI Sheets and fabric reinforcement for concrete by the GE shall be optional at the discretion of the GE in case of procurement of steel from main producers and testing charges shall be borne in accordance with Condition 10A of IAFW 2249 i.e. testing charges shall be borne by the Department if the test results are found in order otherwise these shall be borne by the Contractor.

[c] Independent testing of Structural Steel, GI Sheets and Fabric Reinforcement by the GE shall be mandatory and testing charges shall be borne by the Contractor irrespective of the outcome of test results.

[d] For independent testing, random samples of steel drawn from various lots and shall be got tested from a National Test House / SEMT Wing / Government Approved Laboratories / NABL Accredited Laboratories / Regional Research Laboratories / IIT / National Institute of Technology / Command Testing Lab as per the minimum frequency given below. Samples from each lot shall be also tested for quality and elongation.

[e] 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.

10.4.2. 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 as per Annexure “F”.

10.5. FREQUENCY OF SAMPLING FOR INDEPENDENT TESTING BY GE:

10.5.1. 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:
PARTICULAR SPECIFICATIONS [Continued]

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Nominal Size</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>STEEL FOR CONCRETE REINFORCEMENT:</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Bars size less than 10 mm</td>
<td>1 Sample [3 specimens] for each test for every 25 tonnes or part thereof</td>
</tr>
<tr>
<td>2</td>
<td>Bar size 10mm to 16 mm</td>
<td>1 Sample [3 specimens] for each test for every 35 tonnes or part thereof</td>
</tr>
<tr>
<td>3</td>
<td>Bar size over 16 mm</td>
<td>1 Sample [3 specimens] for each test for every 45 tonnes or part thereof</td>
</tr>
<tr>
<td>[b]</td>
<td>STRUCTURAL STEEL:</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Tensile Test</td>
<td>1 Test for every 25 tonnes of steel or part thereof</td>
</tr>
<tr>
<td>5</td>
<td>Bend Test</td>
<td>1 Test for every 10 tonnes of steel or part thereof</td>
</tr>
</tbody>
</table>

10.5.2. 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 these additional tests 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.

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

10.5.4. In case test results of testing pursuant to clause 10.5.1 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.

10.5.5. Cost of test samples as per frequency given in clause 10.5.1 above shall be borne by the contractor irrespective of test results.

10.6. DOCUMENTATION:

10.6.1. 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 of the work 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 as per Annexure “D” will be maintained by the GE

[d] In/Out Register for details of receipt, acceptance/rejection and consumption of steel will be maintained as per Annexure “G”.

[e] Register containing results of independent and additional testing by GE

[f] Inspection registers

PARTICULAR SPECIFICATIONS [Continued]

10.6.2. CWE/GE[I] 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 [Para 10.6.1 [f] above].

10.7. STORAGE ACCEPTANCE/PRESERVATION OF STEEL:

10.7.1. The steel procured by the contractor shall be stored in the site of work as directed by Engineer-in-Charge / GE 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.

10.7.2. 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.

10.7.3. 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.

10.8. CONVERSION WEIGHT OF STEEL:

10.8.1. 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 MES Schedule /ISI tables.

10.8.2. 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.

10.8.3. 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.

10.9. PAYMENT IN RAR:

10.9.1. Payment of the steel brought by the contractor should only be released by the GE after taking action on points enumerated in Para 10.6 hereinbefore and after completing the documentation mentioned hereinbefore in this regard.

10.9.2. Before procurement of steel, contract and structural drawing 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 mentioned hereinafter under clause 10.10

10.10 SAFETY OF STEEL: It will be responsibility of contractor to make sure that all possible arrangement 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.

10.11. 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 this CPM chart. Schedule of supply of steel will be finalised 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.
PARTICULAR SPECIFICATIONS [Continued]

10.12. **HOLD FASTS:** 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.

10.13. **ALUMINIUM WIRE MESH:** Provide aluminium wire mesh for mosquito proofing irrespective what is indicated on the drawings. The aluminium wire mesh shall be of aluminium alloy wire cloth, 0.45 mm nominal dia of wire and average width of aperture 1.40 mm fixed with aluminium wire staples. The mesh shall be fixed to shutters / frames using second class hard wood beading, wrought faces, fixed with screws.

10.14. **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.

10.15. **DASH-THRU-FASTENERS:** Where the frames of doors, windows, cupboards are to be fixed to reinforced concrete jambs, these shall be fixed with "Dash-Thru-Expansion Fasteners" of adequate size manufactured by "Dash Fasteners Pvt. Ltd, C-10, South Extension Part – II, New Delhi" and marketed by "M/s Moni Traders, C-16, Tardeo AC Market, Mumbai – 400 034". Wherever expansion fasteners are being used hold fasts / lugs need not be used.

10.16. **MS GRILLS:** Provide fabricated MS Grills to windows where 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.

10.17. **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 hereinafter.

10.18. **RCC JALLI:** Provide RCC Jalli at the locations and 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].

10.19. **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 at all sites simultaneously as per the CPM. No claim whatsoever arising out on this account shall be admissible.

10.20. **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.

10.21. **ROLLING SHUTTER:** Rolling shutter shall be of mechanical gear operated 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.
PARTICULAR SPECIFICATIONS [Continued]

11. RCC ROOFING:

11.1. 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 15mm thick plaster with cement mortar 1:4 mixed with waterproofing 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 [for omit purpose].

11.1.2. 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.

11.1.3. 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 48hours. 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.

11.1.4. 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.

11. 2. WATER PROOFING TREATMENT OVER ROOF SLAB OF BUILDING [FOR NON ACCESSIBLE ROOF]

11.2.1 The RCC roof slab shall be laid to slopes/laid flat and padding concrete of 1:3:6 type C1 [using 20 mm graded stone aggregate] provided to achieve the slope as indicated in drawings.

11.2.2 Water proofing treatment to roof slab shall be provided as under:

[a] Roof slab shall be cleaned thoroughly by using wire brush [Mechanical / hand brush] to make it free from any loose particle, dirt / dust, etc.

[b] Cement slurry @ 3 KG/Sq.m shall be provided over cleaned roof surface.

[c] Thereafter 5mm thick cement screed in cement mortar 1:4 with water proofing compound as per manufacturer instructions will be applied on surface to have a smooth surface for laying of water proofing membrane.

[d] After setting & drying cement mortar, the entire surface of the roof slab shall be cleaned thoroughly to remove all loose particles, dust/dirt particles and applied with hot blown grade bitumen 85/25, @ 1.20 KG/Sq.m over bitumen primer @ 0.5 Litre/Sq.m.

[e] Over hot blown grade bitumen 85/25, polymeric water proofing membrane 3 KG/Sq.m shall be laid over entire roof surface and on vertical surface up to grooves as applicable [or as per manufacturers recommendation] with over laps of 100mm. The overlaps shall be sealed by flames or as per manufacturer instructions. Water proofing membrane shall be tucked in wall to a depth of 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.

[f] A coat of hot blown bitumen 85 / 25 grade @ 1.2 KG /Sq.m shall be applied over water proofing membrane and finally it shall be finished with a coat of bituminous aluminium primer @ 0.10 KG/Sq.m.

[g] Proper care shall be taken to provide similar treatment near junction of roof and parapet to avoid any leakage through junction.
11.3. **WATER PROOFING TREATMENT OVER ROOF SLAB OF BUILDINGS [FOR ACCESSIBLE ROOF]:**

11.3.1. Water proofing treatment to roof slab shall be provided as under:

[a] Same as 11.2.2 [a] to [e] above and:

[b] A coat of hot blown bitumen 85 / 25 at 1.2 KG per Sq.m shall be applied over water proofing membrane.

[c] Hydraulically pressed cement concrete tiles 200 X 200 X 22 mm size conforming to IS 1237-1980 shall be laid on 15 mm thick cement sand mortar 1:4, jointed and pointed in cement sand mortar 1:3 [joint thickness not exceeding 5mm].

11.4. **TREATMENT OVER CHAJJAS/CANOPY/PORTICOS OF BUILDINGS UNDER SCHEDULE "A" PART – I AND INTERNAL SURFACE OF RCC GUTTER WHERE APPLICABLE:**

11.4.1 Top of RCC Chajja/Canopy/Portico/Gutter shall be plastered 15mm thick in cement mortar [1:4] mixed with water proofing compound as per manufacturer’s instructions and finished to a slope of 1:60. The plaster shall be taken up to 200mm height over adjacent vertical surfaces of walls in addition to external plaster for a length equal to length of Chajja.

11.5 Polymer Water proofing membrane shall be 3 KG/Sq.m consisting of minimum 90 micron HMHDPE Film Center core.

11.5.1 The water proofing membrane shall comply with following requirements:

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Softening point</td>
</tr>
<tr>
<td>2</td>
<td>Penetration at 25°C 100 g 5 Sec</td>
</tr>
<tr>
<td>3</td>
<td>Thickness of Central PE Film</td>
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<tr>
<td>4</td>
<td>Pliability</td>
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<td>5</td>
<td>Heat resistance</td>
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<td>6</td>
<td>Tensile strength:</td>
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<td>[a]</td>
<td>Lengthwise</td>
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<td>[b]</td>
<td>Cross wise</td>
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<td>7</td>
<td>Elongation:</td>
</tr>
<tr>
<td>[a]</td>
<td>Length wise</td>
</tr>
<tr>
<td>[b]</td>
<td>Cross wise</td>
</tr>
</tbody>
</table>

11.5.2 **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.

11.5.3 The work of water proofing treatment to roof shall be carried out under the guidance of manufacturer of water proofing membrane and a certificate to this effect shall be taken by contractor from manufacturer and shall be submitted to GE before completion of work.
11.6 **FLOODING TEST OF ROOF:** On completion of water proofing treatment as herein before, the contractor shall carry out 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. The cost on this account shall be included in relevant items in Schedule ‘A’/Lump sum amount quoted for the buildings.

11.7 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’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.

11.7.1 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 treatment 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 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 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.

11.8 A cement mortar tablet of size 300mm x 300mm x 10mm 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”.

11.9 **TRIANGULAR FILLETING:**

11.9.1 At the junction of roof slab with parapet wall and wall with Chajja/Canopy provide coving of PCC [1:2:4] Bo [using 12.5mm graded aggregate] type, mixed with water proofing compound.

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

12. **FLOORING:**

12.1 **GENERAL:**

12.1.1 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.

12.1.2 Floors shall be laid to levels or to falls as shown on drawings and as directed by Engineer-in-Charge.

12.1.3 Floor finish shall be extended over dwarf walls, door openings and other openings.
PARTICULAR SPECIFICATIONS [Continued]

12.1.4 The dividing lines between the floors of different types wherever they so meet between adjoining rooms shall be determined of the basis of the finish visible when the doors are closed and the applicable finish shall accordingly be provided.

12.1.5 Floor finish over RCC slabs shall be laid all as specified in clause 13.32.5 of MES Schedule Part – I.

12.1.6 Sub floor may not be laid in panels.

12.1.7 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.

12.2. CEMENT CONCRETE FLOORS:

12.2.1. CEMENT CONCRETE SUB FLOOR: Unless otherwise mentioned elsewhere, cement concrete sub floor i.e. PCC sub base laid below floor finish in ground floor shall be plain cement concrete and thickness shall be as indicated on Schedule of Finishes. PCC sub floor need not be laid in alternative bays and the same shall be worked upto an even surface. Cement concrete sub base wherever indicated to be provided over hard core laid over consolidated approved earth filling all as indicated in Schedule of finishes.

12.2.2. PCC FLOOR: PCC floors [except floors in sub base] shall be laid in bays adopting panel dimension of 1200 mm X 1200 mm. The bays shall be so arranged that the end bays shall be of equal width not exceeding 1200 mm. The floor shall be laid in alternate bays. Floor topping shall be finished even and smooth using extra cement. 3mm thick glass dividing strips shall be provided to form joint in all cement concrete floors. The glass dividing strips shall be 3mm less than the thickness of PCC floor finish. The glass dividing strip shall be inserted in the PCC while the concrete is still plastic and the strips shall be left in position. PCC floors upto 40mm thickness only shall be provided with glass strips. PCC floors to be provided with glass strip shall not be laid in alternative bays and this will not involve any price adjustment. The surfaces of PCC floor shall be finished with a steel trowel to even and smooth surface using extra cement. Floors finishes of Ramps shall be worked upto an even and smooth surface without using extra cement and making of expanded metal impressions while the concrete is green. Wherever indicated in schedule of finishes and on treads of steps floor shall be provided with chequered finish.

12.2.3. PCC Floor finish shall be provided at locations mentioned in Schedule of finishes and shall be laid over cement concrete sub floor to the thickness as indicated on drawings. PCC floor finish shall be in 1:2:4 mix, Type B1, using 20mm graded stone aggregate. The surface shall be cured efficiently by water ponding as directed by Engineer-in-Charge.

12.3. NON SKID CERAMIC TILE FLOORING: Provide non skid ceramic tile flooring at locations all as shown on drawings and as specified in Schedule of Finishes drawing. 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 – 13755 grade B–II[a] for Toilets and B–II[b] for other locations for floor tiles and grade B–III for wall tiles. Irrespective of what is mentioned in Schedule of Finishes, the size of the tiles shall be 450mm X 450mm, 8mm thick / 600mm X 600mm, 9mm thick as indicated on drawing, set, jointed in neat cement slurry and pointed flush in coloured cement to match, laid over 15mm thick screed in CM [1:4] laid over 25mm thick PCC 1:2:4, Type B-0 over 75mm thick PCC [1:4:8], Type D–2 sub base over 100mm thick hard core over rammed earth in Ground Floor and laid over 15mm thick screed in CM [1:4] over RCC Slab. The shade shall be as indicated in the schedule of finishes drawing/as approved by GE. 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.

12.4. GREEN MARBLE STONE FLOORING: Provide mirror polished Green marble flooring at locations shown in the drawing and as specified in schedule of finishes drawing. The size of the marble slab in flooring shall be minimum 1200mm X 600mm. The slabs shall be machine cut and shall be of uniform colour as
approved by GE. The thickness of Green marble stone shall be 18 to 20mm thick. The green marble slab shall be set and jointed in neat cement slurry @ 3 Kg/Sq.m over screed bed as indicated. If details of screed bed are missing then it shall be minimum 15 mm screed in CM 1:4 and pointed in white cement with pigments or coloured cement to match the green marble slab. The grinding & polishing shall be done after laying of slabs to mirror polish [Tin oxide polish].

12.5. SKIRTING:
12.5.1. CEMENT PLASTER SKIRTING: Provide cement plaster skirting at locations shown in Schedule of finishes drawing. Skirting shall be of 5 mm thick in cement mortar [1:3] over 10 mm thick rendering in cement mortar [1:6], 100mm high. Surface shall be finished even and smooth with steel trowel using extra cement.

12.5.2. NON SKID CERAMIC TILE SKIRTING: Provide coloured glazed ceramic tile skirting 100 mm high at locations shown in Schedule of finishes drawing over 10 mm thick screed in cement mortar [1:3]. Tiles shall be all as specified hereinbefore 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.

12.5.3. COVING TO SKIRTING: Wherever skirting is provided, the top portion of skirting shall be provided with triangular coving in CM 1:3, finished even and smooth. The height of coving shall be equal to the projection of skirting from the wall surface.

12.6. GLAZED CERAMIC TILE DADO:
12.6.1. Provide glazed ceramic tile dado at locations all as shown in schedule of finishes drawing. The size of tile shall be 400mm x 300mm or 450mm x 300mm [or nearest size] and 7 mm thick grade B-III. The tile shall be plain, coloured and designed, Type B-III, grade-I quality and shall be got approved by the GE. The tile shall be set over cement screed 10 mm thick in cement mortar [1:3], jointed in neat cement slurry and pointed with white cement mixed with pigment, to match the colour of the tile. The height of dado shall be as shown in the drawing. The dado shall be provided al round, irrespective of what is shown in the drawing. Where not indicated in the drawing the height of dado shall be 1.50 M for W/C, and shall be 2.0 M for bathrooms.

12.6.2. The dado thickness projecting from the rendered wall surface shall be flushed using cement mortar 1:6. The top level of the flushed surface shall be finished to a true line as directed by the Engineer-in-charge.

13. PLASTERING AND POINTING:
13.1. Sand shall be fine and conform to the requirement of IS-1342 free from deleterious materials.

13.2. Water used for mixing and curing shall be clean free from deleterious matter. Water fit for drinking is normally suitable.

13.3. PREPARATION OF BACKGROUND FOR APPLICATION OF PLASTER:
13.3.1. 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.

13.4. 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.
PARTICULAR SPECIFICATIONS [Continued]

13.5. 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.

13.6. 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.

13.7. Dubbing out and rendering coat shall be same type and mix and dubbing coat shall be executed along with rendering coat.

13.8. Plastering shall not be done till doorframes are firmly fixed. Provide protection to fittings against splash of plaster, however if any plaster of mortar is noticed, it shall be cleaned off immediately.

13.9. 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.

13.10. In case of 2 coats plaster work, 1st coat shall be allowed to the materially completed before 2nd coat is applied.

13.11. The finished work of plastering shall not show more than 4mm projection when checked with straight edge of 2m length placed over it.

13.12. 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.

13.13. The plastered surface shall be finished even and fair without using extra cement unless stated otherwise hereinafter.

13.14. 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.

13.15. CURING: Each coat of rendering shall be kept damp continuously for 2 days. Moistening shall commence after plaster is sufficiently hardened.

13.16. PLASTERING [INTERNAL AND EXTERNAL]:


13.16.2. Irrespective of what is indicated in Schedule of finishes drawing all the external surfaces of walls/concrete shall be rendered with 15mm thick plaster in two coats. First coat shall be 10mm thick in cement-sand mortar 1:6 and the second coat shall be 5mm thick in cement sand mortar1:4, mixed 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.
PARTICULAR SPECIFICATIONS [Continued]

14. **SURFACE FINISHES TO BUILDINGS:**

14.1. **WHITE [LIME] WASHING:** Lime used for white washing shall be freshly burnt fat lime [Class “C”] white in colour, conforming to IS – 712. 3 coats of white wash shall be provided to walls all as specified in clause 15.12 of MES Schedule Part – I. Skirting and dado are not to be white washed. Unless otherwise shown in Schedule of finish Drg the ceiling are to be treated with 3 coats of white wash all as specified herein above.

14.2. **OIL BOUND DISTEMPER:** Wherever indicated in Schedule of finishes drawings provide oil emulsion distemper two coats over a coat of alkali resistant primer over wall care putty. Distemper, oil emulsion shall conform to IS 428-1969. Preparation of surfaces application of primer and distemper shall be in accordance with clauses specified in MES Schedule Part – I. Oil emulsion distemper shall be of any of the makes specified hereinafter.

14.3. **CEMENT BASE PAINT:** Wherever indicated in Schedule of finishes drawings provide cement base paint as per Clause 15.15 of MES Schedule Part – I.

14.3. **EXTERNAL WEATHER PROOF PAINT:**

14.3.1. **GENERAL:** Unless samples of all materials are approved, the contractor will not be allowed to commence the work. Brushing for painting etc., shall be got approved by Engineer-in-Charge based on manufacturer’s recommendations. No improvised brushes or sub standard brushes shall be brought to site and used.

14.3.2. **MATERIALS:**

14.3.2.1. Paint shall be weather proof Acrylic emulsion, exterior grade [100%acrylic] premium quality. Paint shall be procured from any of the makes listed hereinafter.

14.3.2.2. Shade of the paint shall be as approved by GE.

14.3.2.3. Primer shall be water based acrylic suitable for exteriors as per manufacturer’s instructions. Primer shall be of same make as of paint.

14.3.2.4. The paint and primer shall be brought in manufacturer’s sealed containers only by the contractor duly marked with batch number from the manufacturer.

14.3.2.5. 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.

14.3.2.6. Each container of paint and primer shall bear the following particulars:-

- [a] Manufacturer’s trade mark.
- [b] Reference to Indian Standard to which they comply.
- [c] Name of product.
- [d] Net weight.
- [e] Date of manufacturing.
- [f] Batch No.
- [g] Storage requirement.
- [h] Storage life.
- [i] Date of expiry.
14.3.2.7. 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.

14.3.3. WORKMANSHIP:

14.3.3.1. All brushes, tools, pots, kettles etc., used in carrying out the work shall be free from foreign matter and shall be thoroughly cleaned with hot water and solutions at the end of a day’s work or before use for a different type of material. No finish shall be executed until a sample of the finish to the required colour and shade has been approved by the GE. Where more than one finish is indicated, each coat shall be approved by the GE before the subsequent coat is applied.

14.3.3.2. The colour shall be even shade over the whole surface, if it is patchy or otherwise bad, the work shall be redone by the contractor at his own expense.

14.3.4. PREPARATION OF SURFACES: The surface shall be thoroughly cleaned of loose particles, dust, dirt, efflorescence, chalking, grease, mortar drops and other foreign matter. The surface shall be sandpapered with grade I abrasive paper and dusted off to achieve an even and smooth surface free from all dust particles. The contractor will use electric blowers for this purpose. If surface so obtained is uneven, it shall be brought to a perfectly even surface by applying putty and allowing it to dry completely and then it shall be rubbed with the abrasive paper and dusted off and finally area cleaned by use of electric blower.

14.3.5. PRIMING COAT: After preparing the surface as approved by GE, 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.

14.3.6. APPLICATION OF WEATHER PROOF PAINT:

14.3.6.1. The acrylic emulsion weather proof paint shall be applied by brush or roller. No stainer or colorants shall be used. The paint shall be stirred well before use. The primer coat shall not be left without application of top coats for a long period time.

14.3.6.2. Two coats of 100% Acrylic emulsion weatherproof paint thinned with 400 ml water per litre of paint shall be applied. The drying period between two coats shall be minimum 4 hours or as per Manufacturer’s instructions. The shade shall be as approved by GE. The finish of Acrylic emulsion weather paint shall be smooth matt finish.

14.3.6.3. 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.

14.3.7. GUARANTEE:

14.3.7.1. The work of applying primer and paint shall be got carried out under the supervision and guidance of accredited representative of the manufacturer. A certificate from their representative shall be obtained by the contractor to the effect that work of painting and primer has been carried out under their strict supervision and as per manufacturer’s instructions. The same shall be submitted by the contractor to GE. The contractor shall also obtain a written guarantee for effectiveness of paint against fading out, peeling off, cracking, dust / algae accumulation etc., for a period of 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.

14.3.7.2. 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 location 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 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 5 Years from the certified date of completion, unless the GE had previously given notice to the contractor to rectify the defects. Defect Liability Period under Condition – 46 of General Conditions of Contracts [IAFW – 2249] shall be deemed to be amended to the extent mentioned above for Acrylic Emulsion Paint.

14.3.7.3. An amount of Rs. 50,000.00 [Rupees fifty thousand only] shall be retained out of the contractor’s Final Bill as Security Deposit against the guarantee for Acrylic Emulsion Paint for 5 Years. If contractor fails to rectify the defects noticed in the treatment or found in the material the aforesaid amount so retained shall be utilised for rectification of defects and contractor shall have no claim whatsoever on this account. This amount shall be released after successful expiry of the 5 Years 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.

14.3.8. SCAFFOLDING:

14.3.8.1. 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.

14.3.8.2. 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 pervert it from swaying from the building or structure.

14.3.8.3. 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.

14.3.8.4. Safe means of access shall be provided to all working platforms and other working places.

14.3.8.5. 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 / Garrison Engineer after considering the quality of the work undertaken on completion of the painting.

14.3.9. SAFETY PRECAUTIONS:

14.3.9.1. 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.

14.3.9.2. 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.
14.3.10. **STAGE PASSING:**

14.3.10.1. 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:**

1. Extent of area to be painted.
2. Sample of painting work [Area to be decided by GE]
3. After preparation of surface and before applying priming coat.
4. After applying priming coat.
5. After applying first coat of Acrylic emulsion paint.
6. After applying second coat of Acrylic emulsion paint.

15. **GLAZING:** 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 of 4 mm irrespective of what is indicated 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.

16. **PAINTING**

16.1. The synthetic enamel paint shall be of 1st quality as approved by GE.

16.2. 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.

16.3. Paint for priming coat, under coat and finishing coat will be of the same manufacturer.

16.4. Tint of paint, if not mentioned in drawings/schedule of finishes will be approved by the GE.

16.5. 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.

16.6. 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.

16.7. Surfaces which become inaccessible for painting after execution shall be painted before execution.

16.8. Surfaces which are specified to be treated with synthetic enamel paint in the schedule of finishes and drawings shall be prepared and painted with two coats of approved synthetic enamel paint over a coat of primer all as specified. 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.
16.9. **PAINTING TIMBER SURFACES/STEEL SURFACES:** Where painting to timber/steel surfaces is indicated on drawings prepare surfaces and apply two coats of synthetic enamel paint over one coat of primer as specified here -in-before. 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.

16.10. **WORKMANSHIP:**

16.10.1. 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.

16.10.2. 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.

16.11. Unless otherwise indicated on drawings and/or specified in these particular specifications all surfaces of iron and steel work shall be prepared and treated with two coats [one undercoat and one finishing coat] of synthetic enamel paint over a coat of primer all as specified here-in-before. Reinforcement bars, tinned or galvanized iron surfaces and steel-work embedded in concrete/plaster shall however not to be painted.

16.12. Bottom of door shutters shall be given one coat of primer only.

16.13. Irrespective of what is indicated on drawings and specified elsewhere, finishing coat and undercoat shall be with the same paint.

16.14. **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. Contractor’s quoted rates shall be deemed included of the above said provision and nothing extra shall be admissible on this ground.

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

17. **PLUMBING:**

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

17.2. **SCOPE OF WORK:**

17.2.1. The work of plumbing included in unit rates of Schedule "A" Part – I shall include for all materials and labour for all items of plumbing shown on drawings and as specified and all as mentioned below including connections and joints with and including necessary specials such as bends, tees, etc.

[a] UPVC/WR 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.

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.

17.2.2. All soil pipes and fittings shall be 110mm dia UPVC pipes inside the Bldg 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 110 mm 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.

[a] Gully traps including necessary waste pipe in between gully traps and Nahani trap / Floor trap.
[b] Drain pipes from gully trap to first manhole outside the building area and connection thereto.
[c] Excavation and earth work up to first manhole [excluding the manhole] shall be deemed to be included in the cost of respective building in Schedule “A” Part – I.
[d] Separate soil waste pipe will 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.

17.2.3. 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.

17.2.4. 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.

17.2.5. Where not indicated else-where, angle iron bracket shall be fixed to walls with PCC [1:3:6] type C-1 block of size 100mm x 100mm x 75mm.

17.2.6. Cast iron brackets shall be fixed on walls with wooden plugs [built in walls] or plugged to walls, Size of PCC blocks shall be 100mm X 100mm X 75mm and shall be in PCC [1:3:6] type C1 using 20 mm graded stone aggregate.

17.3. 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.

17.4. **SOIL, WASTE AND VENT PIPES:**

17.4.1. 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 MES Schedule Part – I.
PARTICULAR SPECIFICATIONS [Continued]

17.4.2. All the pipes and fittings shall have ISI certification mark.

17.5. **JOINTING:** Jointing shall be carried out as specified in clause 18.52 & 18.67.7A of MES Schedule Part – I.

17.6. **FIXING OF PIPES TO WALLS**

17.6.1 Fixing of pipes to walls/floors shall be carried out as per manufacturer’s instructions.

17.6.2. Pipes embedded in floor between Nahani trap and Nahani trap from Nahani trap to external waste pipe stack shall be in one piece.

17.6.3. 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.

17.7. **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.

17.8. **GULLY TRAPS:**

17.8.1. Where shown on drawings gully traps shall be salt glazed stone ware Grade “A” complying with the requirement of IS – 651.

17.8.2. Gully traps shall be square mouthed, 150mm x 150mm size set in PCC [1:3:6] type C1.

17.8.3. Cast iron grating shall be 150mm x150mm and coated with bituminous paint and fixed as directed by the Engineer-in-Charge.

17.9. **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. Testing apparatus, material, labour, etc shall be provided by contractor at his own expense.

18. **SANITARY APPLIANCES:**

18.1. Sanitary appliances shall be of vitreous China 1st quality and shall conform to IS-2256. 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.

18.2. **WATER CLOSET ORISSA PATTERN:** Provide Orissa Pattern Water closet, white, shall be of size 580 X 440mm with integral foot rests and “P” or “S” trap along with 10 Litres discharge capacity, Low level PVC valve less syphonic action flushing cistern conforming to relevant IS with all fittings including 32mm dia chromium plated brass tube flush pipe with brass unions at ends at locations shown on drawings. Squatting pan shall conform to IS – 3556 Part – III. The pan shall be set in cement mortar 1:2 at least 150mm around and finishing just below the level of rim of pan to receive the specified thickness of floor finish.
18.3. **FLUSHING CISTERN:**

18.3.1. Provide PVC flushing cistern low level 10 liters capacity for water closets. The PVC cistern shall be of "Champion" model with Delrina valve conforming IS 7231 manufactured by M/s. Phenoweld Polymer [P] Ltd. Mumbai or M/s. Parry ware, "Slimline" model. The cistern shall be fitted with suitable handle / chain / rope for smooth and convenient operation. 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.

18.3.2. 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 polythene 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.

18.4. **WATER CLOSET [EUROPEAN TYPE]:**

18.4.1. Water Closet European Type [pedestal pattern] wherever shown on drawing shall comprise as under:

- **i** Vitreous China white water closet apparatus [Pedestal Pattern] of height 400mm to 410mm rear outlet conforming to IS with integral "P" Trap having minimum 75mm water seal. The water closet shall be screwed to wooden plugs embedded into floor.

- **ii** Seat and cover shall be of thermo plastic material conforming to IS – 2548 [Part – II] black plastic closed pattern, flat bottom, hinged with chromium plated brass hinges, rubber buffers of suitable size and conforming to IS.

- **iii** PVC [HDPE] low level cistern 10 litres capacity all as described hereinafter.

- **iv** Flush pipe.

18.5. **WASH HAND BASIN:**

18.5.1. Provide Wash hand basin at the locations as shown on drawing.

18.5.2. Wash hand basin shall include the following:

- **a** Vitreous china wash hand basin of size 550mm X 450mm complete with brass chromium plated waste outlet screwed with necessary coupling connection.

- **b** A pair of painted cast iron brackets fixed on and including teak wood plugs embedded in walls.

- **c** Brass chromium plated chain and rubber plug

- **d** Readymade 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.

- **e** 32 mm GI pipe with waste Brass CP coupling, GI waste pipe shall be provided up to floor trap and further waste pipe in floor shall be done as per drawings.
PARTICULAR SPECIFICATIONS [Continued]

18.6. WASH HAND BASIN ON GRANITE SLAB COUNTER WITH MIRROR:

18.6.1. 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.

18.6.2. Provide mirror of full width of counter all as shown on drawing. Mirror shall be of selected quality glass of 6 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 specified 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.

18.7. STAINLESS STEEL TOWEL RAIL: Provide towel rail at locations shown on drawing. Towel rail shall be of 19 / 20mm dia stainless steel tube of wall thickness 1.5mm, 600 mm long of reputed make and of shape shown on drawing. Brackets shall be fixed to wooden plugs embedded in wall.

18.8. SOAP TRAY: Provide vitreous china white soap tray at locations shown on the drawings.

19. MISCELLANEOUS ITEMS:

19.1. STEPS: Provide steps at location and as per details shown on drawing. 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.

19.2. MIRROR: Provide mirror at location and to the size shown on drawing. Mirror shall be of selected quality glass not less than 5.5 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 specified hereinafter. Mirror shall have 6 mm thick plywood backing of BWR grade with commercial face veneers. Mirror shall be fixed with suitable number of CP brass screws and cup washers and wooden plugs embedded in wall. If size of mirror is not mentioned then the same shall be of full size.

19.3. CUPBOARDS: Provide cupboards at locations and to the sizes and details shown on the drawing. The wooden Frame / Chowkats for cupboard shall be of II Class hard wood, of species as specified hereinbefore. The frame face, in contact with plastered surface shall be given 2 coats of tarring before fixing. Provide 19mm thick commercial veneered particle board [exterior grade] with 6mm thick teak wood lipping around in lieu of the shutters shown on drawings. Provide 19mm thick commercial veneered particle board [exterior grade] in shelves in lieu of RCC shelves shown on drawing except top shelf which shall be of RCC. Provide aluminium anodized builders hardware as shown in the drawing. Provide stainless steel piano hinges in lieu of MS butt hinges shown on drawing. The surfaces of wood and particle board shall be treated with 2 coats of synthetic enamel paint, over a coat of pink primer. The internal plastered surfaces of cupboard shall be treated with 2 coats of oil bound distemper over a coat of alkali resistant primer.

19.4. DRAPERY RODS: Provide drapery rods with brackets and finials, at locations indicated on drawings. The drapery rod shall be powder coated aluminium rod of 25mm dia, with wall thickness not less than 1.5mm and as approved by GE. 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.
19.5. **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

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. Cl 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.

19.6. **SOAP NICHE:** Provide soap niche in toilets at locations shown on drawings. The internal surfaces of soap niche shall be finished as per adjoining wall finish.

19.7. **POLISHED KOTA SPLASH STONE:** Provide polished Kota splash stone at each down take RWP. The size of splash stone shall be all as indicated in the drawing. If not indicated the same shall be of size 450 x 750 x 25mm set over plinth protection.

19.8. **HDPE WATER TANK:** Rotational moulded polyethylene water storage tanks [double layered] shall be as per IS-12701 and shall be of any of one of the makes as specified hereinafter. 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, Whether shown on drawing or not, provide 30 cm long inlet, 30 cm long outlet GI pipe medium grade of suitable dia with necessary check nuts and the Lumpsum quoted for buildings under Schedule “A” Part – I shall deemed to include the cost of the same. 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.

19.9. **SPOUTS:** Provide UPVC spouts at locations with diameter and length as shown on drawings. UPVC pipes shall be pressure rating 4.5 KG / Sq.cm and GI pipe shall be of medium grade.

19.10. **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.

19.11. **DAMP PROOF COURSE:**

19.11.1. 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.

19.11.2. Water proofing compound for damp proof course shall be as per IS – 2645.

19.11.3. 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.

19.12. **CILL:** Provide 18 to 20mm thick machine cut Green Marble stone slab in one piece Cills at locations as shown on drawings and set over PCC 1:2:4, Type B1. Cill shall have 75 mm bearing on either side of opening. Cill shall have slope to external side for easy drain out of water.
PARTICULAR SPECIFICATIONS [Continued]

19.13. **STAIR CASES:**

19.13.1. Provide RCC staircase all as shown in drawings. Railing shall be of stainless steel as shown on drawing. 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.

19.13.2. Staircase shall be provided with 18 to 20mm thick Green Marble stone slab irrespective of what is shown on drawings. Treads of steps & landing of staircase shall be provided with Green Marble stone slab 18 to 20mm thick machine cut in one piece set over 15 mm thick CM 1:4 and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing/polishing. Risers shall be provided with Green Marble stone slab 18 to 20mm thick machine cut in one piece set over 10 mm thick CM 1:4. Soffit of RCC staircase shall be treated with 3 coats of white wash all as specified hereinbefore.

20 **SITE CLEARANCE / AREA DEVELOPMENT / EARTHWORK EXCAVATION:**

20.1 Site clearance/Earthwork excavation shall be carried out all as detailed in Schedule “A”.

20.2 Site clearance consists of cutting, removing and disposing of all materials such as trees [less than 30 cm girth], bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150mm in thickness, rubbish etc., from the area of land containing embankment, drains, cross-drains etc as directed by the Engineer-in-Charge. It includes necessary excavation, back filling of pits resulting from uprooting of trees and stumps to required compaction, handling, salvaging and disposal of cleared materials. This also includes surface dressing as per clause 3.3.6 of MES Schedule Part – I. Clearing and grubbing shall be performed in advance of earthwork operation. The unseverable materials obtained from site clearance shall be disposed to a distance not exceeding 50m.

20.3 **MOORUM / RED BAJRI:** Moorum/Red bajri shall be all as per cause No 3.21.1 of SSR Part – I. Moorum/Red Bajri Shall be obtained from approved pits and quarries of disintegrated rocks containing silicious material and natural mixture of clay of calcareous origin. These shall not contain any admixtures of ordinary earth. Red Bajri shall be dark red in colour consisting of coarse grains, free from mica and other foreign matter. Size of moorum/Bajri shall vary from dust to 40 mm gauge. Anything over in size shall be rejected or shall be broken down to bring within 40 mm 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. 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 15 cm [Spread thickness] over entire width. Successive layers shall not be placed until the layer under construction has thoroughly compacted. Each layer shall be compacted based on initial and final levels taken before and after filling.

21 **ROADS / PATH / HARDSTANDING:**

21.1 The work under this schedule shall be carried out all as specified hereinafter and in MES Schedule, shown on drawings and as directed by the Engineer-in-Charge.

21.2 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 measurements of stacks are not subject to any deductions.
PARTICULAR SPECIFICATIONS [Continued]

21.3. **BITUMEN:** Bitumen shall be paving bitumen of Grade VG-30 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.

21.4. **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.

21.5. **BLOCK LEVELS:**

21.5.1. Before commencement of road-work, 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.

21.5.2. 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.

21.5.3. 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 in addition to the entries made in the measurement book.

21.5.4. From the above mentioned signed drawing and final levels, volume of cutting/filling shall be computed by using standard formula of Simpson's rule and prismoidal formula. 10% [TEN] deduction shall be done from the volume of filling.

21.6. **SOLING:** Stones for soling shall be crushed or broken hard stone obtained from approved quarries and shall be broken to size ranging from 100mm to 50mm and conform to the samples kept in GE's office and approved by the GE before incorporation in the work. Thickness of broken stone soling shall be as indicated in Schedule “A”, laid in layers as indicated, levelled, watered and rolled to required surface and camber all as specified in clause 20.A.20.1 of MES Schedule Part – I.

21.7. **WATER BOUND MACADAM:**

21.7.1. Stone for water bound macadam shall be hard broken graded granite aggregate of grading 2, 63 to 40mm size obtained from approved quarries. Screenings shall be of granite and shall be of grading Type B.

21.7.2. WBM work shall be completed six months before laying bituminous carpet. The surface of WBM shall be inspected before laying carpet by GE and representative of contractor for rectifying the defective construction if any, specified in MES Schedule Part – I clause 20.A.21.11, without extra cost to the Government. Bituminous carpet work shall not be carried out unless the “Stage Passing” is given by GE.
PARTICULAR SPECIFICATIONS [Continued]

21.8. **SEMI DENSE ASPHALTIC CONCRETE [SDAC]:**

21.8.1. **MATERIALS:**

21.8.1.1. The semi 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:

<table>
<thead>
<tr>
<th>Is Sieve [mm]</th>
<th>Cumulative % by weight of total aggregate passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>13.2</td>
<td>90 - 100</td>
</tr>
<tr>
<td>9.5</td>
<td>70 - 90</td>
</tr>
<tr>
<td>4.75</td>
<td>35051</td>
</tr>
<tr>
<td>2.36</td>
<td>24 - 39</td>
</tr>
<tr>
<td>1.18</td>
<td>15 - 30</td>
</tr>
<tr>
<td>0.6</td>
<td>15 - 30</td>
</tr>
<tr>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>0.15</td>
<td>09 - 19</td>
</tr>
<tr>
<td>0.075</td>
<td>3 - 8</td>
</tr>
</tbody>
</table>

**Note:** The combined grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.

21.8.1.2. 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 ration 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 hydrophanous 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.

21.8.1.3. The aggregates shall satisfy the following physical requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanliness [Dust]</td>
<td>Grain Size Analysis [IS – 2386 Part – I]</td>
<td>Max 5% Passing 0.075mm sieve</td>
</tr>
<tr>
<td>Particle shape</td>
<td>Flakiness and Elongation Index</td>
<td>Max 30%</td>
</tr>
<tr>
<td></td>
<td>[Combined] [IS – 2386 Part – I]</td>
<td></td>
</tr>
<tr>
<td>Strength</td>
<td>*Los Angeles Abrasion Value</td>
<td>Max 30%</td>
</tr>
<tr>
<td></td>
<td>[IS – 2386 Part – IV]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Aggregate Impact Value</td>
<td>Max 24%</td>
</tr>
<tr>
<td></td>
<td>[IS – 2386 Part – IV]</td>
<td></td>
</tr>
<tr>
<td>Durability</td>
<td>Soundness [IS:2386 Part – V]</td>
<td>Max 12%</td>
</tr>
<tr>
<td></td>
<td>Sodium Sulphate</td>
<td>Max 18%</td>
</tr>
<tr>
<td></td>
<td>Magnesium Sulphate</td>
<td></td>
</tr>
<tr>
<td>Water Sensitivity</td>
<td>Retained Tensile Strength [AASHTO T 283]</td>
<td>Min 80%</td>
</tr>
<tr>
<td>Stripping</td>
<td>Coating &amp; Stripping of Bitumen Aggregate</td>
<td>Minimum retained coating 95%</td>
</tr>
<tr>
<td></td>
<td>[Mixtures] [IS – 6241]</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
1. *Aggregate may satisfy requirements of either of these two tests.*
PARTICULAR SPECIFICATIONS [Continued]

2. Water sensitivity test is only required for the minimum retained coating in the striping 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.

21.8.1.4. 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, hand durable, dry and free from ingenious soft or flaky pieces and organic or other deleterious substances.

21.8.1.5. 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.

<table>
<thead>
<tr>
<th>IS Sieve [mm]</th>
<th>Cumulative per cent passing by weight of total aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6</td>
<td>100</td>
</tr>
<tr>
<td>0.3</td>
<td>95 – 100</td>
</tr>
<tr>
<td>0.075</td>
<td>85 – 100</td>
</tr>
</tbody>
</table>

The rate quoted for the semi asphaltic concrete works shall be including the cost of the filler to be incorporated in the mix as per approved mix design.

21.8.2. DESIGN CRITERIA FOR SDAC:

21.8.2.1. 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:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Specified Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>Number of compaction blow each end of Marshall specimen</td>
</tr>
<tr>
<td>[b]</td>
<td>Marshall stability in KGs</td>
</tr>
<tr>
<td>[c]</td>
<td>Flow value [mm]</td>
</tr>
<tr>
<td>[d]</td>
<td>Percentage air void mix [to prevent bleeding]</td>
</tr>
<tr>
<td>[e]</td>
<td>Percentage air voids filled with Bitumen [VFB]</td>
</tr>
<tr>
<td>[f]</td>
<td>Loss of stability on immersion in wear at 60 C [ASTMD 1075]</td>
</tr>
<tr>
<td>[g]</td>
<td>Binder content % by weight of total mix.</td>
</tr>
<tr>
<td>[h]</td>
<td>Percentage voids in mineral aggregates [VMA]</td>
</tr>
</tbody>
</table>

** The binder content has been indicated in the respective Schedule “A” items. However, the binder content to be used in the works shall be as per approved mix design as per job mix formula obtained from approved Institutions / laboratories. Adjustment in cost of binder between the exact quantity of binder used as per designed binder content and the quantity indicated in Schedule “A” shall be made as specified in schedule “A”.
PARTICULAR SPECIFICATIONS [Continued]

28.8.2.2 MINIMUM PERCENT OF VOIDS IN MINERAL AGGREGATES:

<table>
<thead>
<tr>
<th>Nominal maximum particle size*</th>
<th>Minimum VMA, Percent related to mix Design air voids, percent**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>9.5</td>
<td>14.0</td>
</tr>
<tr>
<td>12.5</td>
<td>13.0</td>
</tr>
<tr>
<td>19.0</td>
<td>12.0</td>
</tr>
<tr>
<td>25.0</td>
<td>11.0</td>
</tr>
<tr>
<td>37.5</td>
<td>10.0</td>
</tr>
</tbody>
</table>

* 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.

21.8.3. JOB-MIX FORMULA FOR SDAC:

21.8.3.1. Job mix formula shall be got designed in any of the Institutions given below:

[a] CRRI, New Delhi
[b] SEMT Wing, CME Pune.
[c] IIT Chennai / Roorkee / Delhi
[d] Any Govt. Approved Lab.

21.8.3.2. 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 here inbefore.

21.8.3.3. 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.

21.8.3.4. 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.

21.8.3.5. Preparation of mix, laying, spreading, compaction and control for semi dense asphaltic concrete shall be done all as specified in clause 20.8.4 of MES Schedule Part – I.

21.8.3.6. 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.


21.8.4.1. Once the laboratory job mix formula is approved the contractor shall carry out plant trails 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.
PARTICULAR SPECIFICATIONS [Continued]

<table>
<thead>
<tr>
<th>Description</th>
<th>Permissible variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate passing 19mm sieve or larger</td>
<td>+8%</td>
</tr>
<tr>
<td>Aggregate passing 13.2mm, 9.5 mm</td>
<td>+7%</td>
</tr>
<tr>
<td>Aggregate passing 4.75 mm</td>
<td>+6%</td>
</tr>
<tr>
<td>Aggregate passing 2.36mm, 1.18 mm, 0.6 mm</td>
<td>+5%</td>
</tr>
<tr>
<td>Aggregate passing 0.3mm, 0.15 mm</td>
<td>+4%</td>
</tr>
<tr>
<td>Aggregate Passing 0.075mm</td>
<td>+2%</td>
</tr>
<tr>
<td>Mixing temperature</td>
<td>+10°C</td>
</tr>
</tbody>
</table>

21.8.4.2. 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.

21.8.4.3 LAYING TRIALS: [For SDAC]

[a] Once the plant trials have been successfully completed and approved, the contractor shall carry out laying trials at the locations as indicated by the Engineer-in-Charge on runway, to demonstrate that the proposed mix can be successfully laid, and compacted all in accordance with contract conditions. The laying trial shall be carried out one suitable area, which is not to form part of the works, unless of 100 Sq.m of construction similar to that of the proposed work, and its shall be in all respects similar, particularly compaction shall be same as required in the proposed work, on which the bituminous material is to be laid.

[b] The contractor shall previously inform the GE of the proposed method for laying and compacting the material. The plant trials shall then establish if the proposed laying plant, compaction plant, and methodology is capable of producing satisfactory results. The density of the finished paving layer shall be determined by taking cores, no sooner than 24 hours after laying or by other approved method.

[c] Once the laying trials have been approved, the same plant and methodology shall be applied to the laying of the material on the project, and no variation of either shall be acceptable, unless approved in writing by the GE, who may at his discretion require further laying trials without any extra cost to the Government.

21.8.5. MIXING AND TRANSPORTATION OF MIX:

21.8.5.1. 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.

21.8.5.2. 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.
PARTICULAR SPECIFICATIONS [Continued]

21.8.5.3. 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.

21.8.6. **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.

21.8.7. **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 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.

21.8.8. **QUALITY ASSURANCE:** Adequate quality control at every stage of work is essential and the contractor is responsible in conducting day to day quality control tests as enumerated in succeeding clauses. This shall be in addition to any other tests which will be required by the Garrison Engineer and Engineer-in-Charge through approved laboratory/test house. Expenses on all test shall be deemed to be included in the rates quoted.

21.8.9. **QUALITY CONTROL PLAN:**

21.8.9.1. The following details are to be submitted by contractor duly signed within 15 days of commencement of work.

**PART – I:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contract Agreement Reference No</td>
</tr>
<tr>
<td>2</td>
<td>CPM Net work prepared and approved by GE</td>
</tr>
<tr>
<td>3</td>
<td>Resource scheduling done base on CPM</td>
</tr>
<tr>
<td>4</td>
<td>Mix design submitted and approved</td>
</tr>
<tr>
<td>5</td>
<td>Preliminary works completed to standard engineering practice</td>
</tr>
<tr>
<td>6</td>
<td>Arrangements for water made</td>
</tr>
<tr>
<td>7</td>
<td>Arrangement for electric supply made</td>
</tr>
<tr>
<td>8</td>
<td>Materials brought to the site to be maintained as per following format:</td>
</tr>
<tr>
<td></td>
<td>Ser No.</td>
</tr>
<tr>
<td>9</td>
<td>List of all T &amp; P, make and numbers that the contractor would deploy at site of work</td>
</tr>
<tr>
<td>10</td>
<td>Name of person nominated by contractor for exercising quality control</td>
</tr>
<tr>
<td>11</td>
<td>Qualifications / Experience of person at Serial No.11 above.</td>
</tr>
<tr>
<td>12</td>
<td>Names of supervisors with their qualifications experience employed by contractor</td>
</tr>
<tr>
<td>13</td>
<td>Confirmation that contract requirements relating to quality of all materials and quality standards workmanship and finishes and acceptance criteria are explained and understood by all</td>
</tr>
<tr>
<td>14</td>
<td>Confirmation that requirement of tests to be conducted on materials before approval of samples and during execution, tests on workmanship, tests before acceptance including the testing procedure, sampling techniques frequency and agencies responsible for testing are understood and shall be complied with.</td>
</tr>
<tr>
<td>15</td>
<td>Method to be adopted for maintaining records of test result</td>
</tr>
<tr>
<td>16</td>
<td>Certificate that contractor shall maintain log of all materials received at site as per the following format:</td>
</tr>
<tr>
<td></td>
<td>Ser No.</td>
</tr>
<tr>
<td>17</td>
<td>General Remarks by contractor of his plan of actions to ensure that quality standards.</td>
</tr>
</tbody>
</table>
PARTICULAR SPECIFICATIONS [Continued]

21.8.10. PLANTS / MACHINERY TO BE USED:

21.8.10.1. 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:

[a] Cold aggregate feed system for providing blended aggregate in correct proportions. At least 3 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 unburned fuel or carbon residue on the aggregates.

[c] 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.

[d] 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.

[e] 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.

[f] Dust control unit shall be part of the plant.

[g] Suitable auxiliary bitumen boiler of adequate capacity with self - heating arrangement and temperature control device.

21.8.10.2. PAVER FINISHER: Paver finisher shall have the following essential features:

[a] Loading hoppers and suitable distributing mechanism.

[b] Hydrostatic drive / Control for all drives

[c] Hydraulically extendable screed for appropriate width requirement

[d] 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.

[e] Necessary control mechanism so as to ensure that the finished surface is free from 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.

21.8.10.3. 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.
21.8.10.4. **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.

21.8.10.5. **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.

21.8.10.6. **PNEUMATIC TYRE ROLLER:**
   [a] 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.
   [b] The contractor shall remove all loose material/wooden twigs or any other material from resurfaced portion of the road after completion of work.

21.8.11 **QUALITY CONTROL TESTS:**

### CONTROL TESTS ON FLEXIBLE PAVEMENT:

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Type of Construction</th>
<th>Test</th>
<th>Frequency [Minimum]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Semi Dense Bituminous Concrete / Bituminous Concrete</td>
<td>[i] Quality of binder</td>
<td>Number of samples per lot and test as per IS – 73, IS – 217 and IS – 8887 as applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[ii] Aggregates Impact Value/Loss Angles Abrasion Value</td>
<td>One test per 200 Cu.m of aggregate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[iii] Flakiness Index &amp; Elongation Index</td>
<td>One test per 50 Cu.m of aggregate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[iv] Stripping Value</td>
<td>Initially one set of three representative specimens for each source of supply. Subsequently when the warranted by changes in the quality of aggregate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[v] Water Absorption of Aggregates</td>
<td>- do -</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[vi] Soundness [Magnesium and Sodium Sulphate]</td>
<td>Initially one determination by each method for each of supply, ten as warranted by change in the quality of aggregates.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[vii] Sand equivalent test</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[viii] Plasticity Index</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[ix] Polished Stone Value</td>
<td>As required, for Semi Dense Bituminous Concrete / Bituminous Concrete</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[x] Percentage of fractured faces</td>
<td>When Gravel is used, one test per 50 Cu.m of aggregates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[xi] Mix grading</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[xii] Stability of mix</td>
<td>For each 400 tones of mix produced, a set of 3 Marshall specimen to be prepared and tested for suitability, flow</td>
</tr>
</tbody>
</table>
### PARTICULAR SPECIFICATIONS (Continued)

<p>| | | |</p>
<table>
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<tbody>
<tr>
<td></td>
<td></td>
<td>value, density and void content subject to minimum of two sets being tested per plant per day</td>
</tr>
<tr>
<td>[xiii]</td>
<td>Water sensitivity mix</td>
<td>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]</td>
</tr>
<tr>
<td>[xiv]</td>
<td>Swell test on the mix</td>
<td>As required for the Bituminous Concrete</td>
</tr>
<tr>
<td>[xv]</td>
<td>Control of temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling</td>
<td>At regular close intervals</td>
</tr>
<tr>
<td>[xvi]</td>
<td>Control of binder content and grading of mix</td>
<td>One test for each 400 tonnes of mix subject to a minimum two tests per day per plant.</td>
</tr>
<tr>
<td>[xvii]</td>
<td>Rate of spread of mixed materials</td>
<td>Regular control through checks on weight of mixed materials and layer thickness</td>
</tr>
<tr>
<td>[xviii]</td>
<td>Density of compacted layer</td>
<td>One test per 250 Sq.m area</td>
</tr>
<tr>
<td>Binder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[i]</td>
<td>Softening Point</td>
<td>Initially on submission there after daily if site blended, weekly if pre – blended</td>
</tr>
<tr>
<td>[ii]</td>
<td>Penetration at 25°C and 4°C</td>
<td>- do -</td>
</tr>
<tr>
<td>[iii]</td>
<td>Elastic recovery</td>
<td>- do -</td>
</tr>
<tr>
<td>[iv]</td>
<td>Ductility</td>
<td>- do -</td>
</tr>
<tr>
<td>[v]</td>
<td>Flash Point</td>
<td>- do -</td>
</tr>
<tr>
<td>[vi]</td>
<td>Frass Breaking</td>
<td>Initially on submission</td>
</tr>
<tr>
<td>[vii]</td>
<td>Viscosity at 150°C</td>
<td>- do -</td>
</tr>
<tr>
<td>[viii]</td>
<td>Thin film oven test, penetration, softening pint, elastic recovery of residue, loss on heating.</td>
<td>- do -</td>
</tr>
</tbody>
</table>

21.8.12. **PERMISSIBLE TOLERANCES FOR SDAC**: The permissible variation in binder content with reference to Schedule “A” shall be within the following limits:

- [i] Binder content : ± 0.3%

21.8.12.1. When the road is opened to traffic, it should be ensured that a minimum density of 95% is achieved.

21.8.13. **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.

21.9. **MISSING DETAILS / SPECIFICATIONS**: In case of any missing specification details, relevant provisions contained in IRC [Indian Road Congress] shall be followed during execution of the work. In case the same are not available in IRC also, the same will be followed from latest version of relevant technical Instructions published by E-in-C’s branch.

21.10. **MEASUREMENTS**: Refer special condition 20.A.1 on Page 433 of MES Schedule Part – II.
PARTICULAR SPECIFICATIONS [Continued]

21.11. OPENING TO TRAFFIC: Traffic may be allowed immediately after completion of the final rolling when the mix has cooled down to the ambient temperature.

21.12. 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.

21.13. 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.

21.14. MATERIALS AND TESTING:

21.14.1. 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.

21.14.2. 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.

21.14.3. 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.

22. BLANK

23. SEWAGE DISPOSAL:

23.1. For materials such as coarse aggregate, fine aggregate, cement, stones, steel for reinforcement etc refer the respective clauses as specified hereinbefore.

23.2. PCC bed and haunching to drain pipes shall be provided all as specified in para 18.68 of MES Schedule Part - I.

23.3. RR masonry shall be provided all as specified hereinbefore.

23.4. SALT GLAZED STONE WARE PIPES AND FITTINGS: SGSW pipes, fittings shall comply to the requirement of IS-651. The pipes and fittings shall be quality Grade "A" and shall be sound, free from visible defects. The glaze shall be free from crazing. The pipe shall give a sharp, clear note when struck with a light hammer. The acceptance criteria shall be as per IS-651-1980.

23.5. BED CONCRETE/HAUNCHING: Concrete foundations to the pipes, hunching the pipes shall be provided as specified in Schedule "A". 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.
PARTICULAR SPECIFICATIONS [Continued]

23.6. **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.

23.7. **TEST FOR PIPES:** The pipes shall be tested for water test all as specified in clause 18.79 of MES Schedule Part I. The unit rate for pipes in Schedule "A" include for this test.

23.8. **MAN HOLES:** Manholes shall be built as per details given in drawing as described in Schedule "A" and as per specification 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 Schedule Part – I.

23.9. **MS RUNGS/STEEL RUNGS:**

23.9.1. The rungs shall conform to IS – 5455. 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.

23.9.2. 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 of 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 against slip.

23.9.3. 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 on cement concrete block being painted with thick cement slurry before fixing.

24. **INTERNAL WATER SUPPLY:**

24.1. **GENERAL:**

24.1.1. The scope of work included under Schedule "A" comprises of 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-Change.

24.1.2. Layout shown in the drawing is tentative.

24.1.3. Particulars specifications given hereinafter are brief and are only to particularise, amend and emphasis the specifications given in MES Schedule, Which are not repeated.

24.1.4. In addition to IS mentioned in the MES Schedule the following IS shall be applicable and supersede the provisions of MES Schedules in case of any discrepancy.

24.1.5. IS – 1172, Basic requirement of water supply, drainage and sanction [second revision].


24.2. **SAMPLES AND MATERIALS:**

24.2.1. 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.
PARTICULAR SPECIFICATIONS [Continued]

24.2.2. 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.

24.2.3. 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.

24.2.4. 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 and 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.

24.2.5. 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 hereinafter and neatly finished as per surrounding surfaces. Cost of cutting chasing in fly ash brick walls shall be included in Lumpsum cost of building.

24.3. PP-R WATER SUPPLY PIPES: Pipe and pipe fittings shall be of 3-layered PP-R [Polypropylene random copolymer] pipes SDR 7.4 [PN-16] UV stabilized and antimicrobial fusion welded having thermal stability for hot & cold water supply including all PP-R plain & brass threaded polypropylene random fittings all as specified in Clause 18.114 of MES Schedule Part – I. Laying, jointing and fixing of pipes shall be carried out all as specified in clauses 18.114.3 and its sub-clauses of MES Schedule Part – I. The Contractor shall use proper bends, elbows, tees etc. at turning corners. Bending of pies 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.

24.4. BIB TAPS AND STOP VALVES: Bib taps and stop valves shall be shall be of size and specificatiion as given in respective item of Schedule "A", 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].

24.5. GATE VALVE: Gate Valve shall be of size and specification as given in respective item of Schedule "A", ISI marked and of approved make.

24.6. PILLAR TAPS: Pillar taps shall be of size and specification as given in respective item of Schedule "A", ISI marked and of approved make. Minimum finished mass of pillar tap shall be all as specified in relevant of MES Schedule Part – I.

24.7. 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.

24.8. WORKMANSHIP:

24.8.1. Skilled artisans and qualified supervisors shall be employed by the contractor.
PARTICULAR SPECIFICATIONS [Continued]

24.8.2. 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.

24.8.3. 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.,

24.8.4. 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.

24.8.5. 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.

24.8.6. Water tubing shall be bitumen coated where the pipes are concealed or buried.

24.8.7. Pipes shall not run diagonally. The galvanizing of clamps nuts and bolts shall be as per relevant IS.

24.8.8. 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.

24.8.9. Screwed plugs shall be provided to all open ends of pipes on completion of work.

24.8.10. Three copies of record drawings on tracing cloth of line plan of complete water supply line as executed in the building with position of fitting shall be submitted by the contractor on completion of work.

24.8.11. Work shall be executed by licensed plumbers. The contractor shall produce the license of the plumber for verification of Engineer-in-Charge

25. INTERNAL ELECTRIC SUPPLY:

25.1.1. SCOPE OF WORK: The scope of work under this Schedule “A” consists of providing internal electrification to the buildings as described in Schedule “A” Part – I and as specified and shown on drawings.

25.1.2. The specifications and general rules/conditions laid in MES Schedule Part – I and Part – II including errata and amendments as applicable.

25.1.3. 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.

25.1.4. All electrical works shall be executed as specified in MES Schedule.

25.1.5. The general tentative layout of the wiring points and fittings is shown in the drawings. The exact locations of fittings may be altered by the Engineer-in-Charge to suit the site requirements and the contractor shall have no claim of any nature on this account.

25.1.6. All electrical fittings and wiring runs must be clear off doors, windows and openings.

25.1.7. Point wiring circuit. The arrangement of circuit shall be as per schematic drawing.
25.2. **CLASS OF WORK:**

25.2.1. 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.

25.2.2. 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.

25.2.3. The position of electrical fittings and fixtures shown on the drawings may be changed by the GE. If found necessary such changes does not entail any price adjustment.

25.2.4. 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.

25.2.5. Looping in system of wiring shall invariably be used throughout the installations.

25.2.6. Wiring shall be done strictly in accordance with IE Rules and IS Specifications, layout shall be strictly in conformity with modern Engineering practice.

25.2.7. The phase identification should clearly be provided at the main incoming switch.

25.2.8. 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.

25.2.9. 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. The lump sum quoted is deemed to include for the same.

25.2.10. Suitable lintels as required in brick construction for mounting sheet steel terminal boxes, etc shall be catered as ordered by GE and cost of these are deemed to be included in buildings under Schedule “A” Part – I and for special item of work for computers.

25.2.11. Marking of apparatus shall conform to clause No. 19.106 of Sec-19 of MES Schedule Part – I.

25.3. **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.

25.4. **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.

25.5. **TYPE OF WIRING:** Type of wiring shall be all as described in Schedule and shown on drawings and directed by Engineer-in-Charge.
25.6. **SUB MAIN WIRING:** Sub main wiring shall be as described in Schedule “A” and at locations directed by Engineer-in-Charge.

25.7. **POSITION OF MAIN SWITCH BOARD:**

25.7.1. The main switch board for buildings shall be conveniently and suitably provided as shown on drawings/as directed by Engineer-in-Charge.

25.7.2. All MS boxes for mounting switches, sockets, regulators etc. shall be fixed flush with the finished surface of the wall. All switches and socket outlets are to be mounted on laminated sheet of white colour complying with IS-2046-1925A9 and fitted to the sunken switch box. The rates for point wiring shall include the cost of MS box and laminated sheet cover.

25.8. **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.

25.9. **MS BOX FABRICATED STEEL BOX:** MS box for housing, switches etc. shall be fabricated out of 1.6 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, control mentioned in Schedule ‘A’. Number of MS boxes and size to be provided in each room/place shall be decided by the Engineer-in-Charge. No price adjustment shall be admissible on this account.

25.10. **SWITCHES, SWITCH SOCKET OUTLET:**

25.10.1. The switches shall be best quality and approved conforming to the requirement laid down in IS-3254-1966. Switches shall be of 6 Amps. Piano type switches shall be connected to phase and not to the neutral wire.

25.10.2. These shall be with porcelain base and Bakelite cover.

25.10.3. All the switches/switch socket outlet shall bear ISI mark.

25.11. **CONDUIT:**

25.11.1. 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.

25.11.2. 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.

25.12. **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.

25.13. **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.
PARTICULAR SPECIFICATIONS [Continued]

25.16 MCCBs, MCBs AND MCB DB:

25.16.1 MCCBs, MCBs shall be approved by GE:

25.16.2 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.

25.16.3 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.

[i] The sheet steel MCB distribution boards shall be provided with electrolitic quality copper bus bar for phase neutral.

[ii] Powder coated factory made enclosure fabricated out of 1.6 mm thick CRCA steel sheet.

[iii] detachable conduit entry plate shall be provided for both top and bottom with knock outs.

[iv] All the miniature circuit breakers [MCBs] shall comply with IS-25A25A225A - [C curve 10 KA]

[v] The MCBs shall be designed for operated on hammer trip principle for effectively limiting the fault current within shortest period.

[vi] The MCBs inside DBs shall be direct rail mounted.

25.16.4 All MCB DBs MCBs on panel board shall be provided with suitable compression lugs/glands for various PVC cables as specified in Schedule “A” and the cost of such MCBs/DBs/main boards deemed to include the above provisions.

25.16.5 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.

25.17 EARTHING:

25.17.1 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.

25.17.2 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.

25.17.3 No extra payment shall be made to the contractor where greater depth of pit is required and consequent extra length of earth wire is required to be provided to obtain proper test results as specified hereinafter. 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 shall be as specified in Schedule “A”.

25.18 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.

25.19 PORCELAIN CONNECTORS ⅔ 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 ⅔ way shall be used invariably.
25.20. **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.

25.21. **ELECTRICAL TESTS**

25.21.1. **[a]** On completion of wiring the following tests shall be carried out :-

   [i] Insulation test  
   [ii] Testing of earth continuity and earth resistance.  
   [iii] Polarity test

   **[b]** The test result shall be recorded and signed by Engineer-in-Charge and the contractor and to be submitted to the department in triplicate.

   **[c]** The contractor shall submit CMRI test certificate to conform relevant IS provisions, for flame proof fitting supplied by the contract. Fittings shall be allowed for incorporation in the work only on production of the above certificate.

26. **EXTERNAL ELECTRIFICATION:**

26.1. **GENERAL:**

26.1.1. The work under this schedule comprises of provision of underground cables etc.

26.1.2. 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.

26.1.3. The contractor shall be responsible for supplying, erecting, installing, testing, commissioning of all the equipment as specified and shown on drawings and as directed by the Engineer-in-Charge.

26.1.4. 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.

26.2. **APPLICABILITY OF RULES, REGULATIONS AND CODE OF PRACTICE:**

26.2.1. 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.

26.2.2. 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 this installation 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.

26.3. **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.

26.4. **PAINTING AND PROTECTION:**

26.4.1. 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
PARTICULAR SPECIFICATIONS [Continued]

Painted equipment shall be made good by applying same tint and type of paint at no extra cost. The cost of painting shall deemed to be included in the unit rate of respective items of Schedule “A”.

26.4.2. 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 at no extra cost. All instruments and appliances, and other materials, etc, required for carrying out the tests shall be provided by the contractor at his own cost. The entire electrical installation shall be tested before commissioning by electrical inspector deputed by the Accepting Officer.

26.4.3. 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.

26.4.4. After connecting the power supply, the whole of the insulation shall be tested to demonstrate its ability to operate satisfactorily.

26.4.5. 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.

26.5. OPERATION OF EQUIPMENT OF CONTRACTOR: The contractor shall be responsible for all operations necessary for 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 shall provide all materials and stores etc, necessary for these operations until the work is taken over.

26.6. EXCAVATION AND EARTH WORK FOR CABLE: The trenches for cable shall be up to 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.

26.7. 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. 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.

26.8. 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. The cable record shall be maintained all as per clause 19.95 of MES Schedule Part – I.

26.9. MCCB: for both Internal and External Electrification shall be suitable for operation on triple pole AC 415 Volts 50 cycles of different interrupting capacity as specified in Schedule “A”.
PARTICULAR SPECIFICATIONS [Continued]

26.10. CONNECTING: The cables shall be connected to the terminals of switches etc through suitable type aluminium lugs as required site.

26.11. 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.

26.12. 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.

26.13. GI PIPE: GI tubing shall be all as specified in Schedule “A” and 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 specified hereinafter.

26.14. GUARANTEE FOR LED LIGHT FITTINGS:

26.14.1. 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

26.14.2. 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.

26.14.3. Should the GE at any time during the Guarantee period, finds 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.
PARTICULAR SPECIFICATIONS [Continued]

26.15. **GUARANTEE FOR SOLAR LIGHT FITTINGS:**

26.15.1. Contractor shall furnish a written guarantee to GE for a period of **5 Years** from the certified date of completion of the entire work for effective functioning and continuous glowing of Solar Light Fittings including Batteries and LED Bulbs on Non–Judicial stamp paper of Rs. 100.00. If the Solar Light Fittings including Batteries and LED Bulbs become non functional or in case of any defect found in the light fitting during aforesaid guarantee period, the contractor shall carry out the necessary repairs / rectification / replace the necessary spares including LED Bulbs and Battery to the entire satisfaction of Garrison Engineer at his own cost.

26.15.2. An amount calculated @ 2% of the value of Solar 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 Solar Light Fittings for **5 Years**. This Security Deposit shall be released after successful expiry of the **5 Years** 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.

26.15.3. Should the GE at any time during the Guarantee period, finds defective performance of the Solar 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 Batteries and 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 **5 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.

26.16. **LT PANEL:**

26.16.1. **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 as specified in Schedule “A” 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.

26.16.2. **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 as specified in Schedule "A".

26.16.3. **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.

26.16.4. **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.

26.16.5. **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.

26.16.6. **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.

26.16.7. **BUSBAR:**

26.16.7.1. Busbars shall be either of copper or aluminium of rated capacity as specified in Schedule "A". 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] with uniform cross section with maximum current density of 1.6 A/Sq.mm for copper.

26.16.7.2. 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.

26.16.7.3. 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.

26.16.7.4. 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.
PARTICULAR SPECIFICATIONS [Continued]

26.16.8. **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, descaling in dilute sulphuric acid or any other acid and phosphate. Paint shade will be 631 of IS – 5.

26.16.9. **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.

26.16.10. **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 and as specified hereinafter.

26.16.11. **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.

26.16.12. **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 maters 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.

26.16.13. **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 convolutional skull and bones in signal red colour shall be fixed either with 25 X 3 mm MS clamps or rivet/nut bolts.

26.16.14. **EARTHING:**

26.16.14.1. 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.

26.16.14.2. 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.
26.16.14.3. 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.

26.16.14.4. 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.

26.16.14.5. 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.

26.16.14.6. 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.

27. EXTERNAL WATER SUPPLY:

27.1. GENERAL:

27.1.1. The work under this Schedule comprises of taking branch connection by cutting, the existing cast iron pipe line, laying cast iron pipes and specials, PP-R pipe including fittings.

27.1.2. Layout of pipe lines shown in drawing is tentative and any charge 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.

27.1.3. 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.

27.1.4. The work shall be carried out all as described in Schedule “A” and as specified hereinafter as shown on drawing and as directed by Engineer-in-Charge.

27.2. 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.

27.3. MILD STEEL GALVANISED TUBES AND FITTINGS: Water tubing and fittings shall be of galvanised medium grade as indicated in Schedule "A" 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 pies 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.
PARTICULAR SPECIFICATIONS [Continued]

27.4. **GATE VALVES/NON RETURN VALVE/SLICE VALVE:** These shall be of size and specification as given in respective item of Schedule "A", ISI marked and of approved make.

28. **FENCING AND GATE:**

28.1. The work under this schedule shall be carried out all as specified hereinbefore and in MES Schedule, shown on drawings and as directed by the Engineer-in-Charge. For materials such as coarse aggregate, fine aggregate, cement, steel for reinforcement etc refer the respective clauses as specified hereinbefore.

28.2. **STEEL GATE:**

28.2.1. Mild steel gate shall be all as shown on drawings.

28.2.2. Mild steel, plain, black sheet 1.6mm thick wall cladding to be welded to gate which includes cutting to size, punching holes, round headed screws or riveted or welded as directed by Engineer-in-Charge including bending and turning and fixing in position, hold fasts, wheel track including wheels, locking arrangement to gate etc., complete.

28.2.3. All exposed steel surfaces shall be painted with two coats of synthetic enamel paint over a coat of red oxide primer. Embedded posting of steel shall be tarring and sanding.

28.2.4. RR masonry pillars shall be in CM [1:4]. Coping shall be PCC [1:2:4] type B1, using 20mm graded stone aggregate.

28.2.5. 32mm dia PVC conduit with accessories shall be provided in RR masonry pillar for provision of electrical purpose.

28.3. **BARBED WIRE:** Barbed wire shall be stretched and fixed in specified number of rows and diagonals. The diagonal wires will intervene with horizontal wires by fixing the odd rows of wires, then the diagonal cross wires and lastly the even rows of wires. The barbed wires shall be held to the posts by means of GI staples fixed to wooden plugs, of GI binding wire tied to 6mm bar nibs fixed while casting the posts. Turn buckles and straining bolts shall be used at the end posts, where indicated.

29. **BLANK**

30. **SPECIFICATIONS FOR SOLAR POWER PLANT**

30.1. **SCOPE OF WORK:** This Contract covers all works described in BOQ special conditions and particular specification.

30.2. **SPV MODULES:**

30.2.1. Individual SPV modules to be supplied shall have minimum declared output of 320 Wp or more at standard test conditions.

30.2.2. Individual SPV modules to be supplied shall have minimum declared output of 320 Wp or more at standard test conditions.

30.2.3. **IDENTIFICATION AND TRACEABILITY:** Each PV module used in must use a RF identification tag. The following information must be mentioned in the RFID used on each module. This must be laminated inside the panel and it must be able to withstand harsh environmental conditions.
PARTICULAR SPECIFICATIONS [Continued]

[a] Name of the manufacturer of PV module
[b] Name of the manufacturer of Solar cells
[c] Month and year of the manufacturer [Separately for Solar cell and module]
[d] Country of origin [Separately for Solar cell and module]
[e] I-V curve for the module
[f] Wattage, Im, Vm and FF for the module
[g] Unique Serial No and Model No of the module
[h] Date and year of obtaining IEC PV module qualification certificate
[i] Name of the test lab issuing IEC certificate
[j] Other relevant information on traceability of Solar cell and module as per ISO 9000 series.

30.2.4. Entire drawings, detailed test reports obtained from the manufacturer of the offered modules shall be submitted for approval of GE within 30 days from the date of placement of module order and supply shall start thereafter.

30.2.5. PV ARRAY CONFIGURATIONS: The Solar array shall be configured in multiple numbers of sub-arrays, providing optimum DC power to auditable number of sub arrays. The Contractor shall submit their own design indicating configuration of PCU and respective sub arrays and bill of material.

30.2.6. Stabilized output of the Solar Power Plant shall not be less than 1.0 MW AC, under Standard Test Condition after one year of operation.

30.2.7. Peak power point voltage and the peak power point current of any supplied module and/or any module string [series connected module] shall not be more than 3% from the respective arithmetic means for all modules and/or for all module strings, as the case may be.

30.2.8. Each module shall have low iron tempered glass front for strength & superior light transmission. It shall also have tough multi-layered polymer back sheet for environmental protection against moisture & provide high voltage electrical insulation.

30.2.9. The module frame shall be made of anodised aluminium or corrosion resistant material, which shall be electrically compatible with the structural material used for mounting the modules.

30.2.10. Solar Modules offered shall be certified as per IEC 61215-Edition-II, IEC 61646 and IEC 61730-1, 2 amended up to date or equivalent Indian Standard.

30.2.11. All materials used shall have a proven history of reliability and stable operation in external applications. It shall perform satisfactorily in relative humidity up to 100% with temperatures between [-] 10° C and [+] 50° C and shall have lowest temperature coefficient and shall withstand gust up to 200 km/h on the surface of the panel. Each and every SPV module shall be checked for conformity with relevant standard and no negative tolerance shall be accepted.

30.2.12. SPV module shall contain crystalline high power silicon solar cells. The solar cell shall have surface anti-reflective coating to help to absorb more light in all weather conditions.

PARTICULAR SPECIFICATIONS [Continued]

30.2.14. Crystalline power cells shall be used in the Solar Photovoltaic module. Solar module shall be laminated using lamination technology using established polymer [EVA] and Tedlar / Polyester laminate.

30.2.15. The solar modules shall have suitable encapsulation and sealing arrangements to protect the silicon cells from the environment. The arrangement and the material of encapsulation shall be compatible with the thermal expansion properties of the Silicon cells and the module framing arrangement/material. The encapsulation arrangement shall ensure complete moisture proofing during life of the solar modules.

30.2.16. All materials used shall be having a proven history of reliable, light weight and stable operation in external outdoor applications and shall have service life of more than 25 Years.

30.2.17. Module rating is considered under standard test conditions, however Solar Modules shall be designed to operate and perform under site condition including high temperature, dust. The Geological data for the area shall be referred for design to get optimum generation.

30.2.18. Solar PV Module design shall conform to following Mechanical requirement:

- [a] Toughened, low iron content.
- [b] High transmissivity front glass.
- [c] Anodised Aluminium frame
- [d] Ethyl Vinyl Acetate [EVA] encapsulant
- [e] Silicon edge sealant around laminate
- [f] Tedlar / Polyester trilaminate back surface
- [g] Weatherproof DC rated MC connector and a lead cable coming out as a part of the module, making connections easier and secure, not allowing for any loose connections.
- [h] Resistant to water, abrasion, hail impact, humidity & other environment factor for the worst situation at site.

30.2.19. Each module shall have low iron tempered glass front for strength and superior light transmission. It shall have back sheet for environment protection against moisture and high voltage electrical insulation.

30.2.20. Modules shall be provided with a junction box with provision of external screw terminal connection and with arrangement for provision of external & adequate capacity by-pass diode. The box shall have hinged, weatherproof lid with captive screws and cable gland entry points.

30.2.21. The fill factor of module shall not be less than 0.70 [typical]. The V-I curve of each PV module with Serial Nos. shall be submitted along with Modules meeting the required specifications.

30.2.22. Minimum following parameters shall be provided in the detail documents:

- [a] Maximum Power : $P_{\text{max}}$
- [b] Minimum Power : $P_{\text{min}}$
- [c] Open Circuit Voltage : $V_{\text{oc}}$
- [d] Short Circuit Current : $I_{\text{sc}}$
- [e] Voltage at Max Power : $V_{\text{mp}}$
- [f] Current at Max power : $I_{\text{mp}}$
- [g] Fill Factor : FF
- [h] Efficiency of cell : $\eta_{c}$
- [i] Efficiency of module : $\eta_{m}$
PARTICULAR SPECIFICATIONS [Continued]

30.3. **POWER CONDITIONING UNIT [PCU]:**

30.3.1. Power Conditioning Unit [PCU] is critical equipment in Grid Connect SPV Power plant. This equipment converts DC power generated by SPV array, into 3 Phase AC Voltage to be connected to Grid. It also provides necessary protections for Grid Synchronisation and Data Logging/Monitoring. MPPT controller, inverter [Minimum 100KW or higher] depends on array formation and associated control and protection devices etc. all shall be integrated into PCU. They shall convert DC power produced by SPV modules, into AC power and adjust the voltage & frequency levels to suit the local grid conditions. All inverters shall be located in the central control room mandatorily.

30.3.2. MPPT controller, inverter and associated control and protection devices etc. all shall be integrated into PCU.

30.3.3. The DC energy produced has to be utilized to maximum and supplied to the DC bus for inverting to AC voltage to extract maximum energy from solar array and provide 415 VAC / [+15% to –10%], 3 Phase, 50 Hz through 3 winding transformer with secondary voltage of 22 kV to synchronise with local grid.

30.3.4. The PCU shall have protection features such as, over current, short circuit, over temperature to name a few.

30.3.5. The PCU shall be designed for continuous, reliable power supply as per specification.

30.3.6. The PCU shall be designed to be completely compatible with the SPV array voltage and grid supply voltage.

30.3.7. The dimension, weight foundation details etc. of the PCU shall be clearly indicated in the detailed technical specification.

30.3.8. It shall have user friendly LEDs/LCD display for programming and view on line parameters such as:

- [a] DC Power Input
- [b] DC Input Voltage
- [c] DC Current
- [d] AC Power Output
- [e] AC Voltage [all the 3 Phases and line]
- [f] AC Current [all the 3 Phases and line]
- [g] Power Factor
- [h] Inverter on
- [i] Grid on
- [j] Inverter under Voltage / Over Voltage
- [k] Inverter Overload
- [l] Inverter over Temperature.

30.3.9. The PCU shall have arrangement for adjusting DC input current and shall trip against sustainable fault downstream and shall not start till the fault is rectified.

30.3.10. Both AC & DC lines shall have suitable fuses/breaker and contactors to allow safe start up and shut down of the system.

30.3.11. Fuses used in the DC circuit shall be DC rated.
PARTICULAR SPECIFICATIONS [Continued]

30.3.12. The PCU shall have provision for input & output isolation. Each solid-state electronic device shall have to be protected to ensure long life of the inverter as well as smooth functioning of the inverter.

30.3.13. The PCU shall be capable of complete automatic operation, including wakeup, synchronization & shut down.

30.3.14. PCU shall be capable to synchronize independently & automatically/ to be phase locked to the Local grid power line frequency to attain synchronization and export power generated by the solar panel to grid.

30.3.15. Built in with data logging to remotely monitor plant performance through external PC shall be provided [PC shall be provided along with SPV Plant].

30.3.16. Inverter shall be tested for islanding protection performance.

30.3.17. PROTECTIONS:

[a] Over voltage both at input & output.
[b] Over current both at input & output.
[c] Over/under grid frequency.
[d] Over temperature.
[e] Short circuit.
[f] Protection against lightening.
[g] Surge voltage induced at output due to external source.

30.3.18. Typical failure analysis report of PCUs and recommended list of critical components shall be provided by the Contractor.

30.3.19. The PCU shall be capable of operating in parallel with the grid utility service and shall be capable of interrupting line fault currents and line to ground fault currents.

30.3.20. The PCU shall be able to withstand an unbalanced load conforming to IEC standard and relevant Indian electricity condition. The PCU shall include appropriate self protective and self diagnostic features to protect itself and the PV array from damage in the event of PCU component failure or from parameters beyond the PCU’s safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation feature, shall be cleared by the PCU protective devices and not by the existing site utility grid service circuit breaker.

30.3.21. The PCU shall go to shutdown/standby mode, with its contacts open, under the following conditions before attempting an automatic restart after an appropriate time delay. When the power available from the PV array is insufficient to supply the losses of the PCU, the PCU shall go to standby/shutdown mode. The PCU control shall prevent excessive cycling of shut down during insufficient solar radiance.

30.3.22. Galvanic isolation is required to avoid any DC component being injected into the grid and the potential for AC components appearing at the array.
PARTICULAR SPECIFICATIONS [Continued]

30.3.23. Disconnection of the PV generator in the event of loss of the main grid supply is to be achieved by inflicts protection within the power conditioner. This may be achieved through rate of change of current, phase angle, unbalanced voltages, or reactive load variants.

30.3.24. Detailed technical description of the complete unit of offered PCU shall be furnished as per clauses of "Completion Time" mentioned in contract document for approval of GE. Following Technical documents of PCU shall be supplied for approval after placement of order.

[a] Detailed technical description of the complete unit

[b] Instructions for installation and operation

[c] Electrical diagrams of all internal cabling, necessary for installation, maintenance and fault finding.

[d] Description of electrical and mechanical characteristics of units.

[e] Maintenance and fault finding & trouble shooting procedures.

[f] Safety precautions.

[g] Software for data monitoring with detailed description.

[h] Details of data acquisition

[i] Factory test reports in details on various parameters.

[j] All maintenance requirements and their schedules, including detailed instructions on how to perform each task.

[k] Detailed schematics of all power instrumentation and control equipment and subsystems along with their interconnection diagrams. Schematics shall indicate wiring diagrams, their numbers and quantities, type and ratings of all components and subsystems.

[l] A detailed bill of materials which shall list components model numbers, quantities and manufacturer of each supplied item.

[m] All documents and write ups shall be in English. They shall be clean and legible, and must be checked, signed, approved and dated by a competent representative of the contractor.

30.3.25. The Contractor shall provide data sheet for PCU as per manufactures specification.

30.3.26. MAKE AND TYPE OF INVERTER: The contractor shall provide Inverter of make ABB / Schneider Electric / Delta / TMEIC / Hitachi as approved by GE.

30.4. DC BUS & PANEL [COMBINER BOX]: DC generated by the solar modules is transmitted through the appropriate cables from Array Yard to Control Room. DC bus & Panel shall be provided or the incoming DC supply from Array Yard. The Panel shall consist of adequate size DC Bus/Cable which can handle the current and the voltage safely as per the relevant IS standards. DC panel shall be equipped with an adequate DC circuit breaker along with control circuit, Protection and equipment for input to remote monitoring of each string, array parameters. Contractor shall submit design calculations and detailed explanations along with drawings for approval of GE as per clause[C] of "Completion Time" mentioned in contract document. All features mentioned above can be clubbed in Power conditioning unit to satisfy mentioned functions.
PARTICULAR SPECIFICATIONS [Continued]

30.5. **DATA MONITORING OF POWER PLANT:** The performance and generation data is recorded using a data logger. The monitoring system shall comprise of the following main components:

[a] PCU to log the inverter performance data and transmit the same to the Data logger.

[b] Data logger gathers information and monitors the performance of the inverter. It shall support measurements from external sensors. Computer and other accessories required shall also be in the scope of this tender.

[c] PC Data logging software shall enable automatic long-time storage of measured data from PV-Plant. It shall allow visualization, monitoring, commissioning and service of the installation.

[d] Communication interface the entire system can be operated and monitored via various interface viz. [RS485], in addition to the information indicated on the operator panel. Link shall be provided between SCADA & office of GE.

30.6. **CONSTRUCTIONAL FEATURES OF MAIN DISTRIBUTION BOARD:**

30.6.1. It shall be Metal enclosed, indoor, floor mounted, modular type, dust, vermin proof, of uniform height [not more than 2100 mm] in Single front as specified. Neoprene gaskets shall be provided all around the perimeter of adjacent panels, panel and base frame, doors and removable covers. The module shall be provided with door operable by a handle. Door fixed by screwed knobs are not acceptable. All the switchboards shall be suitable for bottom cable entry.

30.6.2. The panels shall be fabricated out of 2.0 mm thick cold rolled sheet steel. Stiffeners shall be used wherever necessary. Panels shall be provided with fabricated base channel. The panels shall have adequate provision for grouting on foundation. The angles, channel used in the panels shall be fabricated out of 10 gauge sheet steel. All doors shall be fabricated out of 12 gauge sheet steel.

30.6.3. The construction of switchgear shall conform to a degree of protection of IP: 4X as per IS – 2448. All doors, removable covers, Gland plates and joints between adjacent sections shall be gasketed all around with neoprene gaskets. Lifting facilities shall be provided for each shipping section. Switchgear shall have readily accessible terminals for making connections to external equipment. Suitable shrouding shall be provided for all incoming & outgoing terminals. The bottom most row of equipment mounted in the panel shall be at least 250 mm, above bottom cover to facilitate repair and maintenance. Power and control terminals shall be segregated. All equipment shall have permanent identification labels.

30.6.4. Panel shall be divided into distinct vertical sections each comprising of metal enclosed horizontal bus bar compartment, individual feeder module in multitier arrangement, enclosed vertical bus bars, vertical cable alley [minimum 250 mm wide], horizontal separate enclosure for auxiliary power and control bus, space heater with thermostat.

30.6.5. Each shipping section shall have metal sheets on both sides.

30.6.6. All doors shall be with concealed type hinges and captive screws. The doors shall be operable by a handle. Door fixed by screwed knobs are not acceptable.
PARTICULAR SPECIFICATIONS [Continued]

30.7. MAIN & AUXILIARY BUSES:

30.7.1. Bus bars shall be of uniform cross section throughout the length and made of high conductivity Aluminium alloy of E 91 E grade.

30.7.2. Busbar shall be fully insulated with close fitting heat shrinkable sleeve and adequately supported to withstand stresses developed due to short circuit. Supports shall be of glass reinforced phenolic material or cast resin. All bus bar joints shall be shrouded.

30.7.3. Space heaters shall be provided in each cable alley and provided with MCB/thermostat. The space heater supply shall be derived from the incoming supply and distributed throughout the switchgear through Auxiliary bus bars.

30.7.4. Earth bus of 75 x10mm GS flat shall run throughout the length of the switchgear.

30.7.5. All hardware used in Busbar connections shall be electro-galvanised. All busbar connections shall be provided with spring washers.

30.7.6. Switchgear controls shall be through the UPS supply. The control bus shall run throughout the length of the panel and shall be made of same material as main busbar.

30.8. WIRING AND TERMINAL BLOCKS:

30.8.1. The wiring shall be carried out with PVC insulated, 650/1100 V Grade, flexible stranded tinned copper conductor wires. The following minimum sizes shall be used.

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Minimum Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a] Power Circuit</td>
<td>2.5 Sq.mm</td>
</tr>
<tr>
<td>[b] Control Circuit</td>
<td>1.5 Sq.mm</td>
</tr>
<tr>
<td>[c] CT Circuit</td>
<td>2.5 Sq.mm</td>
</tr>
</tbody>
</table>

30.8.2. The control circuit wires shall be provided with identification ferrules at both the ends.

30.8.3. The terminal blocks for control circuit shall be Elmex clamp on type. The terminals for the CT circuit shall be disconnecting and short circuiting type.

30.8.4. The power terminals for outgoing connections shall be bolted type. All the power terminal blocks shall be provided with nickel cadmium coated bolts.

30.8.5. Nut & bolts including metallic shall have to be adequately protected against atmosphere and weather prevailing in the area.

30.9. DC CABLE: DC cables shall comply following specifications and standard EN 50618. The construction of the cable shall be as follows Conductor Tinned fine copper strand according to VDE 0295 / IEC 60228, Class 5. Insulation XLPO, flame-retardant, halogen free, electron-beam cross-linked Jacket XLPO, flame-retardant, halogen free, electron-beam cross-linked, UV and ozone resistant, with white or red marking and stripe. Jacket colour – black

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a] The photovoltaic system with a rated value U0</td>
<td>1.5 kV DC</td>
</tr>
<tr>
<td>[b] The electrical values should be as Rated value U0</td>
<td>1500 V DC [Maximum permitted voltage U01800 V DC]</td>
</tr>
<tr>
<td>[c] Test Voltage</td>
<td>11 kV AC 50 Hz</td>
</tr>
</tbody>
</table>
PARTICULAR SPECIFICATIONS [Continued]

31. **38/11KV STEP UP TRANSFORMERS**: 2 Nos, 630 KVA transformer shall be used for 1.0 MW AC SPV Power Plant. Transformer shall be connected to Interface panel through suitable cables. The Contractor shall furnish Guaranteed Technical Particulars as per Data Sheet. The detail specification of step up transformer is as under.

31.1. **GENERAL REQUIREMENTS**: The intention of the specification is to provide information for the design of the above mentioned transformers to be fully suitable in every respect for the functions designated. It is required that the contractor agrees to furnish all apparatus, appliance and material whether specifically mentioned or not, but which may be found necessary to complete, perfect, or test any of the herein specified units in compliance with the requirements implied in this specification.

   [a] All terminal screws, studs, nuts and bolts shall be in accordance with the Indian Standards.

   [b] All electrical and mechanical equipment shall be designed and manufactured so that no damage will result from transportation, installation and operation of the equipment under the climatic conditions to which it will be subjected.

   [c] All materials used shall conform to this specification and appropriate standards and shall be new in all respects.

31.2. **STANDARDS**: The transformers, their accessories and fittings, transformer oil, etc. shall conform to the latest edition of the following standards [as amended up to date] except where specified otherwise in this specification:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>IS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>Transformer</td>
<td>IS – 1180</td>
</tr>
<tr>
<td>[b]</td>
<td>Transformer Oil</td>
<td>IS – 335</td>
</tr>
<tr>
<td>[c]</td>
<td>Bushings</td>
<td>IS – 2099, 3347, 8603</td>
</tr>
<tr>
<td>[d]</td>
<td>Fittings and Accessories for Transformers</td>
<td>IS – 3639</td>
</tr>
<tr>
<td>[e]</td>
<td>Code of Practice for Selection Installation &amp; Maintenance of Transformer</td>
<td>IS – 10028</td>
</tr>
<tr>
<td>[g]</td>
<td>Method of Impulse Voltage Testing</td>
<td>IS – 2070</td>
</tr>
<tr>
<td>[h]</td>
<td>Gas &amp; Oil Operated Relay</td>
<td>IS – 3637</td>
</tr>
<tr>
<td>[i]</td>
<td>Specifications for Insulating Kraft Paper</td>
<td>IS – 9335</td>
</tr>
<tr>
<td>[k]</td>
<td>Ready Mixed Paint, Brushing Zinc Chromate, Painting</td>
<td>IS – 104</td>
</tr>
<tr>
<td>[l]</td>
<td>Determination of Water Content in Oil for Porcelain Bushing Transformers</td>
<td>IS – 2362</td>
</tr>
<tr>
<td>[m]</td>
<td>Dimensions for Clamping Arrangements for Bushings</td>
<td>IS – 4257</td>
</tr>
<tr>
<td>[n]</td>
<td>Selection, Installation and Maintenance of Transformers: Silica-Gel</td>
<td>IS – 3401 &amp; IS – 10028</td>
</tr>
<tr>
<td>[o]</td>
<td>Terminal Connector</td>
<td>IS – 5561</td>
</tr>
<tr>
<td>[p]</td>
<td>Gas &amp; Oil Operated Relay</td>
<td>IS – 3637</td>
</tr>
<tr>
<td>[q]</td>
<td>Method of Impulse Voltage Testing</td>
<td>IS – 2070</td>
</tr>
</tbody>
</table>
31.3. **ELECTRICITY RULES ACT & RULES:** All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed there under and as amended from time to time.

31.4. **TYPE AND RATING:**

31.4.1. The transformers shall be of copper wound 1250 KVA, 0.38/11kV, 3 phase, natural cooled, double wound, core type construction, oil immersed and shall be suitable for outdoor service as step-up transformers [At times however these may be required to work under reversal of power also].

31.4.2. The transformers covered by this specification are to run in parallel with transformers which are being installed or will be installed in future [for same rating] and as such the characteristics of the transformers covered in this specification for the sub-station will be identical so as to enable these transformers to run in parallel. The technical particulars of transformers required are as under:

<table>
<thead>
<tr>
<th></th>
<th>Maximum Continuous Rating at reference Ambient Temperature Specified</th>
<th>630 KVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ii]</td>
<td>Frequency</td>
<td>50 Hz</td>
</tr>
<tr>
<td>[iii]</td>
<td>No. of Phases</td>
<td>3 Phase</td>
</tr>
<tr>
<td>[iv]</td>
<td>Rated Primary Voltage on Principal Tap</td>
<td>11 kV</td>
</tr>
<tr>
<td>[v]</td>
<td>Rated Secondary Voltage</td>
<td>0.380 kV as per inverter LV</td>
</tr>
<tr>
<td>[vi]</td>
<td>Winding Connections</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HV Side</td>
<td>Delta</td>
</tr>
<tr>
<td></td>
<td>LV Side</td>
<td>Star</td>
</tr>
<tr>
<td></td>
<td>Vector Group</td>
<td>Dy11y11 [Typical]</td>
</tr>
<tr>
<td></td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>[vii]</td>
<td>Type of cooling</td>
<td>ONAN</td>
</tr>
<tr>
<td>[viii]</td>
<td>Percentage Impedance at Normal Voltage &amp; 75°C Average Winding Temperature Between HV-LV with Tolerance as per IS</td>
<td>4.5 % as per inverter OEM</td>
</tr>
<tr>
<td>[ix]</td>
<td>Off Load Tap Changer</td>
<td>Having 9 equal steps [in steps of 2.5% of each to have voltage variation of ±10% on HV side Also match the range of requirement of HV voltage Vis-a-Vis Inverter output voltage.</td>
</tr>
<tr>
<td>[x]</td>
<td>Maximum Current Density for HV &amp; LV</td>
<td>3 Amp / Sq.mm [for Copper winding including tapped winding wound]</td>
</tr>
<tr>
<td>[xi]</td>
<td>Neutral Unbalance Current</td>
<td>Not exceeding 2.0%</td>
</tr>
<tr>
<td>[xii]</td>
<td>Type of Terminal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HV Side</td>
<td>Suitable cable for inter connection</td>
</tr>
<tr>
<td></td>
<td>LV Side</td>
<td>Suitable for connecting LT Cables</td>
</tr>
</tbody>
</table>

31.4.3. **EFFICIENCY:** The percentage loading for the maximum efficiency shall be clearly stated at unity power factor as well as 0.8 and 0.9. Pf.
PARTICULAR SPECIFICATIONS [Continued]

31.4.4. **INSULATION:** The dielectric strength of the winding, given insulation and the bushings shall conform to the values given in IS – 1180 for highest system voltage of 22 kV, 1.1 kV and shall be suitable for the following impulse test\power frequency test voltages.

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>System Voltage</th>
<th>HST System Voltage</th>
<th>Impulse Test Voltage</th>
<th>PF Test Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>11kV</td>
<td>24 kV</td>
<td>125 kVp</td>
<td>50 kV</td>
</tr>
<tr>
<td>[b]</td>
<td>415 kV</td>
<td>1.1 kV</td>
<td>–</td>
<td>2.5 kV</td>
</tr>
</tbody>
</table>

31.4.5. **TEMPERATURE RISE:** Each transformer shall be capable of operating continuously at their normal rating without exceeding temperature rise limits as specified below:

<table>
<thead>
<tr>
<th>Type of Cooling</th>
<th>Temperature Rise</th>
<th>External Cooling Medium [Air]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winding [Temperature rise measured by resistance method]</td>
<td>ONAN 50°C</td>
<td>When the Oil Circulation is Natural non Directed</td>
</tr>
<tr>
<td>Oil [Temperature rise measured by thermometer method]</td>
<td>As above 45°C</td>
<td>–</td>
</tr>
</tbody>
</table>

The reference temperature conditions for which the transformers shall be designed are as per the climatic conditions of the site as specified. The hottest spot temperature shall not exceed 98 degree C when calculated over an annual weighted average ambient temperature of 35 degree C when transformer is loaded to its rated MVA. The transformer shall be capable of being over loaded in accordance of relevant IS. Bushing and its terminal connectors shall have minimum continuous current rating corresponding to 120% rated current of transformer at lowest tap.

31.4.6. **GUARANTEE:** The Contractors are required to offer the transformers having no load losses and load losses not exceeding the following values as per CBIP manual.

- [a] No load loss at rated voltage, Rated current, rated frequency as per IS – 1180.
- [b] Load loss at rated current, rated Voltage, rated freq. and 75°C.

31.4.7. **COOLING:**

- [a] Transformer shall be provided with ONAN type cooling.

- [b] The ONAN cooling of the transformers shall be by natural circulation of air while the circulation of oil shall be effected by natural convection, the maximum oil flow being assured by a method whereby the return flow of cooled oil is made to enter the tank at a level coinciding with the bottom of the hot columns of oil thus avoiding centre heads of cold oil at the bottom of the tank. Out flow shall be arranged to coincide as nearly as possible with the hot oil level at the top of the tank so that the total available difference will be fully employed in circulating the oil round the shortest possible paths.

- [c] The windings of the transformers shall be designed to deliver continuously rated KVA corresponding to ONAN cooling. Radiators shall be provided for cooling purpose. These shall be directly mounted on the tank on both sides in a balanced manner & not on one side only.
PARTICULAR SPECIFICATIONS [Continued]

31.4.8. TRANSFORMER CORE:

[a] The core shall be built up with thin lamination of high grade, non ageing, low loss, high permeability, cold rolled, grain oriented silicon steel specially suitable for transformer core. The particulars of laminated steel to be employed shall be furnished along with DC magnetization, B-H and iron loss curves.

[b] If required after being sheared the laminations shall be treated to remove all burrs and shall be re-annealed to remove all residual stresses. At least one side of each lamination shall be coated with a double baked enamel insulation coating which will not deteriorate due to pressure and the action of hot oil. The nature of insulation shall be specified.

[c] Every care shall be exercised in the selection, treatment and handling of core steel to ensure that as for as practicable, the laminations are flat and the finally assembled core is free from distortion.

[d] The design of the magnetic circuit shall be such as to avoid discharges, development of short circuit paths within itself or to the earthed clamping structure and the production of flux components at right angles to the plane of the laminations which may cause local heating.

[e] The core shall be rigidly clamped to ensure adequate mechanical strength and to prevent vibration during operation. The core/clamping bolts shall not pass through Core/Yoke and clamping structure shall be so constructed that eddy currents will be minimum.

[f] The core shall be provided with lugs suitable for lifting the complete core and coil assembly of the transformer. The core and the coil shall be so fixed in tank that shifting will not occur when the transformer is moved or during a short circuit.

31.4.9. FLUX DENSITY: The flux density in any part of the core built from cold rolled grain oriented steel shall not exceed 16000 lines per sq. cm. at any tap position necessary to maintain No-load terminal voltage of 415 V on LV side as required. Due regard shall also be given to limiting the flux density based on the characteristics of the material used. Over flux in the core shall be limited to 12.5% of rated value to ensure that core does not get saturated in the event of over voltage to the extent of 12.5%. The core step section and flux density calculation shall be furnished. The magnetizing current at rated voltage shall not exceed 2% of full load current and at 112.5% of rated voltage shall not exceed 4% of rated full load current. The above values are maximum and no tolerance shall be allowed.

31.4.10. SUPPRESSION OF HARMONICS: The transformer shall be designed with particular attention to the suppression of harmonics voltages especially in the third and fifth harmonics so as to eliminate wave form distortion and any possibility of high frequency disturbances.

31.4.11. WINDING:

[a] The copper windings shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable and field repairs to the windings can be made readily, without special equipment. The coils shall be between adjacent sections by insulating spacers and bracers. Bracings and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot spots in the windings. The windings shall be designed to reduce to a minimum the out of balance forces in the transformer at all ratios. The double paper covering insulation shall be used in HV & LV coils.
PARTICULAR SPECIFICATIONS [Continued]

[b] The insulation of the coils shall be suitable to develop the full electrical strength of the windings. All materials used in the insulation and assembly of the windings shall be insoluble, non catalytic, and chemically inactive in the hot transformer oil, and shall not soften or otherwise be adversely effected under the operating conditions.

c] All threaded connections shall be provided with locking facilities. All leads from the windings to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable. The windings shall be clamped securely in place so that they will not be displaced or deformed during short circuits. The assembled core and windings shall be vacuum dried and suitably impregnated. The Copper conductor used in the coil structure shall be best suited to the requirements.

d] The material used for insulation and coils shall be of best quality and if desired, invoices and manufacturers test certificates shall be furnished. All permanent current carrying joints in the windings and the leads shall be welded or braced except compression type which may be used for terminal connections. Bolted connection may be used at the bushings and at terminal board with suitable locking device. The drying out procedure of the core coil assembly shall be indicated.

31.4.12. Fault Withstanding Capacity of Windings: All the windings shall be suitably designed to withstand short time rating for not less than 3 seconds. The maximum temperature attained for short time rating shall not exceed 250°C.

31.4.13. INSULATING OIL:

[a] The oil for first filling shall be supplied with each transformer. The oil shall be EHV grade and shall comply relevant IS with latest amendments.

[b] Particular attention shall be paid to deliver the oil for topping up free from moisture having uniform quality throughout in the non-returnable new steel drums.

[c] The quantity of oil for first filling of each transformer shall be stated. Quantity of oil required for filling of conservator and radiators shall also be stated.

31.4.14. TANK:

[a] The transformer tank and cover shall be fabricated from good commercial grade low carbon steel suitable for welding and of adequate plate thickness. The tank and the cover shall be of welded construction. All seams shall be welded and where practicable they shall be double welded. The transformer tank shall have sufficient strength to withstand without permanent distortion.

[b] At least one manhole/inspection cover with a welded flange and a bolted cover shall be provided on the tank cover. The manhole shall be of a sufficient size to afford easy access to the lower ends of the bushings, terminals etc.

[c] All bolted connections to the tank shall be fitted with suitable oil tight gaskets which shall give satisfactory service under the operating conditions. Special attention shall be given to the methods of making the hot oil tight joints between the tank and the cover as also between the cover and the bushing and all other outlets to ensure that the joints can be remade satisfactorily and with ease, with the help of semi-skilled labour. Where compressible gaskets are used, steps shall be provided to prevent over compression. Suitable guides shall be provided for positioning the various parts during assembly or dismantling.
PARTICULAR SPECIFICATIONS [Continued]

[d] Lifting eyes or lugs shall be provided on all the parts of the transformers requiring independent handling during assembly or dismantling. In addition the transformer tank shall be provided with lifting lugs and bosses properly secured to the sides of the tank, for lifting the transformer either by cranes or by jacks.

[e] The design of the tank, the lifting lugs and bosses shall be such that the complete transformer assembly filled with oil can be lifted with the use of these lugs without any damage or distortions. The tank shall be provided with two suitable copper alloy lugs for the purpose of groundings.

[f] The main body of the tank shall have sufficient strength to withstand and without permanent distortion

[i] A vacuum of 760mm of mercury.

[ii] Continuous internal gas pressure of 0.7 atmospheres above atmosphere pressure with oil at operating level i.e. the transformer tank shall be able to withstand 100% vacuum and also one atmosphere pressure above atmosphere internal pressure.

[g] The tank cover shall be belled to the tank and the transformer design shall be such that at the tank will not split between the lowest and upper cooler connections.

[h] The exterior of transformer tank shall be thoroughly given one primary coats & two finishing coats of durable oil and weather resistant paints of enamel. The colour of the finishing coats shall be dark admiralty grey confirming to colour code number of relevant IS.

31.4.15. UNDER CARRIAGE:

[a] The transformer tank shall be supported on a structural steel base equipped with forged steel or cast steel, flat uni-directional rollers suitable for moving the transformer completely filled with oil. The rollers shall be of Cast Iron with mild steel mounting arrangement and also mild steel axle with mild steel split pin. The surface of roller shall be machined and axle shall be of round shape.

[b] Pulling eyes shall be provided to facilitate moving the transformer and they shall be suitably braced in a vertical direction so that bending does not occur when the pull has a vertical component.

31.4.16. OFF LOAD TAP CHANGER MECHANISM:

[a] The off circuit tap changer [OCTC] shall be of high quality and robust in construction. It shall be located at a convenient position so that it can be operated from ground level by a standing operator. The handle of OCTC shall be provided with a locking arrangement. Thus enabling the OCTC to be locked in position. Arrangement for indicating of tap position shall also be provided. It shall be suitable for local manual operations. The tap changer shall be capable of permitting parallel operation with other transformer of the same type. When one unit is in parallel with another of same type, the tap changer shall not become out of step.

[b] The OCTC shall be capable of carrying rated MVA on all taps. The breaking capacity of the OCTC shall be compatible with the highest system voltage and current based on maximum over loading permissible under IS – 6600 -1972 [150% of rated this] Step voltage of OCTC shall not be less than 115% of 2.5% of the nominal phase voltage of the HV winding and rated through current of OCTC at this voltage will not be less than 150% of rated current of HV winding at lowest tap.
PARTICULAR SPECIFICATIONS [Continued]

31.4.17. CONSERVATOR:

[a] Oil preserving equipment shall be conventional conservator tank type. The minimum oil level in the conservator tank shall not be below the level of the bushing flanges. Oil conservator tank shall be located well clear of the bare connection of the transformer terminals. The conservator tank shall have adequate capacity between highest and lowest permissible levels to meet the requirement of expansion of the total cold oil volume in the transformer and cooling equipment from min. ambient temperature to highest oil temp. as per desired.

[b] The total volume of the conservator shall be min.10% of the total quantity of oil in transformer. The inside diameter of the pipe connecting the conservator to the main tank shall be min.50mm and it shall be projected into the conservator in such a way that its end is projected 30mm above the bottom so as to create sump for collection of impurities. The min. oil level shall be above the sump level.

[c] A conservator complete with sump and drain valve shall be provided in such a position as not to obstruct the electrical connections to the transformer, having a capacity between highest and lowest visible levels to meet the requirement of expansion of the total cold oil volume in the transformer and cooling equipment from the minimum ambient temperature shall be with 0°C to 90°C. The minimum indicated oil level shall be with the feed pipe from the tank covered with not less than 15mm depth of oil and the indicated range of oil level shall be minimum to maximum.

[d] The oil connection from transformer tank to the conservator vessel shall be arranged at arising angle of 3° to 9° to the horizontal up to gas and oil actuated relay and shall consist of 50mm inside diameter pipe.

31.4.18. BUSHINGS:

[a] All main winding and neutral leads shall be brought out through outdoor type bushings. The electrical characteristics of bushing shall be in accordance with IEC-137 as well as relevant IS. The bushing shall be rated for highest voltage and current rating of the respective windings. The current ratings of bushing shall be at least 150% of the rated current at minimum tap to permit overloading.

[b] The bushings shall have high factor of safety against leakage to ground and shall be so located as to provide adequate electrical clearances between bushings and between the bushings and ground parts. The spacing between the bushings shall be adequate to utilize full flashover strength preventing flashover between the phases or between phase and ground parts under all conditions of operation. The creep age distance shall not be less than 25 mm per KV.

[c] All bushings shall be equipped with suitable solder less terminals of approved type. The type and size shall be specified. All external current carrying contact surfaces shall be placed adequately.

[d] Bushings of identical voltage ratings shall be interchangeable.

[e] All porcelain used in bushings shall be of the wet process homogeneous impervious to moisture and free from cavities or other flaws and throughout verified and smoothly glazed. The glazing shall be of the uniform colour and free from blisters, burns and other defects. All bushings shall have puncture strength greater than the dry flashover voltage.
PARTICULAR SPECIFICATIONS [Continued]

31.4.19. CENTRE OF GRAVITY: The centre of gravity of the assembled transformer shall be low and as near the vertical centre line as possible. The transformer shall be stable with or without oil.

31.4.20. FITTINGS AND ACCESSORIES: Each transformer shall be provided with the following fitting and accessories in accordance as specified in IS – 1180.

[a] 150 mm dial type thermometer for oil, a dial type indicating thermometer with maximum pointer of robust pattern mounted in the marshalling box of the transformer at a convenient height to read the temperature in the hottest part of the oil and fitted with alarm and trip contacts. Adequate thermometer pockets shall also be provided on the transformer tank.

[b] Two winding temperature indicators, One for HV and other for LV winding. Current transformer for WTI shall have secondary current of rating of 2 Amp.

[c] One oil drain cum sampling valve for main tank with plug or core plate of suitable size with locking arrangement.

[d] One filter valve located at the top of the tank on the LV side. The opening of this valve shall be baffled to prevent aeration of oil.

[e] One filter valve located near the bottom of the tank on the HV side of the transformer.

[f] Air release device. It shall be of adequate capacity and shall be provided to release the trapped air during/after filling of the oil.

[g] Explosion vent [with diaphragm /Pressure release device]

[h] One No. double float Buchholz relay shall be provided with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressure, complete with shut-off valves on either side and flange coupling to permit easy removal without lowering oil level in the main tank, a bleed valve for gas venting and a test valve. The Buchholz relay shall be of best indigenous make having ISI certification.

[i] Detachable radiators complete with shut off valves as necessary for cooling

[j] An oil conservator having detachable end plates, with following provisions.

[i] Magnetic type oil level gauge with low level alarm contacts.

[ii] One oil filling hole with plug and drain valve on the conservator.

[iii] One prismatic oil level gauge having painted/embossed marking as min., normal, and maximum Oil level.

[iv] Silica gel breather with Oil seal and dehydrating agent.

[k] Eye bolts and lugs on all parts for ease of handling.

[l] Two grounding terminals

[m] Rating, Diagram and Terminal Marking Plates: Rating, diagram and terminal marking plates of stainless steel or brass for transformers and other accessories giving details as per ISS-2026 shall be provided. Value of full wave [1.2/50 micro second] impulse level, short circuit current, its duration, weights of all important items, Impedances, loss values at normal/extreme taps and Postal address. Performance guarantee shall also be indicated.
PARTICULAR SPECIFICATIONS [Continued]

[n] All transformers shall have the marking in paint on the body for identification as per Indian Standard or as instructed by purchaser. Further, the following shall be embossed at the top of the tank cover.

[i] Ser. No. of the Transformer.
[ii] The details of P.O. i.e. Order No. & Date.
[iii] Name of the firm.
[iv] Month and year of manufacture.

[o] Bimetallic terminal connectors for HT & LT cable termination.

[p] Suitable weather proof cubicles [Marshalling box] for housing the local control equipment for fans, terminal blocks, for current transformer secondary's and for mounting winding temperature indicators and oil temperature indicator as [a] and [b] above.

[q] Triple pole type off load tap changer.

[r] **Rollers:** Transformers shall be provided with four numbers of flat uni-directional / Bidirectional rollers.

[s] Skids

[t] **Hauling Eyes:** Hauling eyes shall be provided on all the four sides of the transformer base.

[u] **Jacking Pads:** Four, sturdy jacking pads shall be provided for lifting complete transformer to enable rotation of its wheels through 90 degree for pulling on transformer tank. Lifting height and safe capacity of jacks shall be specified in Bid.

[v] **Lifting Lugs:** Two sets of forged or tested mild steel plate lifting lugs, one set for top cover, core and coil assembly and other set of complete transformer shall be provided. Lifting lugs shall be of adequate strength and size for attaching steel rope slings. Shall lugs for lifting complete transformer be located on the base, sling guides shall be provided on cover.

[w] **Inspection Covers:** One inspection covers of sufficient size for access to the interior of the tank shall be provided on the cover. The inspection covers shall be provided with suitable lifting arrangements.

[x] **OFF CKT Tap Changer.**

[y] **Axles & Wheels:** All type of valves shall be of gun metal except radiator shut off valves which may be of cast iron/steel. All valves shall be provided either with blind companion flanges or with pipe plugs for protection. The makes of fitting & accessories shall be Specifications as under:

<table>
<thead>
<tr>
<th>Ser. No.</th>
<th>Fitting &amp; Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>[i]</td>
<td>Buchholz Relay</td>
</tr>
<tr>
<td>[ii]</td>
<td>Winding Temperature Indicator</td>
</tr>
<tr>
<td>[iii]</td>
<td>Magnetic Type Oil Level Guage</td>
</tr>
<tr>
<td>[iv]</td>
<td>Radiator Valve</td>
</tr>
<tr>
<td>[v]</td>
<td>Filter Valve &amp; Drain Valve</td>
</tr>
<tr>
<td>[vi]</td>
<td>Oil Temperature Indicator</td>
</tr>
</tbody>
</table>
PARTICULAR SPECIFICATIONS [Continued]

Radiator valves shall have clear & distinct OPEN/CLOSE indication embossed/casted as well as painted on the both sides of main body of valve.

31.4.21. **FACTORY ASSEMBLY AND TESTS:** The transformer shall be completely assembled and tested at the Factory. Routine and Acceptance tests as per specification are to be conducted and no deviation in respect of conducting these tests will be acceptable. No extra charges for these tests will be paid. Test charges shall be part of cost of the equipment. If purchaser selects to send a representative, all tests shall be carried out in his presence. Type test certificate shall be furnished before start of supply.

31.4.22. **ROUTINE TESTS:** Each completed transformer shall be subjected to following routine tests as per IS – 1180. No extra charges for any of the tests shall be paid. No deviation shall be acceptable. If the CONTRACTOR desires, he may not fix radiators on transformers [other than the one which is to be type tested] during routine testing. However in that case, radiator manufacturer’s test certificate shall be furnished for reference of inspecting officer with undertaking that CONTRACTOR shall be responsible for proper alignment/fixing of radiator on transformer at site.


[b] Measurement of turn’s ratio between HV-LV windings at each tap.

[c] Checking of polarity and phase relationships for each winding.


[e] Positive phase sequence impedance/short circuit impedance between HLV windings on minimum, maximum and normal taps.

[f] Separate source voltage withstand test.

[g] BDV test on transformer oil.

[h] Induced over voltage withstand test.


[j] Regulation at rated load at unity, 0.90 and 0.80 lagging power factor.

[k] Load losses measured at rated frequency by applying voltage sufficient to produce the rated relevant current in one winding with the other winding short circuited.


[m] The total losses shall comprise of the No Load Losses, load losses at rated output duly converted at 75°C average winding temperature and shall also be indicated in the test report. Load losses shall be that corresponding to rated load on HV & LV winding.

[n] Routine dielectric tests as per IS – 1180.

[o] Check complete transformer against approved outline drawing, provision for all fittings, finish oil level etc.

31.4.23. **TYPE TESTS:** Type test certificate shall be furnished with tender and before start of supply for approval.
31.4.24. **TESTS AT SITE:** After erection at site all transformer[s] shall be subjected to the following tests:

[a] Insulation resistance test.
[b] Ratio and polarity test.
[c] Dielectric test on oil.

In case the equipment is not found as per the requirements of the purchase order, all expenses incurred during site testing will be to the tenderer’s account and the material shall be replaced by him at site, free of cost.

31.4.25. **FURTHER TESTS:** The owner reserves the right of having other reasonable tests carried out at his own expenses either before dispatch or during performance guarantee period from Govt. Approved/ Govt. recognized lab to ensure that the transformer complies with the requirements of this specification after due intimation to the contractor. In case the equipment is not found meeting the requirement of Work Order/Contract/ Agreement specification, all expenses incurred for such testing will be on contractor’s account and the material shall be replaced by the contractor at site free of cost.

31.4.26. **FREQUENCY AND SYSTEM VOLTAGE:** The transformer shall be suitable for continuous operation with a frequency variation of plus minus 3% from normal of 50 cycles per second without exceeding the specified temperature rise. The highest system rated voltage shall be 24KV. However the flux density requirements shall be as per this specification.

31.4.27. **DRAWINGS:**

[a] The drawings and the technical literature list below shall be submitted.

[i] General outline drawings showing front, side elevations and plan views of the transformer and all accessories and external features with detailed dimensions, net and shipping weight, crane lift for undertaking and for erection/ removal of bushing, size of lifting and pulling eyes, HV & LV terminal clearances, live terminal to ground clearances, quantity of insulating oil etc.

[ii] Core assembly drawing showing complete constructional details and flux density calculations & details of insulation.

[iii] Drawings giving details of name plate & terminal marking and connection diagrams.

[iv] Drawings of bimetallic terminal connectors with test certificates. Thermal / dynamic calculations to provide transformers capability to withstand short circuit under worst conditions.

[b] Any shop work done prior to approval of the drawing shall be at the contractor’s risk. The contractor shall make all such changes in the design as are considered necessary to make the equipment conform to the provisions and intent of this specification without any additional cost to the OWNER.

[c] Each drawing shall be identified by a drawings number and each subsequent resubmission/ revision or addition to the drawings or procedure. All drawings shall be thoroughly checked for accuracy and completeness and signed or initialled by a responsible officer of the contractor.
PARTICULAR SPECIFICATIONS [Continued]

[d] Checking and approval of the drawings by the contractor is for the benefit of the contractor and shall not relieve the contractor of full responsibility for ensuring correct interpretation of design drawings and specifications or for completeness and accuracy of the shop drawings and relevant specifications.

NOTES:

1. The Tolerance in weight and Dimension of the transformer shall not be more than \([\pm] 5\%\).

2. Minimum external electrical clearance after mounting the bi-metallic terminal connectors in position shall be maintained as per relevant standards.

3. Make of each accessories/components shall be clearly and invariably indicated in the bill of material. Further following make[s] of bought out items are acceptable to the department.

   [a] Bushings.
   [b] Bimetallic terminal connector
   [c] OFF circuit tap changer.
   [d] Oil temperature indicator

   However other makes of bought out items are also acceptable, if it is of “ISI mark” or type tested for which Contractor shall furnish attested Photostat copy of valid ISI certificate / type test report from Govt. approved/ recognized lab. The type test report shall not be older than 5 years.

31.5 INSTALLATION & COMMISSIONING: Mainly following activities are required to be carried out before commissioning of Power Transformers:

   [a] Assembling of Power Transformer accessories.
   [b] Testing activities in presence of Purchaser such as
   [c] Ratio Test
   [d] Megger Value
   [f] Oil BDV
   [g] Earth Resistance
   [h] Bucholz Relay checking.
   [i] WTI/OTI/MOLG [oil level] checking.
   [j] Checking of points of leakage of oil from Transformer body/ Radiator/Valve,
   [k] Setting of Relays in Panel

32. TECHNICAL SPECIFICATION OF 11KV SWITCHGEAR:

32.1 3 Pole, 50 Hz, 11kV switchgear panels shall be fitted with 11kV vacuum circuit breakers including voltage transformers, current transformers, metering instruments, protection relays etc. The power system is with neutral solidly earthed. The circuit breaker and protective devices shall be of latest design so as to ensure rapid and efficient interruption of fault current, low arc energy, small arcing time, complete phase segregation and freedom from fire hazards.
32.2. **STANDARDS:** The Circuit Breaker / Metal Enclosed Switchgear, Voltage Transformers, Current Transformers and all other equipment shall also comply with the requirement of following latest edition of relevant Indian standards. Voltage transformer and current transformers shall be mounted within the panels.

<table>
<thead>
<tr>
<th>Ser. No.</th>
<th>IS/IEC Reference Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>IEC – 298 : AC Metal - enclosed and control gear for rated voltages above 1KV and including 72.5KV</td>
</tr>
<tr>
<td>[b]</td>
<td>IS – 3427 : AC Metal - enclosed and control gear for rated voltages above 1KV and including 52KV</td>
</tr>
<tr>
<td>[e]</td>
<td>IEC – 529 : Degrees of Protection.</td>
</tr>
<tr>
<td>[g]</td>
<td>IS – 325 : Specification for 3 Phase Induction motors.</td>
</tr>
<tr>
<td>[h]</td>
<td>IS – 2629 : Recommended practice for Hot dip galvanizing of iron and steel.</td>
</tr>
<tr>
<td>[k]</td>
<td>IS – 5561 : Terminal Connectors</td>
</tr>
<tr>
<td>[l]</td>
<td>IS – 3156 : Voltage Transformers</td>
</tr>
<tr>
<td>[m]</td>
<td>IS – 2705 : Current Transformers</td>
</tr>
<tr>
<td>[o]</td>
<td>IS – 13779 : Static Energy Meters</td>
</tr>
<tr>
<td>[p]</td>
<td>IS – 8686 : Static Protection Relays</td>
</tr>
<tr>
<td>[q]</td>
<td>IS – 1248 : Electrical measuring instruments</td>
</tr>
<tr>
<td>[s]</td>
<td>IS – 10118 : Minimum clearances for Outdoor Switchgear.</td>
</tr>
</tbody>
</table>

32.3. **PARTICULARS OF SYSTEM:**

|       | Nominal System Voltage : 11kV |
|-------|-----------------------------:|---|
|       | Highest System Voltage      : 24 kV |
|       | Frequency                   : 50 Hz |
|       | No. of Phases               : 03 |
|       | Neutral Earthing            : Effectively Earthed |

32.4. **SERVICE CONDITIONS:** The equipment shall operate satisfactorily under the climatic conditions specified in this specification. The reference maximum ambient Air temperature may be taken as 50°C as against 40°C. The permissible temperature rise for various equipment offered shall therefore be derated accordingly.
32.5. **PRINCIPAL PARAMETERS:**

32.5.1. **CIRCUIT BREAKERS:** Rating and characteristics of circuit breakers:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[i]</td>
<td>No. of Poles : 3</td>
</tr>
<tr>
<td>[ii]</td>
<td>Class : Indoor</td>
</tr>
<tr>
<td>[iii]</td>
<td>Rated Voltage : 11kV</td>
</tr>
<tr>
<td>[iv]</td>
<td>Rated Insulation Level :</td>
</tr>
<tr>
<td></td>
<td>[a] Lightning Impulse Voltage : 125 KV [Peak]</td>
</tr>
<tr>
<td></td>
<td>[b] One minute Power Frequency withstand voltage : 50 KV [RMS]</td>
</tr>
<tr>
<td>[v]</td>
<td>Rated Frequency : 50 Hz</td>
</tr>
<tr>
<td>[vi]</td>
<td>Rated Normal Current : 800A</td>
</tr>
<tr>
<td>[vii]</td>
<td>Short Circuit Breaking Capacity : 40 KA</td>
</tr>
<tr>
<td>[viii]</td>
<td>Short time withstand Current for 3 seconds : 40 KA</td>
</tr>
<tr>
<td>[ix]</td>
<td>First Pole to Clear Factor : 1.5</td>
</tr>
<tr>
<td>[x]</td>
<td>Protection Class : IP 4X</td>
</tr>
<tr>
<td>[xi]</td>
<td>Maximum Opening Time : 5 Cycles</td>
</tr>
<tr>
<td>[xii]</td>
<td>Rated Operating Sequence : 0-3min-CO-3min-CO</td>
</tr>
<tr>
<td>[xiii]</td>
<td>Minimum operations at full rated short circuit breaking current : 100</td>
</tr>
<tr>
<td>[xiv]</td>
<td>Rated Breaking Capacity :</td>
</tr>
<tr>
<td></td>
<td>[a] Symmetrical : 40KA</td>
</tr>
<tr>
<td></td>
<td>[b] Asymmetrical : As per ISS</td>
</tr>
<tr>
<td>[xv]</td>
<td>Rated making capacity : 2.50 x 40 KA</td>
</tr>
<tr>
<td>[xvi]</td>
<td>Operating Mechanism : Motor operated spring charged closing mechanism</td>
</tr>
<tr>
<td>[xvii]</td>
<td>Heater/Lamp/Socket : 240 V AC</td>
</tr>
<tr>
<td>[xviii]</td>
<td>Control Voltage : 230V AC</td>
</tr>
</tbody>
</table>

32.5.2. Characteristics of the operating mechanism of Circuit breaker and associated equipment:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[i]</td>
<td><strong>METHOD OF OPERATION:</strong> The circuit breakers shall be equipped with power operated mechanism to operate all the three phases simultaneously using 220/240V universal motors operated spring closing mechanism or magnetic actuator. The circuit breakers shall also be provided with hand operated spring closing mechanism or magnetic actuator. The Circuit Breaker shall have electrical and mechanical tripping arrangements under various conditions. In case of spring closing mechanism no main spring of the mechanism shall be plated, powder coated or given any other treatment so that spring property is not lost.</td>
</tr>
<tr>
<td>[ii]</td>
<td><strong>NUMBER AND TYPE OF SPARE, AUXILIARY SWITCHES:</strong> Adequate number of spare auxiliary switches / contacts both of normally open and normally close type but not less than four each shall be provided on the circuit breaker for use in the indication and controlling scheme of the circuit breaker.</td>
</tr>
<tr>
<td>[iii]</td>
<td><strong>RATED SUPPLY VOLTAGE AND RATED SUPPLY FREQUENCY:</strong> The rated voltage for the auxiliary supply shall be 230 V AC Supply. Each switchgear shall be provided with built in Power packs.</td>
</tr>
</tbody>
</table>

32.5.3. **CONSTRUCTIONAL FEATURES:** The circuit breakers shall be triple pole metal clad truck mounted horizontal draw out type enclosed in cubicle made of CRCA sheet steel of minimum 2 mm thickness and shall comply with latest edition of relevant IS. The cubicle /panels shall be vermin proof and dust tight. The cubicle shall be of folded type construction. The switchgears and control gear shall be complete with all necessary supporting frame work, nuts and bolts etc. for securing the same to the floor. The
operating mechanism shall operate [close/open] all the three phases simultaneously. The operating mechanism, links etc. shall be accessible for maintenance. Mechanical safety shutters shall be provided between breaker and panel. Engagement and disengagement of auxiliary supply shall be automatically linked through the movement of the truck so that in service condition auxiliary supply is automatically made. All six terminals shall brought out of cubicle through appropriate class of cable termination and sealing kits. All the breakers shall be supplied with necessary clamps suitable for appropriate current ratings. Suitable arrangement of earthing the switchgear and control gear panels shall be provided. The arcing contacts shall be made of homogeneous special alloy so that surge voltages are reduced to negligible level and multiple arc re-ignition is eliminated. All the connecting bus bar shall be made of Aluminum for these indoor circuit breakers. For indoor panels, switchgear [circuit breakers, CTs, PTs etc.] and control gear [relays, C & R panel meters etc.] shall be mounted on the same panel. A set of air insulated electrolytic copper bus bars with PVC sleeves or PVC insulation are to be provided for all indoor switchgear panels. The switchgear panels shall be provided with the arrangement for extending the bus bar and inter-connecting bus bars. Their supports, nuts and bolts etc. will be supplied loose. The region of such inter connection shall normally be blanked on panels. The bus bars shall be of electrolytic copper with permissible limits of current density. Size of the bus bar and current density shall be specified in the tender. The bus bar conductor shall conform to IS – 8034. The bus bar shall be rated for 40 KA for 3 Seconds. Painting of panel cubicle shall be epoxy based powder coated. The paint shade of indoor panels shall be RAL-7032

32.5.4. **VACUUM CIRCUIT BREAKER:** The three phase vacuum circuit breakers will have three interrupters [one interrupter per phase] mounted on same carriage. The interrupters shall be air insulated in epoxy resin tank or with epoxy resin phase barriers. Each interrupter shall have fixed and moving contacts in sealed envelope having vacuum below 10-6torr. The metallic bellow shall permit axial movement of moving contact and act as vacuum seal. The contacts shall have requisite mechanical strength and good electrical and thermal conductivity and shall be made of copper chromium alloy. Complete literature of vacuum bottles shall be furnished with the tender.

32.5.5. **VOLTAGE TRANSFORMERS:**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>[i]</td>
<td>Highest equipment voltage</td>
<td>124 kV</td>
</tr>
<tr>
<td>[ii]</td>
<td>No. of phases</td>
<td>3</td>
</tr>
<tr>
<td>[iii]</td>
<td>Insulation level</td>
<td></td>
</tr>
<tr>
<td>[a]</td>
<td>Impulse withstand voltage</td>
<td>125 kVP</td>
</tr>
<tr>
<td>[b]</td>
<td>One minute power frequency withstand voltage on</td>
<td>50 kV</td>
</tr>
<tr>
<td>[1]</td>
<td>Primary winding</td>
<td>50 kV RMS</td>
</tr>
<tr>
<td>[2]</td>
<td>Secondary winding</td>
<td>2kV RMS</td>
</tr>
<tr>
<td>[iv]</td>
<td>Frequency</td>
<td>50 Hz.</td>
</tr>
<tr>
<td>[v]</td>
<td>Transformation ratio</td>
<td>11000/110 V</td>
</tr>
<tr>
<td>[vi]</td>
<td>Rated output</td>
<td>50 VA / phase</td>
</tr>
<tr>
<td>[vii]</td>
<td>Accuracy class</td>
<td>0.5 for measurement and 3P for Protection</td>
</tr>
<tr>
<td>[viii]</td>
<td>Winding connection</td>
<td>Star/Star</td>
</tr>
<tr>
<td>[ix]</td>
<td>Rated voltage factor</td>
<td>1.2 continuous and 1.9 for 30 seconds</td>
</tr>
<tr>
<td>[x]</td>
<td>Type of insulation</td>
<td>Resin cast</td>
</tr>
</tbody>
</table>

VTs shall be provided with HRC type fuses on the secondary side. The VT fuses on primary side shall also be provided with all safety precautions. One of the secondary terminals of the VTs shall be solidly earthed. One number three phase voltage transformer of this rated output will be required for each incoming indoor panel. Voltage transformers shall be mounted in the top part of the cubicle for ease of replacement of fuses.
PARTICULAR SPECIFICATIONS [Continued]

32.5.6. CURRENT TRANSFORMERS:

- [i] Rated voltage : 11/24kV
- [ii] Insulation level :
  - [a] Impulse withstand voltage : 125kVP
  - [b] One minute power frequency voltage on:
    - [1] Primary winding : 50 kV RMS
    - [2] Secondary winding : 2kV RMS
- [iii] Frequency : 50 Hz
- [iv] Rated continuous thermal : 120% of rated primary current
- [v] Short time thermal rating current : 40 KA for 3 Sec.
- [vi] Transformer CTs of ratio for incoming type indoor panel:
  - [vi] Rated output/accuracy etc. for CTs :
    - [a] Rated output [However VA burden shall not be less than suitable for AC series trip requirement with shunt trip arrangement] : 10 VA
    - [b] Class of accuracy : 5P
    - [c] Accuracy limit factor : 15
    - [d] Purpose : Relaying
- [viii] Maximum instrument security factor : – 5
- [ix] CT for differential protection and restricted earth fault protection : PS Class
- [x] Type of Insulation : Resin Cast

The core shall be of high grade non ageing laminated silicon steel of low hysterics loss and high permeability to ensure high accuracy for both normal and fault current.

32.5.7. The rating of secondary winding shall be 1 Amps. However, the current transformers will have to satisfy the requirement of rated VA burden, class of accuracy, accuracy limit factor and short time thermal rating as specified. Magnetization curves corresponding to all secondary taps must be submitted with the tender. The ratings of current transformers of all classes regarding ratio error, knee point voltage, resistance of secondary winding etc. shall have to be co-ordinated with the requirements of protective relays and protection scheme, without any extra cost.

32.5.8. All the type test certificates are also needed to be furnished with tender.

32.5.9. The tenderer shall also furnish along with the tender, complete general arrangement, schematic and outline diagrams indicating the mounting arrangement and position of current transformers, voltage transformer terminal blocks etc. Type of current transformer and voltage transformer employed shall also be clearly stated.

32.5.10. INDICATING AND INTEGRATING METERS/INSTRUMENTS: All indicating instruments shall be of switchboard type, back connected, suitable for flush mounting and provided with dust and vermin proof cases for tropical use and finished in suitable colour. All instruments shall have practical laboratory means for adjustment of accuracy. The limits of errors for ammeters/voltmeters shall be those permissible for class 0.5 instruments as per IS – 1248. The ammeters and voltmeters shall be suitably scaled to indicate the current/voltage for all the rating of current/voltage transformers. A phase selector switch with four/six position shall be used to measure the current/voltage of each phase/line. The meters shall be located at eye level to facilitate observation of readings correctly.
32.5.11. **AC STATIC HT TRIVECTOR METER:** AC Static HT Trivector Meter shall be provided with RS485 communicable in 22kV Switchgear for energy measurement. The meters shall be located at transformer HT side VCB panel on eye level to facilitate observations of readings correctly.

32.5.12. **RELAYS:**

[a] 11 kV Switchgear located near 630 KVA transformer in proposed SPV plant shall have Numerical relay [Siemens 7SJ64 / MiCom P132 / or equivalent] and it shall have the following as a minimum protection:

[i] IDMT + Instantaneous O/C, S/C [50/51]
[ii] IDMT + Instantaneous E/F protection [50N/51N]
[iii] Reverse power relay [32]
[iv] Breaker failure protection [50BF]
[v] Trip circuit supervision [74TC]
[vi] Lockout [86]

[b] For 22kV Switchgear located in Existing 22kV Receiving Station for evacuation shall have following as a minimum protection:

[i] IDMT + High set and Instantaneous O/C, S/C [50/51]
[ii] IDMT + High set and Instantaneous E/F protection [50N/51N]
[iii] Breaker failure protection [50BF]
[iv] Trip circuit supervision [74TC]
[v] Lockout [86]

[c] 630 KVA Oil filled transformer protections:

[i] Bucholz trip [63T] - [transformer mounted via marshalling box]
[ii] Oil Temperature trip [26T] - [transformer mounted via marshalling box]
[iv] Pressure Relief Device - [transformer mounted via marshalling box]

[d] The circuit breaker shall be fitted with shunt trip coil for operation on Numerical relay with communication facility with standard open protocol / SCADA compatibility. The coils shall be rated for 110VAC operation on station battery.

[e] Three phase protection relays shall be Numerical Over-current & Earth Fault protection having 2 elements for over current and one for earth fault protection.

[f] The setting for over-current shall be 50-200% [in step of 1%] for earth fault element from 5 to 80% [in step of 1%].

[g] These relays shall be numerical / non directional with selectable curve from all standard 5 IDMT curves. The relay shall be able to store a minimum of two previous fault values including fault level and phase. The relay shall be fully compatible to SCADA system.

[h] The relay shall be numerical type mounted in flush pattern on the panel board.

[i] The relay shall be rated for 1 Amp. CT secondary. The relay shall conform to IS – 3231 & 8686 specifications. The tenders shall furnish the detail in this regard along with the offer.
PARTICULAR SPECIFICATIONS [Continued]

[j] All the relays shall be provided with test blocks in panel so designed that the relays may be tested at site. The relays shall have provision of testing either through test block or test plug easily accessible by injecting the voltage / current / frequency [as applicable] from external testing instruments /source without first disconnecting/ reenergizing the primary electrical circuit protected by the relays. Facilities for isolating the tripping circuit during such testing shall be also provided.

[k] The requirement of test block shall not be applicable in case of draw out type relays which can be tested by using test plug without removing the relay from its casing.

[l] The testing facilities provided in the relays shall be specifically stated in the bid. Necessary test plug etc. as may be required for proper testing shall be included in the contractor’s scope of supply. One test plug with five panels or part thereof is to be supplied.

[m] Wiring: All wiring shall be of switch board type consisting of copper conductor of 1.5 Sq.mm. for alarm / annunciation / control circuits and 2.5 Sq.mm. for CT and all other Circuits insulated with polyvinyl chloride insulation suitable for 660 Volt service and in accordance with relevant IS – 732. Polyvinyl Chloride used shall have excellent resistance against burning, moisture, oil and vermin and shall be finished with clear colour. Rubber insulated wiring shall not be acceptable.

[n] Tenderers shall furnish the details of method being adopted by them for Joint/Connections.

[o] All instruments and Panel wiring shall be of heat resisting and self extinguishing type in compliance with IS. Plastic or porcelain cleats of the limited compression type shall be used for holding wiring runs. All wires shall be suitable for bending to meet the terminal studs at right angles. Metal cases of all apparatus mounted on panels shall be separately earthed by means of copper wire or strips. The following colour scheme of the wiring shall be used as per IS – 375.

[a] AC three phase circuits:
   [i] No. 1 Phase: Red.
   [ii] No. 2 Phase: Yellow.
   [iii] No. 3 Phase: Blue
   [iv] Neutral Conductor: Black
   [v] Connection to Earth: Green

[b] D.C. circuits: Grey

[p] Mimic Diagram: For indoor panels painted colour bands shall be used for the mimic bus. The mimic diagram shall be on eye level. Equipments such as current transformers, voltage transformers etc. shall be represented by suitable symbols. The colour shall be Red Shade 537 of IS – 5.

[q] Indicating LEDs / LAMPS: Indicating LEDs shall be provided on the control board to indicate the following:

[a] Visual indication of ON and OFF position of each circuit breaker.
[b] Trip circuit healthy indication.
[c] Auto trip indication for each circuit breaker panel.
[d] VT supply indication.
PARTICULAR SPECIFICATIONS [Continued]

[r] Test Terminal Blocks: Two nos. test terminal blocks shall be provided one for testing of relays and other for testing meters. They shall be of switch board, back connected type for front of panel mounting. The test blocks shall provide complete isolation of meters, instruments, etc. and the arrangement shall be such that testing power could be connected at the test block from any external source or may be taken from the instrument transformers. Provision shall be made for short circuiting current transformers. Suitable sealing arrangement shall be provided in test terminal blocks.

32.5.13. FERRULES: Ferrules engraved/printed with the same number, letters or symbols as indicated in the connection and wiring diagram shall be provided on the terminal ends of all wires for identification of circuits for inspection and maintenance. Ferrules shall be of strong and flexible insulating material with glossy finish to prevent adhesion. They shall be engraved / printed and clearly marked and shall not be effected by dampness. Ferrule numbering shall be in accordance with IS – 375. The same ferrule number shall not be used on wires in different circuits on a panel.

32.5.14. SPACE FOR CABLES AND CABLE GLANDS: Sufficient space for receiving the cables inside the switch board at the bottom of the cubicles and mounting arrangement for the terminal cable glands shall be provided. Cable gland plates shall be above the ground level for the ease of working.

32.5.15. SCHEDULE OF REQUIREMENTS:

[a] 22kV Switchgear for 1500KVA transformer shall have the following [a] 22kV/800A Circuit Breaker vacuum type draw out with provisions of manual tripping by means of a control switch/push button.

[b] Motor Charged Spring operated closing mechanism or magnetic actuator operated device.

[c] Numerical relays with necessary protections along with communication facility and standard open protocol, Communication on RS-485, Port – Mod Bus – Open Protocol. [Siemens 7SJ64 / Micom P132 / or Equivalent]

[d] Single phase 22kV current transformers of suitable ratio for metering and protection. The class of accuracy shall be 0.5 S for metering and 5P10 for protection. Rated burden [output] shall be 10 VA for each secondary winding. Instrument Security factor for metering core shall not exceed 5.

[e] 11000/110 Volts three phase voltage transformers of suitable burden and class of accuracy 0.5. The transformer shall be star-star connected.

[f] Digital AC voltmeter

[g] Voltmeter phase selector switch to indicate phase to phase and phase to neutral voltage of all the three phases.

[h] Indicating LEDs coloured red, amber and blue for PT supply indication.

[i] Arrangement for reception of incoming and outgoing cable connection along with cable termination and sealing kits of requisite for suitable size of XLPE power cables.

[j] Set of three phase air insulated main Electrolytic copper bus bars of 800A continuous current rating with PVC insulation or sleeves. STC rating 40 KA for 3 seconds.
PARTICULAR SPECIFICATIONS [Continued]

[k] Mechanical ON/OFF indicator.
[l] Operating handle for independent manual closing mechanism.
[m] Auxiliary switch having minimum of 8 contacts 4 normally open and 4 normally closed.
[n] Digital ammeter
[o] Ammeter selector switch to indicate phase current in all three phases and with OFF position.
[p] AC HT Trivector meter
[q] KW/KWH meter, Power factor [PF] meter
[s] Automatic door CFL with Switch.
[t] 240V, 80WAC single phase anti condensation heaters with thermostat [0 – 60°C] and switch.
[u] Anti pumping contactor.
[v] Operation Counter.
[w] Test terminal blocks for metering and relays, 3 Phase 4 Wire.
[x] Fault trip yellow LED.
[y] Trip Circuit healthy indication.
[z] Ground Bus size min. 40 x 6 mm copper
[aa] Bell for Alarm
[bb] Hooter for Alarm
[cc] 3 Pin Socket with switch
[dd] Indicating Lamps for ON/OFF/Trip

33. 22 KV SWITCHGEAR LOCATED IN EXISTING 22 KV RECEIVING STATION FOR POWER EVACUATION SHALL HAVE:

[a] 22kV/800A Circuit Breaker vacuum type Draw out with provisions of manual tripping by means of control switch/push button.
[b] Motor Charged Spring operated closing Mechanism or magnetic actuator.
[c] Numerical relay with necessary protections along with communication facility and standard open protocol.
[d] Single phase 22kV current transformers of suitable ratio for metering and protection. The class of accuracy shall be 0.5 S for metering and 5P15 for protection. Rated burden [output] shall be 10 VA for each secondary winding. Instrument security factor for metering core shall not exceed 5.
[e] 22000/110 Volts three phase voltage transformers of suitable burden and class of accuracy 0.5. The transformer shall be star-star connected.
[f] Arrangement for reception of incoming and outgoing cable connection along with cable termination and sealing kits of requisite size XLPE power cables.
PARTICULAR SPECIFICATIONS [Continued]

[g] Set of three phase air insulated main electrolytic copper bus bars of 800 A continuous current rating with PVC insulation or sleeves. STC rating 40 KA for 3 seconds.

[h] Mechanical ON/OFF indicator.

[i] Operating handle for independent manual closing mechanism.

[j] Auxiliary switch having minimum of 8 contacts 4 normally open and 4 normally closed.

[k] 11000/110 Volts three phase voltage transformers of suitable burden and class of accuracy 0.5. The transformer shall be star-star connected.


[m] Voltmeter phase selector switch to indicate phase to phase and phase to neutral voltage of all the three phases.


[o] Automatic door CFL with Switch.

[p] 240V, 80W AC single phase anti condensation heaters with thermostat [0-60°C] and switch.

[q] Anti pumping contactor.

[r] Operation Counter.

[s] Adaptor Box for Matching existing panel bus bar [if necessary].

[t] Loose set of 3 Phase Air insulated inter-connection electrolytic copper bus bars, 800 Amps. Rating with PVC insulation with nuts and bolts supports etc. STC rating 40 KA for 3 seconds.

[u] Test terminal blocks for metering and relays, 3 Phase 4 wire.


[w] Ground Bus size min. 40 X 6 mm. copper.

[x] Bell for Alarm.

[y] Hooter for Alarm.

[z] 3 Pin Socket with switch.

[aa] Indicating Lamps for ON/OFF/Trip.

33.1. All equipments shall be complete in all respect. All fittings, accessories or apparatus which may not have been mentioned above but which are usual/ necessary for the equipments shall be included for each circuit breaker panel.

33.2. TEMPERATURE RISE: The maximum temperature rise of various parts of the circuit breakers when tested under rated conditions shall not exceed the specified values at a peak ambient temperature of 50°C. The breakers may be provided with silver plated contacts if necessary to meet the requirement of IS – 13118 where higher temperature rise is permitted with silver plating contacts. The quantity of silver facing shall be such that after carrying out one tenth of the total number of operations specified for the mechanical endurance test, there is still continuous layer of silver on the contacts. The temperature rise of CTs and PTs shall also not exceed the permissible values as per relevant Indian Standards when corrected for maximum ambient temperature at site.
PARTICULAR SPECIFICATIONS [Continued]

33.3. **INSPECTION AND TESTING:** Each equipment shall comply with and shall be subjected to all routine and acceptance tests prescribed in the relevant Indian Standard Specification/IEC.

33.4. **TEST OF 22KV INDOOR CIRCUIT BREAKER:**

33.4.1. **ROUTINE / ACCEPTANCE TESTS:** The following acceptance and routine tests shall be got conducted in presence of purchaser's representative as per stipulation of the relevant standards, on each unit.

- [a] One minute power frequency voltage withstand dry test on main circuit.
- [b] Voltage withstand test on control & auxiliary circuits.
- [d] Mechanical operating test.
- [e] Design and visual checks.
- [f] Any other tests not specified above but covered as per amendment/ latest edition of relevant IS/IEC.

33.4.2. The Contractor must furnish type test reports along with bid in respect of the equipment [of the type and design offered] type tested in NABL approved test laboratory for which particular test the lab has been accredited [for Indian Contractors]. These type tests must not have been conducted earlier than three years from the date of opening of bid. The Contractor may furnish type test report latest upto 45 days after opening of tender.

33.4.3. The type test reports of Circuit Breakers, Current Transformers, Potential Transformers, Relays etc. shall be complete in all respect along with oscillographic records, photographs etc. in respect of all type tests as per relevant IS/IEC. The type test certificates shall be in respect of specific make and type / rating of the Circuit Breakers/ instruments, transformers etc. Intended to be supplied and not in respect of the breakers etc. Manufactured by their foreign collaborators if any. Necessary data with test reports to show capability of circuit breaker to withstand number of full level short circuit faults is also furnished. Complete literature must be sent with the tender.

33.4.4. Routine & acceptance test as per relevant standard shall be carried out on each equipment covered by this specification in the presence of purchaser's representative. If so desired by the purchaser all test reports shall be submitted and got approved from the purchaser before dispatch of the equipment.

33.4.5. Technical Particulars: The tenderers shall furnish the guaranteed technical & other particulars of the equipments offered in the proforma appended at Data Sheet. Tenders not accompanied with such details are liable to be ignored. Make of various equipments shall be clearly stated. Words like reputed, equivalent etc. shall not be accepted. Alternative makes of equipments shall not be more than two in the order of preference.

33.4.6. Inter Changeability: All similar materials and removable parts of similar equipments shall be inter changeable with each other.

33.4.7. Fault / Trouble Alarm Scheme: The automatic trip of the Circuit Breaker due to operation of protection relays shall be indicated by sounding of a hooter. All non-trip alarms shall be indicated by an alarm bell. Other makes shall also acceptable if it is of "ISI MARK" or type tested for which tenderers shall furnish attested photocopies of ISI Certificate/type test report not older than 5 years for the respective make offered along with tender.
PARTICULAR SPECIFICATIONS [Continued]

33.4.8. Make / type of each relay, indicating instruments, integrating instruments, control switches, selector switches, indicating lamps, semaphore indicators, enunciator scheme, bell, hooter etc. shall be clearly and invariably indicated in the GTP [Guaranteed Technical Particulars], bill of material and unit price list. Only specific make accessories shall be indicated. The word "Equivalent/ Reputed Make" will not be given for consideration.

33.4.9. Lighting Distribution Boards / Lighting Panel / Distribution Boards:

- **[a]** Main distribution board/ Lighting panels shall be wall/Column mounted. However, the above provisions may be changed as per design requirement.

- **[b]** The Lighting Distribution board shall be fed from UPS DB. The lighting distribution boards shall consist of four pole MCB as incomer and required number of outgoing feeders. The board shall be designed for the required short circuit level of 9 kA. All the distribution boards shall be sheet steel metal clad, dust and vermin proof, cubicle type with degree of protection conforming to IP-52. Outdoor panels shall be weather proof type with IP-54 protection. The thickness of sheet steel enclosures shall be 2 mm minimum for load bearing, 1.6 mm for other members and 3mm for gland plate.

- **[c]** The equipment shall be housed inside a sheet steel cubicle with hinged front access door and the board shall be complete with Aluminium busbar, of size not less than 25x6 mm, in an enclosed busbar chamber, floor pedestals including iron base for floor mounting, necessary bolts, nuts etc.

- **[d]** The Lighting Distribution board shall be Detachable blank circuit label to be inscribed at site.

- **[e]** The Lighting Distribution board shall be consisting of Caution board.

- **[f]** The lighting panels shall be rated for 415 V, 3 phase, 4 wire, AC with neutral bus and suitable for either wall/column mounting. Indoor panels shall have degree of protection of IP 52 and the outdoor panels shall have a degree of protection of minimum IP 55. Additionally, all outdoor panels shall be provided with detachable canopy at the top with regular slope towards the rear to prevent accumulation of rain water.

- **[g]** The panel bus bars shall be of electrolytic grade Hard drawn Aluminium, sized for a maximum temperature of 40ºc over the ambient temperature, colour coded for easy identification of phase and neutral bus bars. Minimum size shall be 25x6mm

- **[h]** The cable/conduit entry may be either from the top or bottom [for Indoor Panels] / from bottom only [for Outdoor Panels] with removable cable gland plates and shall be terminated in suitable separate terminal blocks. Necessary double compression type brass cable glands, tinned copper cable lugs are to be provided.

- **[i]** Provision shall be made for earthing the panel at two points. A copper earth bus shall run along the length of the panel. The front access door of the panels shall have padlocking arrangement.

- **[j]** The incoming to each Normal AC Lighting Panel shall be provided with a triple pole MCB with neutral isolating facility and one earth leakage circuit breaker. Combined type triple pole MCB and earth leakage circuit breaker [ELCB] are also acceptable for incomers to Lighting Panels.
PARTICULAR SPECIFICATIONS [Continued]

[k] Normal AC lighting panels shall have outgoing MCBs having thermal elements for overload protection and an instantaneous magnetic trip to protect against severe faults. All MCBs provided shall be suitable for breaking capacity of 9kA [minimum] at 230 V AC.

[l] The Emergency Lighting Panels shall have Incoming and outgoing feeders with HRC Switch fuse units or MCB units with back up fuse as required.

[m] The Lighting Panels shall be of double door type with the outer enclosure made of sheet steel having a minimum thickness of 2 mm with a hinged door and suitable locking arrangement.

[n] Each of the LDBs/ ELDBs shall be provided with voltmeter and ammeter along with selector switches, ‘SUPPLY ON’ indicating lamps, etc.

[o] The incomers of Lighting Distribution Boards [LDB] shall be provided with energy [kWh] meter for measurement of energy consumed by the lighting loads. The electronic energy meters shall be 3 phase, 4-wire type suitable for measurement of unbalanced loads. Energy meter shall have provision to communicate with DCS through open protocol IEC61850.

[p] Each outgoing MCB shall be of 15 A, but load to be limited to 2 kW or maximum 10 nos. fittings to be connected to one MCB.

[q] Individual control in office buildings shall be through single pole flush type switches. In those areas where group controls are required, rotary switches/MCBs shall be provided.

[r] Lighting panels feeding the remote areas shall be provided with contactors for control from a remote point. Lighting fixtures of remote area shall be fed from different circuits such that all the lights in the area are not ‘On’ all the time. The lights connected to a circuit or few circuits shall be ‘ON’ automatically through photocell. Provision shall be made for switching ‘ON’ for rest of the lights. In heat zones, ie; in the areas where ambient temperature is 60 °C and above, heat resistant control cables shall be used in hot dip galvanized rigid steel surface.

[s] Each Lighting Distribution Board shall be complete with designation and caution notice plates fixed at front cover and a directory plate fixed inside the front cover. This directory plate shall contain details of the lighting panels being fed from the Distribution Board including their designation, location, loading etc. Each Lighting Panel shall be complete with designation and caution notice plates fixed on front cover and a circuit directory plate fixed on inside of the front cover. Circuit directory plate shall contain details of the points to be controlled by each circuit including the location of the point controlled, rating of the protective units and loading of the circuit. The plates shall be of anodised aluminium with inscriptions indelibly etched on it. For street / roads lighting, 3-phase power from LDB shall be supplied by 3 nos. single pole MCB. The circuit shall be looped in and out at each lighting pole through a Junction box and Tee off shall be provided with single pole MCB for supply of power to the fixture of that lighting pole.

[t] Number of outgoing feeders in LDB’s, SLDB’s shall be provided as per requirement. 2 NOs Feeders for Purchaser’s use , and 20% spare feeders of each type and rating shall be provided in LDB, LDBs/SLDBs.

[u] Necessary cabling including laying and terminations shall be in the scope of this Contractor.

[v] Loop-in-loop-out Junction Box: LILO Box [Outdoor type with IP-55] made of sheet steel [CRCA], min. 2mm thickness, having the following and design approved by GE:
PARTICULAR SPECIFICATIONS [Continued]

[i] 25A terminal block for Loop-in-loop-out of cable

[ii] Fuse with link for connection to street light etc.

34. **UNINTERRUPTIBLE POWER SUPPLY SYSTEM**

34.1. Suitable rating of UPS [30 minutes backup, load power factor range 0.85 lag to unity] 230 V, 50 Hz, single phase Uninterruptible Power Supply system complete with all accessories, Sealed Maintenance Free lead acid battery set with racks, UPS DB and necessary accessories.

34.2. Requirements and Services to Be Furnished under the Specification the UPS System shall mainly comprise of the following:

[a] Rectifier Unit
[b] Static Inverter
[c] Set of Sealed Lead Acid Maintenance Free Battery
[d] 230 V AC distribution boards
[e] Built in Isolation Transformer
[f] One bypass transformer with servo control Voltage Stabilizer
[g] Static Transfer Switch
[h] Manual By Pass Switch
[i] One [1] Set of interconnecting cables - between various sub- systems, cables glands, lugs and accessories etc.
[j] Necessary Circuit breaker/Switch Fuse unit for protection.

34.3. **CODES AND STANDARDS:** Codes and Standards shall also meet the requirements of latest IS / IEC. The design and workmanship shall be in accordance with the best engineering practice. The design, manufacture, inspection, testing and performance shall comply with latest revisions of Indian standards, Electricity Act, Indian Electricity Rules and Regulations of Statutory Authorities [Chief Electrical Inspector to State Government].

[a] IS – 2705: Current Transformer
[b] IS – 2834: Shunt Capacitors
[c] IS – 2959: AC Contractors
[d] IS – 3231: Electrical Relays
[e] IS – 3700: Essential ratings and characteristics of semi-Conductors devices
[f] IS – 3895: Monocrystalline semi-conductor rectifier cells and Stack
[g] IS – 4064: Air break Switches
[h] IS – 4237: General requirements for switchgear & control gear
[i] IS – 6553: Environmental requirements for semiconductors Devices and integrated circuits.

34.4. **MODE OF OPERATION AND PERFORMANCE REQUIREMENTS:** Under normal conditions, the loads shall be supplied by the inverters. The rectifier / battery chargers shall derive power from normal AC source and supply DC power to the inverters while simultaneously float/boost charging the battery. In case, the inverter fails, automatic change over to standby transformer shall be effected through static switches. Upon failure of the normal AC source, the loads shall continue to be supplied by inverters which, without any switching shall obtain their power from storage battery for duration of 30 minutes. Upon restoration of the normal AC source, the rectifier/battery chargers shall power the inverters and simultaneously recharge the battery. This shall be automatic causing no interruption to critical loads.
PARTICULAR SPECIFICATIONS [Continued]

[a] The entire load shall be automatically transferred to an alternate AC source through static switch within a maximum of four [4] milli seconds under the following conditions.

[i] Battery discharged completely
[ii] Initiation of manual control switch

[b] In case of failure of inverters, static transfer switch shall changeover within five [5] milli seconds to connect the alternate AC source to the load. On restoration, the retransfer shall be manually initiated.

[c] During Asynchronous conditions, if the UPS fails the load shall be transferred through contactor arrangement to the bypass within 20 milli seconds.

[d] Retransfer of load shall be accomplished automatically by synchronising the inverter to the alternate source and allowing the inverter to ramp into the load and then disconnecting the alternate source.

[e] Manual transfer facility through static transfer switches shall be provided in either direction.

[f] In case of maintenance requirement, it shall be possible to isolate inverters and static bypass switches from load and connect alternate AC source to the load through manually operated, make before break manual transfer switch.

[g] When battery is taken out of service for maintenance, it shall be disconnected from the rectifier/charger and inverter by means of miniature circuit breakers. The UPS shall continue to function and meet all performance requirements except for the reserve time capability.

34.5. RECTIFIER CUM BATTERY CHARGER: The charger shall provide DC supply at the input terminal of the inverter and battery. The charger shall be of static type, comprising of Silicon Controlled Rectifiers [SCRs] connected in three phase full wave bridge circuit and shall be complete with filter circuits to limit the ripple within the limits specified in Data Sheet A. The rectifier transformer shall be of dry type, double wound with adequate number of primary taps. In float charging mode, charger shall have both auto and manual voltage regulation arrangements with Provision of Selector switch. Output DC voltage shall not vary beyond + 1%. The float charger controller shall have built in load limiting feature which will limit the load on charger in the event of over load and reduce the output voltage. The current setting of load limiting device shall be uniformly adjustable between 100% and 110% of full load. Float-cum-Boost charger shall be provided with suitable device for detection of AC under voltage, DC under voltage and DC earth fault, fuse failure on AC and DC sides and charger overload condition.

34.6. STATIC INVERTER: Inverter shall be of Thyristor controlled alternatively power transistor controlled Pulse Width Modulated [PWM] control type for providing output power having parameters as specified.

34.7. STATIC TRANSFER SWITCH: Static switch shall be of Thyristor controlled type having operating time less than 4 milliseconds. The transition shall be 'make before break' type.

34.8. MANUAL BYPASS: The manual bypass switch shall be used to isolate the static transfer switch from its load and from bypass supply source without interrupting supply to the load. Manual bypass transfer shall be make before break.

34.9. BATTERY: The battery shall be sized to feed load for the period specified. Vendor shall furnish calculations for battery capacity. Battery shall be supplied with all necessary accessories.
PARTICULAR SPECIFICATIONS [Continued]

34.10. **ALARMS, INDICATIONS PROTECTIONS AND METERING:**

34.10.1. **INVERTER PANEL:** Following minimum Audio/Visual alarm / indications and protections shall be provided for the static inverters:

[i] **Protections:**

[a] RFI filter at the rectifier input  
[b] Fast acting semi conductor fuses for all devices  
[c] D.C. over voltage  
[d] HRC fuses for D.C. filter capacitors  
[e] Battery charging current limit  
[f] Snubber circuit for each device dv/dt protection  
[g] Semi-conductor fuses at inverter input and output  
[h] Static Isolator for early removable of faulty inverter  
[i] Over temperature for the inverter  
[j] Fuses in the control circuit  
[k] Low Battery Voltage

[ii] **Alarm / Indications:**

[a] Inverter fuse failure annunciation  
[b] Inverter overload annunciation  
[c] D.C. over voltage/ under voltage annunciation  
[d] Inverter fan failure [if fans are provided] annunciation  
[e] Inverter loss of synchronism annunciation  
[f] Inverter failure annunciation  
[g] Emergency Shut-down  
[h] Low Battery voltage  
[i] Equipment over -temperature  
[j] Mains Failure  
[k] Fan failure  
[l] Battery on load  
[m] DC ground fault

34.10.2. **STATIC TRANSFER SWITCH:**

[i] **Protections**

[a] Fast acting semi conductor fuses for device  
[b] Snubber circuit for each device

[ii] **Alarm/Indications**

[a] Switch in “Normal “ position indication  
[b] Switch in ‘By pass ‘position indication  
[c] ‘Normal & By pass Sources in Synchronism’ indication  
[d] ‘Bypass Source Deviated’ annunciation  
[e] Static switches fuse failure annunciation

[iii] **Bypass Source**

[a] Mains ON indications
PARTICULAR SPECIFICATIONS [Continued]

[b] Mains failure/phase annunciation
[c] Bypass ON indication.
[d] Frequency out of acceptable limit alarm and indication.

(iv) Metering: Following metering instrument shall be provided on the UPS:

[a] Input side
   [i] AC Voltmeter with VSS
   [ii] AC Ammeter
   [iii] Frequency meter
   [iv] DC Voltmeter
   [v] DC Ammeter

[b] Output side
   [i] AC Voltmeter
   [ii] AC Ammeter
   [iii] Frequency Meter

34.10.3. CONSTRUCTIONAL FEATURES: UPS equipment shall be housed in panels freely standing on floor. The panels shall be sheet steel construction of CRCA of thickness not less than 2 mm. Suitable neoprene sponge rubber gaskets shall be provided on doors and covers plates to make the panel construction dust and vermin proof. The panel shall be complete with internal wiring and input/output terminals blocks. All equipments and wire terminations shall be identified by symbols corresponding to applicable schematic/wiring diagrams. The cubicles shall be provided with 240 V AC Power socket for connecting instruments during testing. All remote alarm contacts shall be wired upto the panel terminals blocks.

34.10.4. AC DISTRIBUTION BOARDS: The AC Distribution Boards shall be inbuilt in the UPS Panels. All outgoing feeders shall be provided with Miniature circuit breaker as a minimum Protection.

34.11. POWER AND CONTROL CABLES: All external power cables required for interconnection between sub-systems of UPS shall be 650/1100 V grade stranded copper conductor, PVC insulated, steel wire armoured cable. Cable size shall be selected on the basis of rated current and shall be suitably coordinated with corresponding protective device. Control cables shall be of 650/1100 V grade copper conductor of minimum 1.5 Sq.mm size, PVC insulated steel wire armoured wrapped PVC inner sheath, extruded PVC outer sheath. The CT circuits shall be minimum 2.5 mm2.

34.12. GROUND BUS: Copper ground bus rated to carry maximum fault current shall be furnished along entire length of UPS switched A.C. Distribution Boards Grounding terminals shall be provided at two points for connection to purchaser’s ground grid.

34.13. PAINTING: Steel fabrication work shall undergo surface pre-treatment such as degreasing, descaling, etc. Prior to application of two coats of epoxy based primer. Final two coats of epoxy based paint shall be applied with minimum paint thickness of 50 microns. The shade of final coat shall be as specified. Adequate quantity of touch up paint shall be furnished for application after installation.

34.14. PLANT MONITORING DESK:

[i] Computer aided data acquisition unit shall have features for simultaneous monitoring and recording of various parameters of different sub-systems, power supply of the Power Plant at the DC side and AC side.
PARTICULAR SPECIFICATIONS [Continued]

[ii] Computer Aided Data Acquisition Unit shall be a separate & Individual system comprising of different transducers to read the different variable parameters, A/D converter, Multiplexer, Demultiplexors, Interfacing Hardware & Software, Industrial Type PC, which will be robust & rugged suitable to operate in the Control Room environment.

[iii] Reliable sensors for solar Radiation, Temperature & other electrical Parameters are to be supplied with the data logger unit.

[iv] The PC Shall of Industrial type, rugged & robust in nature to operate in a hostile environment. The PC has latest configuration and adequate memory. The PC shall also have 21” LCD colour monitor, DVD Drive with writer, multimedia kit and UPS with 30 hours Power back up. The printer shall be of industrial type, rugged & robust in nature. The printer shall be equipped for printing, scanning, copying and fax.

[v] The data acquisition system shall perform but not limited to the following operations:

[a] Measurement and continuous recording of

[i] Ambient Air Temperature near Array Field
[ii] Module Back Surface Temperature
[iii] Wind Speed at the level of Array Plane
[iv] Solar Irradiation Incidental to Array Plane
[v] Inverter Output
[vi] System Frequency
[vii] DC Bus Output
[viii] Energy delivered to the GRID in kWh.

[b] All data shall be recorded chronologically date wise. The data file shall be MS Excel compatible. The data logger shall have internal reliable battery backup to record all sorts of data simultaneously round the clock. All data shall be stored in a common work sheet chronologically. Representation of monitored data shall be in graphics mode and/or in tabulation form. All instantaneous data can be shown in the Computer Screen.

[c] The Bill of Materials associated with the equipment must clearly indicate especially the detail about the PC, Modems, etc.

[d] The data acquisition system shall be housed in a desk made of sheet steel.

34.15. CABLES & INSTALLATION ACCESSORIES:

34.15.1. CODES AND STANDARDS: All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards [IS] / IEC as given below or any international standard acceptable to purchaser.

[a] IS – 1554 [Part – I] : PVC insulated [heavy duty] electric cables for working voltage up to and including 1100V

[b] IS – 1554 [Part – II] : PVC insulated [heavy duty] electric cables for working voltage from 3.3kv up to and including 22kV

[c] IS – 3961 : Recommended current ratings for cables.
PARTICULAR SPECIFICATIONS [Continued]

[d] IS – 8130 : Conductors for insulated electric cables and flexible cords
[e] IS – 5831 : PVC insulation and sheath of electric cables
[f] IS – 2982 : Copper conductor in insulated cables and cords.
[g] IS – 3975 : Mild steel wires, strips and tapes for armouring cables
[h] IS – 5609 : Specification for low frequency wires and cables with PVC insulation and PVC sheath
[k] IEC: 540 : The methods for insulations and sheath of electric cables and cords [elastomeric and thermoplastic compounds]
[l] IEC: 230 : Impulse tests on cables and their accessories
[m] IEC: 60 : High voltage test techniques
[n] IEC: 287 : Calculation of the continuous current rating of the cables [100% load factor].
[o] IEC: 288 : Nominal cross sectional area and composition of conductor of insulated cables.
[p] IEC: 502 : Extruded solid dielectric insulated power cables for rated voltages from 1kV upto 30kV.
[q] NEMA-WC-5 : Thermoplastic insulated wires and cables for transmission and distribution of electrical energy.
[r] IEEE: 383 : Standard for type test for class IE electric cables, filled splices and connection for nuclear power generation station.
[s] IEC: 332-1 : Test on electric cables under fire conditions.
[u] ASTM-D-2863 : Test for determination of oxygen index.
[v] IEC-754-I : Test method for acid gas generation
[w] IEC-331 : Fire resisting characteristics of electric cables
[x] : SVENSK Standard SS-4241475 Class F3

[i] BICC Hand Book For cables in fire regarding temperature index-chapter-6

[ii] Indian Electricity Rule.

34.15.2. Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted subject to approval of the Owner.

34.15.3. The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Codes of Practice. In addition, other rules and regulations applicable to the work shall be followed.

34.16. DESIGN CRITERIA:

[i] For L.V. Cable:
   [a] The cable shall be used for connection of power and control circuits of the auxiliary electrical systems.
   [b] The cable shall be suitable for installation in the required site conditions.
   [c] Cables shall be sized suitably with proper derating factors as per the installation conditions of the cable.
PARTICULAR SPECIFICATIONS [Continued]

[d] For continuous operation at specified rating as well as during short circuit condition the maximum conductor temperature shall be limited to the permissible value as per relevant standard.

[e] The insulation and sheath materials shall be resistant to oil, acid and alkali and shall be tough enough to withstand mechanical stresses during handling.

[f] Armouring, wherever provided, shall be single round/flat wire of galvanised steel for multi-core cables and aluminium for single core cable. Cables in buried formation shall be armoured. Cables laid in duct banks/conduits shall be unarmoured. This will be applicable for all LT cables [On AC side]. The outer sheath shall have flame retardant low smoke [FRLS] characteristics and shall meet the requirements of additional tests specified for this purpose.

[g] Core identification for multi-core cable shall be provided by colour coding. Power cables shall be chosen taking into account the following factors:

[h] System fault level.

[i] Maximum time for fault clearance [i.e. operating time of the backup protection relay plus the time of operation of the circuit breakers].

[j] Full load current of the circuit.

[k] Short circuit current and duration [for breaker protected cables]

[l] Installation conditions.

[m] Voltage drop under normal running and starting condition.

[n] Voltage drop at motor terminals shall be within permissible limit during starting & normal running.

[o] The cable shall withstand the maximum fault current corresponding to the particular voltage level for the minimum time before the fault is cleared.

[p] Consideration shall also be given to limit the cable to the nearest standard sizes instead of using too many types.

[q] The standard cable sizes, ampacities, derating factors, etc. Shall be as given in is or relevant standard.

[r] The minimum size of power cables to be used shall be as follow:

[i] Aluminium Conductor: 6 Sq.mm.

[ii] Copper Conductor: 2.5 Sq.mm.

For HV Cable: The cable shall be suitable for installation in the required site conditions.

[a] The HV cables [22kV] shall be unearthed grade as it is used in non-effectively earthed systems.

[b] Cables shall be sized suitably with proper de-rating factors as per the installation conditions of the cable.

[c] For continuous operation at specified rating as well as during short circuit condition the maximum conductor temperature shall be limited to the permissible value as per relevant standard.

[d] The insulation and sheath materials shall be resistant to oil, acid and alkali and shall be tough enough to withstand mechanical stresses during handling.

[e] Armouring, wherever provided, shall be single round wire of galvanised steel for multi-core cables and aluminium for single core cable. Cables in buried formation shall be armoured. Cables laid in duct banks/conduits shall be unarmoured.

[f] The outer sheath as well as the inner sheath shall have flame retardant low smoke [FRLS] characteristics and shall meet the requirements of additional tests specified for this purpose.

[g] Core identification for multi-core cable shall be provided by colour coding.

[h] Power cables shall be chosen taking into account the following factors:

[i] System Fault level.
PARTICULAR SPECIFICATIONS [Continued]

[ii] Maximum time for fault clearance [i.e. operating time of the backup protection relays plus the time of operation of the circuit breakers].

[iii] Full load current of the circuit.

[iv] Short circuit current and duration [for breaker protected cables]

[v] Installation conditions.

[vi] Voltage drop under normal running and starting condition.

[vii] Voltage drop at motor terminals shall be within permissible limit during starting & normal running.

[viii] Consideration shall also be given to limit the cable to the nearest standard sizes instead of using too many types.

[ix] The standard cable sizes, ampacities, derating factors, etc. shall be as given in IS 2165 [Part II] or relevant standard.

[x] The insulation level of the cable shall be as per the type of grounding [effectively/non-effectively earthed] of the system and the ground fault clearing time.

[xi] The Continuous current rating of the cable shall be calculated in accordance with IEC 60287 Part 1, 2 & 3.

34.17. SPECIFIC REQUIREMENTS:

[a] **Type of Cable:** Power cables shall be stranded aluminium conductor, cross linked polyethylene [XLPE] insulated, extruded black FRLS PVC inner sheathed, armoured and overall FRLS extruded black PVC sheathed cables conforming to IS – 7098. Control Cables shall be 1100 V grade with annealed high conductivity stranded copper conductor, PVC insulated, FRLS PVC inner sheathed, armoured and FRLS extruded black PVC outer sheathed cables conforming to IS : 1554.

[b] **Conductor:** The cable conductor shall be made from standard Aluminium for Power cables and Copper for control cables to form compact conductor having a resistance within the limits specified. All the cables of size 25mm² and above shall have sector shaped conductors.

[c] **Insulation:** The insulation of the LV power cable shall be XLPE type & for control the insulation shall be PVC type. It shall be designed and manufactured for the specified system voltage. The manufacturing process shall ensure that insulation shall be free from voids. The insulation shall withstand mechanical and thermal stresses under steady state and transient operating conditions. The extrusion method shall give a very smooth interface between semi conducting screen and insulation. The insulation of the cables shall be of high standard quality.

[d] **Insulation Shield:** A non magnetic semi conductive shield shall be put over the insulation to confine electrical field to the insulation. The XLPE cable insulation shield shall be strippable. The metallic layer of the insulation shield shall be grounded at least at one location in the cable’s run. In the case of single conductor cable, care shall be taken with regard to ampacity when grounding at more than one point. For all the cables having insulation shield, it shall have some form of stress relief measure at every splice at termination. This can be stress cones, moulded devices, heat shrink or cold shrink kits. All kits must be suitable for the voltage class and cable size.

[e] **Inner Sheath:** The sheath shall be suitable to withstand the site conditions and the desired temperature. It shall be of adequate thickness and applied by a continuous process to produce a sheath of consistent quality free from all defects. PVC sheath shall be extruded with FRLS properties.
PARTICULAR SPECIFICATIONS [Continued]

[f] Armour: Hard drawn aluminium wire armouring / galvanized steel tape/ wire armouring shall be used for single core and multi-core cable respectively. Cables shall be un-armoured wherever indicated. The hard drawn aluminium wire for armour shall be of H4 grade, as per IS – 8130 [having tensile strength above 150 N/mm²]. The diameter of the aluminium wire shall be as per the table for the dimensions of the galvanized steel wire armour given in the relevant standard.

[g] Serving / Outer Sheath: FRLS extruded black PVC serving as per IS – 1554 otherwise shall be applied over the armouring with suitable additives to prevent attach by rodent and termites. All serving must be given anti-termite treatment.

[h] PACKING:

[a] Cables shall be supplied in non-returnable drums. Drum lengths shall be such so that cable joints are totally avoided. The drums shall be of heavy construction. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drum shall be treated by immersing in copper-nitrate solution.

[b] The ends of each cable length shall be sealed before shipment. Heat shrinkable cable cap shall be used for this purpose.

[c] A label shall be securely attached to each end of the reel indicating the length, type, voltage grade, conductor size and number of cores of the cable. A tag containing the same information shall be attached to the leadings end of the cable inside. An arrow and necessary instructions shall be marked on the drum indicating the direction in which it shall be rolled. Drum numbers are to be indicated on the cable drums.

[i] Spare Core: Multi-core control cables shall have 20% spare core, minimum one spare. Separate cables for each type of following services / functions as applicable shall be used for each feeder. Same multi-core cable using different services shall not be acceptable.

[a] Power
[b] Control, interlock and indication.
[c] Metering and measuring.
[d] Alarm and annunciation.
[f] V.T. Cables.

134.18. CONSTRUCTIONAL REQUIREMENTS

[a] Cable shall have suitable filters laid up with the conductors to provide a substantially circular cross section before the sheath is applied. Fillers shall be suitable for the operating temperature of the cable and compatible with the insulating material. All materials shall be new, unused and of finest quality.

[b] Workmanship shall be neat, clean and of the highest grade.
PARTICULAR SPECIFICATIONS [Continued]

[c] LT Power cables shall be 1.1kV grade, heavy duty, stranded aluminium conductor, XLPE Insulated galvanized steel wire/strip armoured, flame retardant low smoke [FRLS] extruded PVC type outer sheathed.

[d] Control cables shall be 1.1kV grade, heavy duty, stranded copper conductor, PVC Type-A insulated, galvanized steel wire armoured, flame retardant low smoke [FRLS] extruded PVC of Type - ST1 outer sheathed.

34.19. SPECIAL PROPERTIES: All the above cables shall be conforming to the relevant Indian/IEC standard in general, with the following special properties:

[a] Oxygen Index of the outer sheath shall not be less than 29, when tested as per ASTM-D-2863.
[b] Temperature Index of the outer sheath shall not be less than 250°C, when tested as per ASTM-D-2863.
[c] Halogen acid contents in outer sheath shall not be more than 20%, when tested as per IEC-60754.
[d] The maximum smoke density in percent light absorption shall not exceed 60% in case of PVC compound and 20% in case of fire survival cables, when tested as per ASTM-D-2843.
[e] Oxygen Index of the outer sheath shall not be less than 29, when tested as per ASTM-D-2863.
[f] Temperature Index of the outer sheath shall not be less than 250°C, when tested as per ASTM-D-2863.
[g] Halogen acid contents in outer sheath shall not be more than 20%, when tested as per IEC-60754.
[h] The maximum smoke density in percent light absorption shall not exceed 60% in case of PVC compound and 20% in case of fire survival cables, when tested as per ASTM-D-2843.

34.20. JOINTS AND TERMINATIONS: Materials of construction for a joint/termination shall perfectly match with the dielectric chemical and physical characteristics of the associated cables. The material and design concepts shall incorporate a high degree of operating compatibility between the cable and joints. The protective outer covering [jacket] used on the joints/terminations shall have the same qualities as that of the cable outer sheath in terms of ambient/operating temperature withstand capability and resistance to Hazardous environments and corrosive elements. No joints shall be allowed unless the cable drawn length is exceeded.

34.21. CABLE IDENTIFICATION: Cable identification shall be provided by embossing the following on the outer sheath:

[a] Manufacturer's name or trade mark
[b] Voltage grade
[c] Year of manufacture
[d] Type of insulation.
[e] Type of outer sheath e.g. "FRLS" etc.
[f] ISI marks
[g] Nominal cross sectional area of the conductor & no of cores
[h] Sequential marking

34.22. INSTRUMENTATION CABLES

[a] Cable Design And Construction: 650/1100v Grade Single Pair Twisted Instrumentation Signal Cable

[b] Construction
PARTICULAR SPECIFICATIONS [Continued]

[a] Conductor: Each core shall be seven stranded annealed copper electrolyte grade conductor of cross section 1.5mm² generally complying to IS – 8130.

[b] Insulation: Each core shall be provided with extruded HR PVC insulation conforming to IS – 5831 Type ‘C’. Insulation thickness shall be >=1.1 mm and shall conform to relevant IS/other standard. Color of insulation shall be Red and black in a pair.

[c] Twist: Every 2 core shall be twisted to form a pair and number of twist shall be 10-12 per meter.

[d] Shielding: The individual pair shall be shielded. Shield shall be Aluminium backed by Mylar tape bonded together side down helically applied with either side 25% overlap and 100% coverage. Minimum shield thickness shall be 0.06mm Drain wire shall be 0.5 sq mm multi stranded bare tinned annealed copper conductor. The drain wire shall be in continuous contact with aluminium side of the shield.

[e] Inner sheath: Cables shall be provided with extruded HR PVC inner sheath as per IS 5831 type ST2. The color shall be black and minimum thickness shall be as per IS – 1554 parts.

[f] Armouring: Armouring applied over inner sheath shall be of galvanised steel wire 1.4 mm dia as per IS 1554 part I and IS 3975.

[g] Overall sheathing: The cable shall be sheathed with extruded FRLS PVC type ST2 as per IS 5831. The shielding and sheathing shall be so done that it fits firmly to the cable and are easily removable without damage to cores. Color of sheath be blue. Thickness of the sheath shall be as per IS 1554 Part-I.

[a] 650/1100 Volts Grade Multi Pair Twisted Instrumentation Signal Cables.

[A] General: Multi-pair twisted instrumentation cables shall be same as single pair shielded cable, except that the area of cross section of the conductor shall be 1.0 Sq.mm. Following additional features shall be applicable:

[i] Shielding: In addition to individual shielding of pair, overall shielding shall be provided. Overall shield shall be Aluminium backed mylar tape helically applied with metallic side down either side 25% overlap and 100% coverage. Shield thickness shall be 0.075mm. Drain wire shall be similar to individual pair drain wire and shall be in continuous contact with the Aluminium side of the overall shield.

[ii] Twist: Overall twist of all pair shall be as per manufacturer standard.

[iii] Pair-Identification: Pairs shall be identified by numbered melinex tape applied over individual pair shield at interval not more than 250 mm. Conductor insulation shall be black and white for each pair.

[b] 650/1100v Grade Two Core Control Cable

[A] Construction

[i] Conductor: Each core shall be seven stranded annealed tinned copper conductor of cross section 1.5mm² generally complying to IS 8130.
PARTICULAR SPECIFICATIONS [Continued]

[ii] Insulation: Each core shall be provided with extruded HR PVC insulation conforming to IS 5831 Type ‘C’. Insulation thickness shall be as per IS – 1554 [I] Color of core insulation shall be red and black.

[iii] Inner sheath: Cables shall be provided with extruded HR PVC inner sheath as per IS 5831 type ST2. The color shall be black. Thickness of sheath shall be as per IS – 1554 [I].

[iv] Armouring: Armouring applied over inner sheath shall be of galvanised steel wire 1.4 mm dia. as per IS 1554 part I and IS 3975.

[v] Overall sheathing: The cable shall be sheathed with extruded FRLS PVC type ST2 as per IS 5831. The shielding and sheathing shall be so done that it fits firmly to the cable and are easily removable without damage to core. Colour of sheath shall be black. Thickness of the sheath shall be as per IS 1554 part-I.

[c] 650/1100v Multi core Control Cables

[A] General: Multi core untwisted instrumentation cables shall be same as two cores unshielded untwisted cable.

34.23. TESTS:

[a] Type Test: Cables shall be type tested quality. For each type and rating of cables reports on all type tests as per relevant standards, and carried out with in last five years from the date of bid opening shall be submitted. These reports shall be for the tests conducted on the similar type of cables proposed to be supplied under this contract. These tests shall have been conducted at an independent laboratory. If type test certificate are not available the same shall be conducted in the presence of the purchaser.

[b] Shop Tests: The Cables shall be tested in accordance with relevant IS/IEC standards at manufacturers’ works in the presence of consultant /purchaser or his representative as given below:

[c] Routine tests on each drum of cables.

[d] Acceptance tests on drums chosen at random for acceptance of the lot shall be conducted in the presence of Consultant / purchaser or his representative.

[e] Additional Tests: Following additional acceptance tests shall also be performed on each type of cables having outer sheath with improved fire performance [Category C1, Type FR/ Category C2, Type FRLS]:

[f] Oxygen index test [for both C1 & C2] - The oxygen index test shall be carried out as per ASTM D2863. The Oxygen index shall not be less than 29. All the additional tests shall be conducted in the presence of the purchaser.

[g] Temperature Index Test [for both C1 & C2] - The measured value of temperature index shall be 21 at a temperature of 250°C.
PARTICULAR SPECIFICATIONS [Continued]

[h] Flame retardance test on single cable and on bunched cables [for both C1 & C2] - After the test, there shall be no visible damages on the test specimen within 300mm from its upper end. After burning has ceased, the cables shall be wiped clean and the charred or affected portion shall not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly.

[i] Halogen acid gas evolution test [for category C2] - This test shall be as per IEC-754-1. The level of HCL evolved shall not exceed 20 per cent by weight.

[j] Smoke density test [for category C2] - Smoke generation by outer sheath under fire as per ASTM D 2843. The cables shall meet the requirements of light transmission of minimum 40% after the test.

[k] Test for rodent & termite repulsion property.

34.24. CABLE INSTALLATIONS: HV power cables shall be XLPE Insulated Power Cables of 22kV voltage grade. They shall be manufactured in accordance with IEC60502, having compacted, stranded copper conductor, thermosetting material semi-conductive conductor screen, XLPE insulated, hand strippable thermosetting material semi-conductive insulation screen, copper wire screen, PVC sheath, aluminium wire armour and PVC black outer sheath. LV power cables shall be XLPE or PVC insulated cables manufactured in accordance with IEC60502 having stranded, aluminium conductors, XLPE or PVC insulation, 0.6/1kV voltage grade, separation tapes and black PVC sheath, with galvanised steel or aluminium wire armour and black PVC outer sheath. All cables shall be installed either on cable trays or racking in ducts, fixed to steelwork or laid in concrete trenches. 22kV cables from solar PV plant to 22kV Receiving Station shall be laid on overhead trays. Cables inside control building shall be laid on trays in underground trenches. Where cabling passes through floors, the cables shall be protected up to a height of 1.5 m from the floor level. The routes of cables shall be arranged to have an adequate clearance from other services. Cables shall generally be routed to avoid hot or fire risk areas, and to minimize the risk of damage from any source. Control cables shall be separated from power cables. The cables shall be brought to motors and other devices using a conduit or a branch of cable tray for mechanical protection. The take-offs shall be located and supported so that the equipment is well accessible for maintenance work, and walkways will not be blocked. The cross-section of power cable conductors shall be selected according to:

[a] Current-carrying capacity at actual mounting location and ambient temperature [correction factors accounted], when selecting the size of the wire for sub-circuits it must be considered as if the sub-circuits are fully loaded [6 Amps.]. Minimum cable size per lighting sub-circuit shall not be less than 3/20 [1.5 Sq.mm min] copper wires. Minimum cable size for 15 Amps Power socket receptacle connection shall not be less than 7/22 [2.5 Sq.mm minimum].

[b] Voltage drop of motor supply cables maximum 10% at starting and 3% when running. Voltage drop from MDBs to the farthest load point must not exceed 3 [three] Volts.

[c] Co-ordination with the fuse rating. The power cables shall be mounted on cable trays in one layer stretched parallel. The cable shall be fixed to the tray at both ends, vertical parts, on both sides of elbows and wherever needed in order to have a neat execution. Metallic fixing devices or weatherproofed bundle ties shall be used for fixing. The control cables may be tied in bundles to save space on the cable trays. The control cables may be installed on the other edge of the power cable tray if there is no special tray for control cables. Instrumentation cables shall always be installed in different trays than the power cables. Crimp connectors shall be used for connections of control cables with flexible conductors. When the cables are brought into connection boxes, the sealing shall be done according to the protection degree
PARTICULAR SPECIFICATIONS [Continued]

of the original equipment. Cables coming from upper direction shall be sealed with a shrink plastic sleeve so that water cannot flow into the box along the cable sheath. All apparatus connections and cable installations shall be designed and installed to minimize the risk of fire and any damage which may be caused in the event of fire. Enclosed vertical runs of cables shall be provided with fire stops to limit the spread of fire, and shall be sealed to prevent "chimney effects". Wherever cables pass through floors, walls or other partitions, a suitable method of sealing shall be used. This sealing shall consist of one-hour fire resisting materials, the whole being arranged to prevent the spread of fire, smoke and fumes through each partition. Cableways containing a large number of cables shall be enclosed in one-hour fireproof material. Every cable shall be securely supported near its termination point, and in places where vertical runs pass through the floors, immediately above the floor. Cables on vertical trays shall be fixed about every half a meter and on horizontal trays about every two meters and in all corner points. Where cables are exposed to mechanical damage, sheet steel guards shall be provided to protect them. Earth connections formed from wire braid screening shall be sleeved with green/yellow insulation. Cable type earth connections shall use green/yellow coloured insulated cable. Phase identification shall be marked on cable terminals, single-core cables and at all connecting points.

34.25. CABLE TRAYS:

[a] All metal cable trays, ladders and racks, etc. shall be galvanized or otherwise protected.

[b] All ladder and trays shall be securely fastened to supporting steelwork and shall be adequately supported to prevent sagging.

[c] The cable trays as well as supports, joints, elbows and crossings shall be made of prefabricated standard parts. The type and supporting method of the cable trays shall be selected so that the maximum mid-span deflection is less than 1/300 of the span between supports, and permitted loads for the assembly will not be exceeded. The cable trays shall preferably be supported by brackets from one side only.

[d] All external cable trays shall be equipped with covers.

[e] Hanging wires or chains, or a single-rod suspend at the middle of the tray is not considered to be rigid enough.

[f] Cable trays shall be pre-fabricated ladder type, perforated type cable trays sheet steel with hot dip galvanizing furnished in standard length of 2.5 metres. In areas, where acid/alkali ingration is likely to occur, glass reinforced plastic trays with fire retardant corrosion resistance properties shall be used.

[g] Cable trays shall be of standard widths.

[h] Cable trays shall be complete with all necessary hot dip galvanized sheet steel accessories such as coupler plates, ground continuity connections, nuts, bolts, washers, hangers, clamps etc. Also horizontal/vertical bends, horizontal / vertical Tee, Reducers, Horizontal crosspieces, protective covers shall be supplied along with straight runs in order to take care of cable tray alignments in different routes.

[i] All fittings like horizontal/vertical elbow, horizontal crosspiece, reducer, horizontal tee etc. shall be prefabricated.
PARTICULAR SPECIFICATIONS [Continued]

[j] Cable trays, fittings & accessories as well as elbows, reducers, tees, crosses etc. shall be fabricated out of 14 gauge [2 mm thick] hot rolled mild steel sheets.

[k] Contractor shall supply 14 gauge [2 mm thick] perforated type hot rolled mild steel sheet covers for vertical cable shafts up to a height of 2.5 metres from floor level. The perforated covers used for the vertical raceways may be of one or more pieces along the width of the raceway, depending on the width of the raceway and shall be bolted to the structural framework of the raceway.

[l] The cable trays, fittings and accessories including all bolts, nuts, screws, washers etc. shall be hot dip galvanized after fabrication as per IS – 2629. Galvanizing shall be uniform, clear, smooth and free from acid spots. Shall the galvanizing of the samples be found defective, the entire batch of steel will have to be regularized at Contractor's cost.

[m] The amount of zinc deposited shall not be less than 610 grams per square metre of surface area and in addition the thickness of the zinc deposit at any spots whatsoever, shall not be less than 86 microns. The Owner reserves the right to measure the thickness of zinc deposit by Elcometer or any other instrument and reject any component, which shows thickness of zinc at any location to be less than 86 microns.

[n] Each 2.5 meter long section of all types of cable trays & each fittings like elbow, tees, crosses etc. shall be provided with 2 [two] nos. hot dip galvanized side coupler plates & associated bolts, nuts and washers on each side.

[o] The Contractor shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and that such tests are adequate to demonstrate that the equipment will comply with the requirement of this specification.

[p] The tolerance on dimensions shall be in accordance with appropriate Indian Standards. The extent of the tests to be performed by the contractor in presence of owner shall include but not be limited to the following:

34.26. **DEFLECTION TEST:** A 2.5 meter straight section of each type of cable trays shall be simply supported at the two ends. A uniformly distributed load of 100 Kg per meter will be applied along the length of the tray. The maximum deflection at mid span shall not exceed 7 mm. All the tests shall be carried out as per relevant Indian standards.

35. **TESTING AND COMMISSIONING OF SOLAR POWER PLANT INCLUDING MUTUALLY AGREED DAMAGES:**

35.1. **PERFORMANCE GUARANTEE TEST:** The test to prove the Performance Guarantee shall be conducted at site by the contractor in presence of department’s representative. This test shall be binding on both the parties of the Contract to determine compliance of the equipment with functional guarantee. Any special equipment, instrumentation tools and tackles required for successful completion of the Performance Guarantee Test shall be provided by the Contractor without any extra cost to the Govt. The accuracy class of the instrumentation shall be as per the relevant clause of the documents.
35.2. **PERFORMANCE RATIO TEST:**

35.2.1. This test checks if the power plant is performing at or above the performance ratio agreed or warranted within the contract. A standard testing period would be continuous testing for a minimum of five consecutive days. Typically, a minimum irradiance will be defined and the performance ratio measured for the period in which that irradiance is exceeded. The electrical energy generated shall be recorded at the metering point. Input from all energy meters will be added to get energy generation from Solar power plant. Energy meters shall have minimum accuracy class of 0.2. This value of energy generated will be taken for calculation of performance ratio [PR]. Global incident radiation value shall be considered for plane of array irradiation for calculation of PR.

35.2.2. The procedure for PG demonstration test shall be as follows:

   **Step - 1:** A calibrated Pyranometer shall be installed by the contractor at the location mutually agreed by the Contractor and Department. The test report for the calibration shall be submitted by the Contractor for approval of the Department. The output of this Pyranometer for test period of the PG test shall be made available at SCADA. Pyranometer shall be of secondary standard as per ISO 9060 classification. Required Software shall be supplied with Pyranometer to get required output.

   **Step - 2:** “Actual Energy” exported from the plant supplied by the Contractor shall be noted for time of the test [Minimum 5 days]. This will be taken as AC Yield in KWH in PR formula. Values calculated in Step – 1 & 2 shall be used to calculate PR. The PR, usually expressed as a percentage, is used to compare PV systems independent of size and solar resource. The PR is expressed as:

   \[
   PR = \frac{AC \text{ Yield [kWh]} \times 100}{\text{Installed Capacity [kWp] \times Plane of array Irradiation [kWh/m²]}}
   \]

35.2.3. For performance ratio calculations: Effect due to variation of meteorological parameters e.g. ambient temperature, wind speed, humidity etc. shall not be considered. Generation loss due to grid outage [or power evacuation system which is not in the scope of the contractor]: the measured global solar radiation of the period of the outage of the power evacuation system shall be excluded to calculate average global solar radiation for the period of the PG test.

35.3. **ACTUAL PERFORMANCE RATIO:** The Actual Performance Ratio [APR] shall be equal to or more than the Minimum Guaranteed Performance ratio of 75%. The Performance Ratio Test shall be conducted within 15 days of successful commissioning of the plant. plant having performance ratio below 75% shall not be accepted by GE. In such case, the contractor at its own cost shall “Make Good” the plant so as to be capable to meet the Minimum Guaranteed Performance ratio. This shall be verified by again carrying out the PR test, within a reasonable period of time. In case, the contractor fails to achieve the minimum 75% PR ratio even in the repeated PR test, then without prejudice to any other right or remedy available GE shall be entitled to forfeit the Security Deposit and Performance Guarantee and terminate the contract and the plant shall be taken over by GE and rectify the same at the risk and cost of contractor.

35.4. **GUARANTEED PERFORMANCE GUARANTEE [PR and CUF]:**

35.4.1. If the Contractor is not able to demonstrate Guaranteed Performance Ratio during the three months he will be given one or more chance to demonstrate the PG test. In that case the steps for PG test shall be repeated again as above.
35.4.2. Performance Ratio will be considered while taking over the plant from the contractor which shall be minimum of 75%.

35.4.3. During the O & M period, at the end of every year starting from first year Value of CUF [Co-efficient of Utilisation Factor] shall be demonstrated by contractor, which shall be not less than value as specified. The capacity factor of a PV power plant [usually expressed as a percentage] is the ratio of the actual output over a period of one year and its output if it had operated at nominal power the entire year, as described by the formula:

\[
C.U.F = \frac{(\text{Energy generated Per annum [kWh]} \times 100)}{(8760 \text{ [hours / annum]} \times \text{Installed capacity [kWp]})}
\]

35.5. AGREED DAMAGES:

35.5.1. ANNUAL CAPACITY UTILIZATION FACTOR [CUF] LESS THAN GUARANTEED CUF: For Annual CUF less than the guaranteed value as per the “Guaranteed Parameters” of this document, the contractor shall pay GE Mutually Agreed damages [MAD] equivalent to loss of units [kWh] @ Power Penalty Rate [i.e. prevalent Forbearance price declared by CERC for Solar REC or prevalent purchased electricity cost of GE per Kwh, whichever is higher].

\[
\text{Mutually Agreed Damages} = [\text{Power Penalty Rate in Rs.}] \times [(2000 \text{ kWp} \times 24 \times 365 \times \% \text{ CUF as guaranteed}) – \text{[kWh generated as inverter output for the year]}}
\]

The CUF performance shall be verified at the end of every year of O & M and recovery if any shall be affected immediately.

35.5.2. ANNUAL AUXILIARY POWER CONSUMPTION MORE THAN GUARANTEED: For Auxiliary power consumption more than the value as per ‘Guaranteed Parameters’ of this document, the contractor shall pay Mutually Agreed damages [MAD] equivalent to the additional consumption of units @ Power Penalty rate per Kwh. The auxiliary power consumption shall be verified at the end of each year of O & M.

35.6. HANDING OVER – TAKING OVER: The work shall be taken over by GE upon successful completion of all tasks to be performed at site[s] on equipment supplied, installed, erected & commissioned by the contractor in accordance with provision of Tender. During handing over complete project work, i.e. after final acceptance, the contractor shall submit the following for considering final payment.

35.6.1. All as- Built Drawings

35.6.2. Warranty/ Guarantee certificates, test certificates etc.

35.6.3. Inventory of spares at projects site immediately after taking over of complete project[s], the same will be handed over to the contractor for operation & maintenance period.

35.7. ERECTION, TESTING & COMMISSIONING: The installation shall be carried out by a contractor holding a valid license as required by the State Government Authorities. The contractor shall provide necessary documents required by statutory authorities and obtain the approval before taking up erection. It shall be the sole responsibility of the contractor in obtaining safety certificate / approval from local statutory authorities.
36. GENERAL TERMS AND CONDITIONS:

36.1. USE OF CONTRACT DOCUMENTS & INFORMATION:

36.1.1. The Contractor shall not disclose the Contract or any provision thereof or any specification, plan, drawing, pattern therewith to any person other than person employed by the Contractor in performance of the Contract. Disclosure to any such employed person shall be made in confidence and shall extend strictly for purpose of performance only.

36.1.2. The Contractor shall not, make use of any document or information except for purpose of performing the Contract. Contractor shall obtain commissioning certificate from local state electricity board if mandatory.

36.1.3. Any document other than the Contract itself shall remain the property of the GE.

36.1.4. Tenderer/Bidder shall submit the design layout of panel & module for approval of GE.

36.2. PATENT RIGHTS: The Contractor shall indemnify the GE against third party claims of infringement of patent, trademark or industrial design rights arising from use of goods or any part thereof in India.

36.3. MATERIALS AND WORKMANSHIP:

36.3.1. All materials shall be of the best quality and workmanship capable of satisfactory operation under the operating and climatic conditions as may be specified. Unless otherwise specified, they shall conform in all respect to the latest edition of the relevant Bureau of Indian Standard [BIS] specification wherever Indian specifications apply or British Standard [BS] or internationally accepted standard.

36.3.2. The Contractor shall supply & deliver all equipment and materials for installation at site. The Contractor shall arrange for transportation, loading & unloading and safe storage of materials at project site at his own cost & risk.

36.3.3. If the Contractor offers equipments manufactured in accordance with other international well recognized standards, he shall, in that case, supply a copy in English of the Standard Specification adopted and shall clearly mention in what respect such standard specification differs from Indian Standard Specifications. The Plant, equipment, and materials offered by the Contractor shall comply with one consistent set of Standards only as far as possible.

36.4. INTER-CHANGEABILITY: All the parts shall be made accurately to Standard gauges so as to facilitate replacement and repairs. All corresponding parts of similar apparatus shall be inter-changeable.

36.5. PACKING AND MARKING:

36.5.1. The Contractor shall be responsible for securely protecting and packing the plant & equipment as per prescribed standards in force to withstand the journey and ensuring safety of materials and also arrival of materials at destination in original condition and good for contemplated use. Packing case size & weight shall take into consideration the remoteness of the goods final destination and absence of heavy material handling facilities at all points in transit.

36.5.2. Packing lists of materials shall be provided in each package to facilitate checking up of the contents at the destination.
PARTICULAR SPECIFICATIONS [Continued]

36.5.3. In order to import any items, associated with the Solar PV Power Project, from abroad or from any other state in India, Contractor shall have to arrange any clearance, permission, if required at his own risk, from any Government [Government of State & Government of India] or any Government [Government of State & Government of India] controlled organization for transportation of materials from manufacturing shop to delivery at Site. Necessary certificates if so required shall be issued by the GE within reasonable time after getting written request from the Contractor alongwith the necessary documents substantiating necessity of such approvals. All packing material shall be the property of the GE and shall be immediately deposited by the Contractor to the Store Yard of GE.

37. MAINTENANCE:

[a] The contractor shall be fully conversant with the daily, weekly, monthly, quarterly, half yearly checks/ maintenance need on various equipments installed. Manufacturer’s specific maintenance schedule shall be ensured in addition to the normal maintenance schedule.

[b] The operating staff shall maintain the following neatly:


[ii] A register of record of periodical maintenance carried out data wise and will be signed by the contractor and Engineer-in-Charge.

[iii] Necessary daily log register and periodical register shall be provided by contractor without additional cost and rates quoted against items of BOQ shall be deemed to include for the same and the register will become the property of the Govt.

[c] The contractor shall ensure by preventive maintenance occurrence of any possible breakdown to keep the plants in serviceable condition at all time.

[d] The contractor will attend on the same day any defect due to fair wear and beyond the control of operator/department.

[e] The contractor shall ensure by preventive maintenance occurrence of any possible breakdown to keep the plants in serviceable condition at all time. The fault should be attended within 72 hours of reporting & if the major parts or components need to be replaced further time extension will be approved by the GE as per the requirement.

[f] Maintenance of the plant will start from date of completion.

[g] Necessary cable duct to be provided for cable in plant room as per requirement cost deem to be included in building work.

[h] Any minor item required for the successful operation of the plant is deemed to be included in the overall cost of project.

38. PENAL RECOVERY:

[a] In case of breakdown of plant, contractor will be given 24 Hours to make it operational, penalty of Rs. 35,000.00 per day or part thereof shall be charged for full duration of breakdown including initial 24 hours also.
PARTICULAR SPECIFICATIONS [Continued]

[b] In case of failure of contractor regarding fulfilling requirement of stores, the contractor shall bear the cost of penal recovery.

[a] Regarding penal recovery, the decision of Garrison Engineer shall be final and binding.

[b] Plant performance ratio must be more than or equal to 75%, and a penalty of Rs. 150.00 per hour will be charge for every 1% drop in performance ratio below 75%.

39. **CLARIFICATION ON DRAWINGS:** In case any conflict / clarification in between main working drawing & TD / Structural TD drawing, provisions shown main working drawings shall supersede.

40. The control room shall be equipped with all fire safety equipments including insulation tested rubber mats min 2mm thick, hand gloves, danger notice boards, line isolating earth rods [HT 33000 KV] etc. as per IE Rules & as directed by GE. Lump sum cost of the buildings shall be inclusive of the same & no extra shall be admissible on this account.

41. **NOTES APPLICABLE TO DRAWINGS:**

41.1. All the TD drawings including RCC general notes, even if not referred in any of the main architectural / structural drawing, shall be deemed to form part of tender documents. The tenderer are deemed to have referred and considered such relevant drawing/RCC Notes while quoting their rates / Lumpsum and no claim whatsoever shall be entertained on this account.

41.2. The drawing No. referred in any of the documents or drawing shall also form part of tender documents although not listed under list of drawings. The tenderer rates are deemed to be inclusive of provision as per respective drawing. Those drawings are available in the office of CE/CWE/GE for reference. No claim whatsoever shall be entertained on this account.

41.3. In case of any discrepancy in between main drawing and structural drawing, the main drawing shall be applicable for architectural details and structural details shall be applicable for structural details.

41.4. The revision date of drawing shall be deemed to be amended as per the respective revised drawings uploaded alongwith the corrigendum’s from time to time.

41.5. In case of discrepancy between schedule of finishes and other drawings forming part of the tender, the provisions in the sch of finishes shall take precedence over the provisions in the other drawings.

41.7. The lintels over openings shall be provided as per TD drawing as per size of opening in addition to through LB as per TD Drawings.

42. **TESTING:** The contractor shall produce manufacturer’s test certificate to GE in respect of routing test enumerated in relevant IS. After installation, plant shall be tested before commissioning by a representative of Accepting Officer. The contractor shall at his own expense provide all facilities for testing including equipments.
# PARTICULAR SPECIFICATIONS [Continued]

## ANNEXURE - I

<table>
<thead>
<tr>
<th>Component</th>
<th>Activity</th>
<th>Description</th>
<th>Interval</th>
<th>By</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Module</td>
<td>Cleaning</td>
<td>Clean any bird droppings/ dark spots on module</td>
<td>Immediately</td>
<td>User/Technician</td>
</tr>
<tr>
<td></td>
<td>Cleaning</td>
<td>Clean PV modules with plain water or mild dish washing detergent. Do not use brushes, any types of solvents, abrasives, or harsh detergents.</td>
<td>Fortnightly or as per the site conditions</td>
<td>User/Technician</td>
</tr>
<tr>
<td></td>
<td>Inspection [for plants &gt; 100 kWP]</td>
<td>Use infrared camera to inspect for hot spots, bypass diode failure</td>
<td>Annual</td>
<td>User/Technician</td>
</tr>
<tr>
<td>PV Array</td>
<td>Inspection</td>
<td>Check the PV modules &amp; rack for any damage Note down location and serial number of damaged modules</td>
<td>Annual</td>
<td>User/Technician</td>
</tr>
<tr>
<td></td>
<td>Inspection</td>
<td>Determine if any new objects, such as vegetation growth, are causing shading of the array and move them if possible.</td>
<td>Annual</td>
<td>User/Technician</td>
</tr>
<tr>
<td>Junction Boxes</td>
<td>Vermin Removal</td>
<td>Remove bird nests or vermin from array and rack area</td>
<td>Annual</td>
<td>User/Technician</td>
</tr>
<tr>
<td></td>
<td>Inspection</td>
<td>Inspect electrical boxes for corrosion or intrusion of water or insects. Seal boxes if required. Check position of switches and breakers. Check operation of all protection devices</td>
<td>Annual</td>
<td>Electrician</td>
</tr>
<tr>
<td>Wiring</td>
<td>Inspection</td>
<td>Inspect cabling for signs of cracks, defects, lose connections overheating, arcing, short or open circuits, and ground faults.</td>
<td>Annual</td>
<td>Electrician</td>
</tr>
<tr>
<td>Inverter</td>
<td>Inspection</td>
<td>Observe instantaneous operational indicators on the faceplate of the inverter to ensure that the amount of power being generated is typical of the conditions. Inspect Inverter housing or shelter for physical maintenance, if required.</td>
<td>Monthly</td>
<td>Electrician</td>
</tr>
<tr>
<td></td>
<td>Service</td>
<td>Clean or replace any air filters</td>
<td>As needed</td>
<td>Electrician</td>
</tr>
<tr>
<td>Instruments</td>
<td>Validation</td>
<td>Spot-check monitoring instruments [Pyranometer etc.] with standard instruments to ensure that they are operational and within specifications</td>
<td>Annual</td>
<td>PV Specialist</td>
</tr>
<tr>
<td>Transformer</td>
<td>Inspection</td>
<td>Inspect transformer oil level, temperature gauges, breather, silica gel, meter, connections etc.</td>
<td>Annual</td>
<td>Electrician</td>
</tr>
<tr>
<td>Plant</td>
<td>Monitoring</td>
<td>Daily Operation and Performance Monitoring</td>
<td>Daily</td>
<td>Site in-charge</td>
</tr>
<tr>
<td>Spare Parts</td>
<td>Management</td>
<td>Manage inventory of spare parts.</td>
<td>As needed</td>
<td>Site in-charge</td>
</tr>
<tr>
<td>Log Book</td>
<td>Documentation</td>
<td>Document all O &amp; M activities in a workbook available to all service personnel</td>
<td>Continuous</td>
<td>Site in-charge</td>
</tr>
</tbody>
</table>
PARTICULAR SPECIFICATIONS [Continued]

ANNEXURE – II

Quality Certification, Standards and Testing for Grid-connected Solar PV Systems/Power Plants

Quality certification and standards for grid-connected rooftop solar PV systems are essential for the successful mass-scale implementation of this technology. It is also imperative to put in place an efficient and rigorous monitoring mechanism, adherence to these standards. Hence, all components of grid-connected rooftop solar PV system/ plant must conform to the relevant standards and certifications given below:

A. Solar PV Modules/Panels:

IEC 61215/ IS 14286 : Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic [PV] Modules


IEC 62804 : Photovoltaic [PV] modules - Test methods for the detection of potential induced degradation. IEC TS 62804-1: Part 1: Crystalline silicon [mandatory for applications where the system voltage is > 600 VDC and advisory for installations where the system voltage is < 600 VDC]

B. Solar PV Inverters:


IEC/IS 61683 [as applicable] : Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency [10%, 25%, 50%, 75% & 90-100% Loading Conditions]

BS EN 50530 : Overall efficiency of grid-connected photovoltaic inverters: [as applicable] This European Standard provides a procedure for the measurement of the accuracy of the maximum power point tracking [MPPT] of inverters, which are used in grid-connected photovoltaic systems. In that case the inverter energizes a low voltage grid of stable AC voltage and constant frequency. Both the static and dynamic MPPT efficiency is considered.

IEC 62116/ UL 1741/ : Utility-interconnected Photovoltaic Inverters - Test Procedure of

IEEE 1547 [as applicable] : Islanding Prevention Measures
C. **Fuses:**


**IEC 60269-6 :** Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems

D. **Surge Arrestors:**

**IEC 62305-4 :** Lightening Protection Standard

**IEC 60364-5-53/IS 15086-5 [SPD] :** Electrical installations of buildings - Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control

**IEC 61643-11:2011 :** Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods

E. **Cables:**

**IEC 60227/IS 694, IEC 60502/IS 1554 :** General test and measuring method for PVC [Polyvinyl chloride] insulated cables [for working voltages up to and including 1100 V, and UV resistant for outdoor installation]

[Part 1 & 2] / IEC69947

**BS EN 50618 :** Electric cables for photovoltaic systems [BT[DE/NOT]258], mainly for DC Cables
PARTICULAR SPECIFICATIONS [Continued]

F. Earthing /Lightning:


G. Junction Boxes:

IEC 60529 : Junction boxes and solar panel terminal boxes shall be of the thermo- plastic type with IP 65 protection for outdoor use, and IP 54 protection for indoor use

H. Energy Meter:

IS 16444 or as specified : A.C. Static direct connected watt-hour Smart Meter Class 1 and 2 [with Import & Export/Net energy measurements] DISCOMs

I. Solar PV Roof Mounting Structure:

IS 2062/IS 4759 : Material for the structure mounting

J. Name of test lab for testing of PV modules during currency/after completion of work:

1. National Institute of Solar Energy [Formerly SEC]
2. Electronics Regional Test Laboratory [ERTL]
3. Electronics Test and Development Centre [ETDC]
4. Underwriters Laboratory [UL]
5. TUV Rheinland [TUV]
6. Ministry of New and Renewable Energy [Govt. of India]
7. The Energy & Resources Institute
## ANNEXURE - III

### MONTHLY O & M REPORT

<table>
<thead>
<tr>
<th>Component</th>
<th>Activity</th>
<th>Description</th>
<th>Date</th>
<th>Name/Signature</th>
<th>* Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Module</td>
<td>Cleaning</td>
<td>Immediately clean any bird droppings / dark spots on module.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cleaning</td>
<td>Clean PV modules with plain water or mild dishwashing detergent.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inspection [for plants &gt; 100 kWp]</td>
<td>Infrared camera inspection for hot spots; bypass diode failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV Array</td>
<td>Inspection</td>
<td>Check the PV modules and rack for any damage. If any new objects, such as vegetation growth etc., are causing shading of the array. Remove if any.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vermin Removal</td>
<td>Remove bird nests or vermin from array and rack area.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction Boxes</td>
<td>Inspection</td>
<td>Inspect electrical boxes for corrosion, intrusion of water or vermin.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiring</td>
<td>Inspection</td>
<td>Check position of switches and breakers. Check status of all protection devices. Inspect cabling for signs of cracks, defects, lose connections, corrosion, overheating, arcing, short or open circuits, and ground faults.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inverter</td>
<td>Inspection</td>
<td>Observe instantaneous operational indicators on the faceplate. Inspect Inverter housing or shelter for any physical Maintenance check for connection tightness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Service</td>
<td>Clean or replace any air filters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruments</td>
<td>Validation</td>
<td>Verify monitoring instruments [Pyranometer etc.] with standard instruments to verify their operation within tolerance limits.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformer</td>
<td>Inspection</td>
<td>Inspect transformer oil level, temperature gauges, breather, silica gel, meter, connections etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant</td>
<td>Monitoring</td>
<td>Daily Operation and Performance Monitoring.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spare Parts</td>
<td>Management</td>
<td>Manage inventory of spare parts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log Book</td>
<td>Documentation</td>
<td>Maintain daily records</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Provide details of any replacement of systems/components, damages, plant/inverter shut down [planned/forced], breakdown, etc under remarks.

*Daily register is to be maintained by the contractor. The same may be inspected by MES or its authorised representative at any time 5 years of O & M period. The Register will have the information about the daily generation, Inverter downtime if any, Grid outages.
### ANNEXURE – IV

**PROJECT COMPLETION REPORT FOR GRID – CONNECTED**

<table>
<thead>
<tr>
<th><strong>Particulars</strong></th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial year *</td>
<td></td>
</tr>
<tr>
<td>Approval No. *</td>
<td></td>
</tr>
<tr>
<td>Proposal Title</td>
<td></td>
</tr>
<tr>
<td>Installed by agency</td>
<td></td>
</tr>
<tr>
<td>Project initiated by</td>
<td></td>
</tr>
<tr>
<td>Title of the Project*</td>
<td></td>
</tr>
<tr>
<td>Capacity [kWp]*</td>
<td></td>
</tr>
<tr>
<td>Category of the organization / beneficiary*</td>
<td></td>
</tr>
<tr>
<td>Name of the contact person*</td>
<td></td>
</tr>
<tr>
<td>Address of contact person*</td>
<td></td>
</tr>
<tr>
<td>State*</td>
<td></td>
</tr>
<tr>
<td>District/City*</td>
<td></td>
</tr>
<tr>
<td>Mobile*</td>
<td></td>
</tr>
<tr>
<td>Email*</td>
<td></td>
</tr>
<tr>
<td>Telephone No.</td>
<td></td>
</tr>
<tr>
<td>STD Code</td>
<td></td>
</tr>
<tr>
<td>Website</td>
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</tr>
</tbody>
</table>

**Other Info**

<table>
<thead>
<tr>
<th><strong>Particulars</strong></th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Distribution Company Name</td>
<td></td>
</tr>
<tr>
<td>Electricity consumer account No. as per electricity bill</td>
<td>as on Date</td>
</tr>
</tbody>
</table>

**Bank Details of Beneficiary**

<table>
<thead>
<tr>
<th><strong>Particulars</strong></th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of A/c holder</td>
<td></td>
</tr>
<tr>
<td>Name of Bank</td>
<td></td>
</tr>
<tr>
<td>Name of Branch and Address</td>
<td></td>
</tr>
<tr>
<td>Bank IFSC Code</td>
<td></td>
</tr>
<tr>
<td>9 Digit MICR Code</td>
<td></td>
</tr>
<tr>
<td>Type of Account</td>
<td></td>
</tr>
<tr>
<td>Account No.</td>
<td></td>
</tr>
<tr>
<td>Adhar Card Number</td>
<td></td>
</tr>
</tbody>
</table>

**Technology Description & System Design /Specification [Compliance to BIS/IEC Standards is mandatory]**

1. **Module**
   - Capacity/Power of each PV Module [Wp]*
   - Cumulative Capacity of Modules [KWp]
   - Solar cell technology
   - Module efficiency [in Percentage]

2. **Inverters**
   - Type of inverter
   - Make of inverter
   - Capacity/Power of each PCU/inverters [VA]*
   - Inverter efficiency [Full load] [in percentage]
PARTICULAR SPECIFICATIONS [Continued]

3. **Metering Arrangement**

   Details of Metering
   - Type of Meter*: 
   - Make of Meter: 

4. **Other information**

   Units of electricity generated by the solar plant as per meter [in KWh]: 

   **Monitoring Mechanism:**
   - No. of personnel to be trained in O & M: 
   - Task & Expected Schedule [in Months]: 
   - Grid connectivity level: 
   - Grid connectivity level phase*: 
   - Grid connectivity level Voltage*: 

   **Costing of Project:**
   - Hardware cost: Rs. 
   - Total Cost of Installation: Rs. 

**Means of Finance:**

   - Envisaged Central Financial Assistance from MNRE*: Rs. 
   - Subsidy from states if any: Rs. 
   - Contribution of Beneficiaries*: Rs. 
   - Other Source [s] of Funding: Rs. 

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**ANNEXURE – V**

**DOCUMENTS TO BE SUBMITTED AFTER COMPLETION OF WORK**

1. After the work is completed, the contractor shall submit as built drawing, test reports, performance ratio, earth resistance test and any other test that engineer-in-charge may prescribe. The performance ratio test will be witnessed by engineer-in-charge with the help of third party inspector/consultant engaged by it.

2. The contractor shall submit warranties certificates in the name of Engineer-in-Charge after the completion of work.

3. Contractor shall submit the O & M plan, staff to be deployed for undertaking O & M, watch and ward of the system.
43. **LIST OF DRAWINGS**: The under mentioned drawings shall form part of the tender documents:

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Description of Drawing</th>
<th>Drawing No.</th>
<th>Sheet No</th>
<th>Date</th>
<th>Date of last Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Note:** In the event of discrepancies in the dates indicated in Column No. 5 & 6 above, the actual date prevailing on the drawing with latest amendments date shall take precedence.
### Approved Names for Products to be Incorporated in Works

The makes of products given hereinafter are expected to confirm IS specifications/bear ISI marking. In case, they do not confirm to IS, they automatically deemed to be deleted from this list. The Tenderer therefore, shall make market enquiry about the same and no claim whatsoever on this account shall be entertained. In such cases, the make shall be as approved by the Garrison Engineer. The makes if given in Schedule “A” shall take precedence over this list of makes.

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Materials</th>
<th>Make/Name Of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>PVC / UPVC Door, Window &amp; Chowkhat</td>
<td>Kumar Arch Tech Pvt. Ltd / Sintex India Ltd / Polywood / Rajashri Plastiwood Ltd. / Marino / Hindopan</td>
</tr>
<tr>
<td>3</td>
<td>Moulded Panel Doors</td>
<td>Jain / Goyal</td>
</tr>
<tr>
<td>4</td>
<td>Solid Panel Foam Doors [Solid / Glazed Panel]</td>
<td>Fenesta / Kesar / LG Hausys</td>
</tr>
<tr>
<td>5</td>
<td>FRP Door Shutters</td>
<td>Fibreways Technology / Krafto Door / Syntax India Ltd</td>
</tr>
<tr>
<td>6</td>
<td>Natural Fibre Thermo Composite Door / Window Shutter &amp; Frames</td>
<td>Durosam [AB Composite Pvt. Ltd.] / ELCONS</td>
</tr>
<tr>
<td>8</td>
<td>Automatic Door &amp; Glass Fittings</td>
<td>Toshi / Hardwin</td>
</tr>
<tr>
<td>9</td>
<td>Aluminium Door &amp; Window Fittings</td>
<td>Bharat / Classic / Alans / Argent / Hettich</td>
</tr>
<tr>
<td>10</td>
<td>Extruded Polished / Matt Finish Brass Builders Hardware</td>
<td>Harrison / Godrej</td>
</tr>
<tr>
<td>11</td>
<td>MS Stove Enameled Builders Hardware</td>
<td>Mowjee / Crown / Everlite / Harrison / Godrej</td>
</tr>
<tr>
<td>12</td>
<td>Floor Springs / Door Closers / Accessories</td>
<td>Hardwin / Godrej / Doorset</td>
</tr>
<tr>
<td>13</td>
<td>False Ceiling &amp; Partition Paneling</td>
<td>Kumar Arch Tech Pvt. Ltd / Rajashri Plastiwood Ltd. / Accura / Saint Gobain / Modiguard</td>
</tr>
<tr>
<td>14</td>
<td>PVC False Ceiling</td>
<td></td>
</tr>
<tr>
<td>Ser No.</td>
<td>Materials</td>
<td>Make/Name Of Firms</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>--------------------</td>
</tr>
<tr>
<td>14</td>
<td>Calcium Silicate Board / Calsidicor Tiles in False Ceiling / Wall Lining</td>
<td>Armstrong / India Gypsum / Lafarge / Gypstone / Saint Gobain / Everest</td>
</tr>
<tr>
<td>15</td>
<td>Mineral Fibre False Ceiling</td>
<td>Armstrong Gyroe [Saint Gobain] / Twiga Insulation / UP Twiga Fibre Glass Ltd. / Lloyd Insulation</td>
</tr>
<tr>
<td>16</td>
<td>Metal False Ceiling</td>
<td>Armstrong / Unifloors / Nittobo</td>
</tr>
<tr>
<td>17</td>
<td>Cement Fibre Board Ceiling</td>
<td>Everest / Lafarge / Armstrong</td>
</tr>
<tr>
<td>18</td>
<td>Anodised Aluminium Partition System with Solid / Glazed Panel</td>
<td>Jindal / Hindalco / Indalco</td>
</tr>
<tr>
<td>19</td>
<td>Frameless Glass Partition System / Wall Paneling</td>
<td>Saint Gobain Glass / IAG</td>
</tr>
<tr>
<td>20</td>
<td>PVC Partition and Wall Paneling</td>
<td>Kumar Arch Tech Pvt. Ltd / Rajashri Plastiwood Ltd.</td>
</tr>
<tr>
<td>21</td>
<td>PVC Kitchen [Cupboards, Cabinets &amp; Wardrobes]</td>
<td>Kumar Arch Tech Pvt. Ltd Rajashri Plastiwood Ltd. / Sintex India Ltd. / Commander</td>
</tr>
<tr>
<td>22</td>
<td>Rigid Foam PVC Sheets from 0.5mm to 40mm thickness</td>
<td>Kumar Arch Tech Pvt. Ltd / Rajashri Plastiwood Ltd. / Sintex / Marino</td>
</tr>
<tr>
<td>23</td>
<td>Prelaminated PVC Sheets from 0.5mm to 40mm thickness</td>
<td>Jain Irrigation Systems Ltd / Rajashri Plastiwood Ltd.</td>
</tr>
<tr>
<td>24</td>
<td>Prefabricated PVC Hut &amp; Bath Rooms</td>
<td>Kumar Arch Tech Pvt. Ltd / Prestar</td>
</tr>
<tr>
<td>25</td>
<td>Galvanised Colour / Powder Coated Steel Windows, Doors, Partition and Structural Glazing</td>
<td>NCL Alltek &amp; Seccolor Ltd.</td>
</tr>
<tr>
<td>26</td>
<td>Aluminium Composite Panel</td>
<td>Alstone International</td>
</tr>
<tr>
<td>27</td>
<td>Calcium Silicate Partition</td>
<td>Ramco Industries Ltd.</td>
</tr>
<tr>
<td>28</td>
<td>Polycarbonate Sheets</td>
<td>Prestar Infrastructure Pvt. Ltd. / GE / Fibreways Technology</td>
</tr>
<tr>
<td>29</td>
<td>CP Bath Fittings</td>
<td>Jaquar &amp; Company Pvt. Ltd. / Marc / Kohler / Cera / Parryware / Grohe / Crabtree / Blue Star &amp; Silver Shine</td>
</tr>
<tr>
<td>31</td>
<td>SS Wash Basins &amp; WCs</td>
<td>Diamond / Nirali</td>
</tr>
<tr>
<td>32</td>
<td>Designer Bath Suits</td>
<td>Jaquar &amp; Company Pvt. Ltd.</td>
</tr>
<tr>
<td>33</td>
<td>Stainless Steel Kitchen Sink</td>
<td>Prayag Polymer Pvt. Ltd. / Jain Brothers Sanitation Pvt. Ltd. / Cera / Blue Star &amp; Silver Shine / Kohler</td>
</tr>
<tr>
<td>34</td>
<td>PTMT Float Valves / Ball Cocks, Cockroach Traps, Glass Shelf, Bath Fittings</td>
<td>Prayag Polymer Pvt. Ltd. / Polytuff</td>
</tr>
<tr>
<td>35</td>
<td>SS Plate Rack</td>
<td>Suyog / Prayag</td>
</tr>
<tr>
<td>36</td>
<td>Kitchen Cabinets and Trolleys</td>
<td>Godrej Interio / Zuari / Kitchen Concepts / Dream Kitchens / Kitchen Crafts</td>
</tr>
<tr>
<td>Ser No.</td>
<td>Materials</td>
<td>Make/Name Of Firms</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>37</td>
<td>Concealed Cisterns</td>
<td>Kohler / Grohe / Hindware / Jaquar</td>
</tr>
<tr>
<td>38</td>
<td>Normal or Dual-Flow PVC Flushing Cistern</td>
<td>Hindware / Cera / Parryware / Commander</td>
</tr>
<tr>
<td>39</td>
<td>Glass Mirror</td>
<td>Prayag / Zircon / Cera / Saint Gobain / Modiguard /</td>
</tr>
<tr>
<td>40</td>
<td>PVC / Acrylic Toilet Mirror Cabinet</td>
<td>Parryware / Polytuff / Commander / Cera</td>
</tr>
<tr>
<td>41</td>
<td>Stainless Steel Towel Rail / Towel Rack / Towel Ring / Soap Dish / Toilet Paper Holder</td>
<td>Kohler / Grohe / Jaquar / Blue Star &amp; Silver Shine / Cera</td>
</tr>
<tr>
<td>42</td>
<td>Toilet Seat Cover</td>
<td>Commander / Parryware / Cera / Hindware / Jaquar</td>
</tr>
<tr>
<td>43</td>
<td>Shower Panels</td>
<td>Grohe / Kohler / Jaquar</td>
</tr>
<tr>
<td>44</td>
<td>Bath Suits</td>
<td>Kohler / Grohe / Jaquar</td>
</tr>
<tr>
<td>45</td>
<td>Glass WHB</td>
<td>Zircon / Sparkle Glass / Seabird</td>
</tr>
<tr>
<td>46</td>
<td>Glass Frameless Shower Enclosures / Cubicles</td>
<td>Cera / Hindware / Lauret / Jaquar</td>
</tr>
<tr>
<td>47</td>
<td>Glass Urinal Partitions</td>
<td>Kesar</td>
</tr>
<tr>
<td>51</td>
<td>Cement Based Paint</td>
<td>Snowcem Plus / Berger / Asian Paints [Gutucam] / Jotun India Pvt Ltd / Crimocem Super Cement Paints</td>
</tr>
<tr>
<td>53</td>
<td>French Polish</td>
<td>Berger / Jenson &amp; Nicholson Paints Ltd / Asian / Jotun India Pvt Ltd</td>
</tr>
<tr>
<td>54</td>
<td>Thermoplastic Road Marking Paint / Retro-Reflective Paint</td>
<td>Asian Apcomark / STP / Shalimar Paints Ltd. / Berger Paints Ltd. / Jenson &amp; Nicholson Paints Ltd / Jotun India Pvt Ltd</td>
</tr>
<tr>
<td>55</td>
<td>Water Based Road Marking Paint</td>
<td>Jotun India Pvt Ltd / Berger / Asian Apcotrax</td>
</tr>
<tr>
<td>56</td>
<td>Acid Resistant Paint</td>
<td>Asian / Berger / Jotun India Pvt Ltd</td>
</tr>
<tr>
<td>57</td>
<td>Epoxy Paint / Polyurethane Paint</td>
<td>Fosroc / Pidilite / Asian / Berger / Johnson &amp; Nicholson / Jotun India Pvt Ltd</td>
</tr>
<tr>
<td>58</td>
<td>Black Bituminous Paint</td>
<td>Asian / Berger</td>
</tr>
<tr>
<td>59</td>
<td>White Cement / Wall Putty</td>
<td>Birla Laval Plast / Berger / J &amp; N / Shalimar Paints / Asian Paints</td>
</tr>
</tbody>
</table>
## PARTICULAR SPECIFICATIONS [Continued]

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Materials</th>
<th>Make/Name Of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td>Veneered Plain Particle Board / Prelaminated Particle Board</td>
<td>Greenply Industries [Ply &amp; Board Division] / Kitply / Anchor / Bhutan Board / Novapan / Associate Décor</td>
</tr>
<tr>
<td>62</td>
<td>Fire Insulation Board</td>
<td>Everest</td>
</tr>
<tr>
<td>63</td>
<td>Gypsum Board</td>
<td>Lafarge / Gypsum India Ltd</td>
</tr>
<tr>
<td>64</td>
<td>Cement Bonded Particle Board [Plain / Prelaminated]</td>
<td>NCLS Bison</td>
</tr>
<tr>
<td>65</td>
<td>MDF / HDF Boards</td>
<td>Greenply Industries Ltd [Engineered Panel Division] / Balaji Action Buildwell / Novapan / National / Kitply</td>
</tr>
</tbody>
</table>

### Tiles

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Materials</th>
<th>Make/Name Of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
<td>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</td>
<td>Kajaria Ceramics Ltd / Asian Granito India Ltd / Somany Ceramics Limited / Varmora Granito Pvt Ltd / H &amp; R Johnson India Ltd / Nitco / Orient Bell Ltd</td>
</tr>
<tr>
<td>67</td>
<td>Precast Concrete Interlocking Paving Blocks</td>
<td>Anjali Tiles / Ultra Tiles Pvt Ltd / Terra Firma / Ecco Scope / Mehtab Tiles</td>
</tr>
<tr>
<td>68</td>
<td>Precast Plain / Chequered Cement Tiles for Flooring</td>
<td>Ultra / Bansal / Nitco / Anjali / Multiwyn</td>
</tr>
<tr>
<td>69</td>
<td>Precast Terrazzo Tiles for Flooring</td>
<td>Johnson / Ultra Tiles Pvt Ltd / Nitco</td>
</tr>
<tr>
<td>70</td>
<td>Wooden Laminated Floor Tiles / Parquet Tiles</td>
<td>Vista / Pergo / Haro</td>
</tr>
<tr>
<td>71</td>
<td>Glazed Mosaic Tiles</td>
<td>Hindustan Tiles / Johnson / Ultra Tiles Pvt Ltd / National Tiles &amp; Industries / Coral / Ceco</td>
</tr>
<tr>
<td>73</td>
<td>Glazed Porcelain Elevation Wall Tiles</td>
<td>Century Porselato / Porselato / Porcelain / Crystal Porcelain</td>
</tr>
<tr>
<td>74</td>
<td>Acid Resistant Vitrified Tiles</td>
<td>Johnson [Endura] / Somany [Durastone]</td>
</tr>
<tr>
<td>75</td>
<td>Metallic Floor Hardener for Wear Proof Topping</td>
<td>Ironite / Stillonite / Hardonate</td>
</tr>
<tr>
<td>76</td>
<td>Non-Metallic Floor Hardener for Wear Proof Topping</td>
<td>Fosroc / Fibrex / Sika / BASF</td>
</tr>
<tr>
<td>77</td>
<td>Epoxy Resin / Polyurethane Based Floor Coating</td>
<td>Sika / Fosroc / BASF / Pidilite Industries</td>
</tr>
<tr>
<td>78</td>
<td>Tile Adhesive</td>
<td>Pidilite Industries Ltd / Somany Ceramics Limited / Kajaria / Latecrete</td>
</tr>
</tbody>
</table>

### A Non-Toxic Bird Deterrent Gel

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Materials</th>
<th>Make/Name Of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>79</td>
<td>Pestgo Brand A Non-Toxic Bird Deterrent Gel Against Bird Menace</td>
<td>Hughes &amp; Hughes Chem Ltd</td>
</tr>
</tbody>
</table>

### Fencing

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Materials</th>
<th>Make/Name Of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>Punched Tape Concertina Coil and Flat Wrap Weld Mesh for Fencing</td>
<td>Global Technocrats Pvt Ltd</td>
</tr>
</tbody>
</table>
## PARTICULAR SPECIFICATIONS [Continued]

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Materials</th>
<th>Make/Name Of Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>81</td>
<td>Pressed Steel Frames for Doors / Windows / Ventilators</td>
<td>BA Enterprises / Multiwyn Industrial Corporation / Doorwyn Industries / Modern Fabricator / Madhu Industries / Ajanta Ispat / Alusys</td>
</tr>
<tr>
<td>82</td>
<td>Anodised / Powder Coated Aluminium Frames</td>
<td>Jindal / Hindalco / Ajit India / Indal</td>
</tr>
<tr>
<td>83</td>
<td>Aluminium Doors / Windows [Solid / Glazed Panel]</td>
<td>Jindal / Hindalco / Balco / Modern Fabricator / Alumilite Pvt Ltd. / Ajit India Pvt Ltd</td>
</tr>
<tr>
<td>84</td>
<td>Frameless Glass Door</td>
<td>Kesar / Super Aluminium / Haresh Aluminium</td>
</tr>
<tr>
<td>85</td>
<td>Metal Rolling Shutters and Rolling Grills / Collapsible Gates</td>
<td>BA Enterprises / Multiwyn Industrial Corporation / Doorwyn Industries / Modern Fabricator</td>
</tr>
<tr>
<td>86</td>
<td>Plain Sheet Glass / Float Glass / Frosted Glass</td>
<td>Saint Gobain Glass / Modiguard Float Glass / Asahi India / Hindustan Pilkinson Glass / Triveni Float Glass / IAG</td>
</tr>
<tr>
<td>87</td>
<td>Toughened Glass / Laminated Glass</td>
<td>Safex / Saint Gobain Glass / Modiguard Float Glass / Kesar / Asahi India / Atul Tuf / Hindustan Pilkinson Glass / Triveni Float Glass</td>
</tr>
<tr>
<td>88</td>
<td>Solar Control &amp; Thermal Insulation Glass</td>
<td>SGG EVO / Evolite / Envision</td>
</tr>
<tr>
<td>89</td>
<td>Wired Glass</td>
<td>Saint Gobain Glass / Modiguard Float Glass / Triveni / Safex / Atul Tuf / Hindustan Pilkinson Glass / Kesar</td>
</tr>
<tr>
<td>90</td>
<td>Black Painted Glass Tiles</td>
<td>Kesar / Marvel / Dreamwalls Color Glass / Paladio / Italia / Mridul / Mehtab Tiles</td>
</tr>
<tr>
<td>91</td>
<td>Tinted / Coloured Glass</td>
<td>Saint Gobain / Modiguard</td>
</tr>
<tr>
<td>92</td>
<td>Glass Top Shelves</td>
<td>Kesar / Ozone / Sparkle Glass</td>
</tr>
<tr>
<td></td>
<td><strong>Road Furniture</strong></td>
<td></td>
</tr>
<tr>
<td>93</td>
<td>Cat Eyes / Studs [Metal / Plastic] / Rumble Strips / Speed Breakers</td>
<td>3M / Dark Eye</td>
</tr>
<tr>
<td>94</td>
<td>Delineators / Road Barriers</td>
<td>3M / Dark Eye</td>
</tr>
<tr>
<td>95</td>
<td>Road Signage</td>
<td>3M / Dark Eye</td>
</tr>
<tr>
<td></td>
<td><strong>HDPE / LDPE Water Tanks</strong></td>
<td></td>
</tr>
<tr>
<td>96</td>
<td>HDPE / LDPE Water Tanks / Loft Tanks</td>
<td>Sintex / Polycon / Oriplast / Jindal</td>
</tr>
<tr>
<td></td>
<td><strong>Sewage Disposal</strong></td>
<td></td>
</tr>
<tr>
<td>97</td>
<td>UPVC / PPR / HDPE Pipe for Sewage</td>
<td>Jain Irrigation / Kisan / Prince / Supreme / Oriplast / Finolex / Diplast</td>
</tr>
<tr>
<td>98</td>
<td>RCC Pipes [NP2]</td>
<td>Any ISI Marked Makes</td>
</tr>
<tr>
<td></td>
<td><strong>Miscellaneous Items</strong></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>PVC Soil / Waste / Rain Water [SWR] Pipes and Fittings</td>
<td>Jain Irrigation / Kisan / Supreme / Prince / Anant / Oriplast</td>
</tr>
<tr>
<td>101</td>
<td>CPVC / UPVC Pipes and Fittings [Water &amp; Sewage]</td>
<td>Astral / Ashirwad Flowguard / Kisan / Reliance / Supreme / Prince</td>
</tr>
<tr>
<td>Ser No.</td>
<td>Materials</td>
<td>Make/Name Of Firms</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>103</td>
<td>Brass Ball [Float] Valve</td>
<td>Leader / Kirloskar / Zoloto</td>
</tr>
<tr>
<td>104</td>
<td>CI Manhole Covers</td>
<td>AIC / PIC</td>
</tr>
<tr>
<td>105</td>
<td>PGI Sheet</td>
<td>Tata / Jindal / SAIL</td>
</tr>
<tr>
<td>106</td>
<td>Galvalume / Zincalume Sheet for Roof and Wall</td>
<td>Saxena Marine Tech Pvt. Ltd.</td>
</tr>
<tr>
<td></td>
<td><strong>LT Wires &amp; Cables</strong></td>
<td></td>
</tr>
<tr>
<td>107</td>
<td>PVC Insulated Cable up to 1100 Volts Copper / Aluminium Conductor, Sheathed / Unsheathed as per IS – 694</td>
<td>Havells / Finolex / Nicco / KEI / Polycab / RR Kabel Ltd</td>
</tr>
<tr>
<td>108</td>
<td>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 &amp; IS – 7098, Part – I.</td>
<td>Havells / Gloster Cables / KEI Industries Ltd / Polycab / Asian Cables / Finolex</td>
</tr>
<tr>
<td>109</td>
<td>HT XLPE Cables</td>
<td>Havells / Gloster Cables / KEI Industries Ltd / Asian [RPG] / CCI / Polycab / Finolex</td>
</tr>
<tr>
<td>110</td>
<td>Other Category of Cables / ABC Cable</td>
<td>Ravin Cables Ltd</td>
</tr>
<tr>
<td></td>
<td><strong>CI, DI &amp; GI Pipes</strong></td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>CI Pipes</td>
<td>Electrosteel / Kesoram / Tisco</td>
</tr>
<tr>
<td>112</td>
<td>DI Pipe, ISI Marked of bore 80 to 1000mm [Except DN 125 &amp; 750mm] of Class K7, K8, &amp; K9 Conforming to IS – 8329</td>
<td>Jindal Saw Ltd / Electrosteel Casting Ltd. / Tata Metaliks / Tata Kabuto</td>
</tr>
<tr>
<td>113</td>
<td>ERW MS Pipes / GI Pipes / Fittings</td>
<td>Surya Roshni Ltd / Tata / Jindal steel / Prakash</td>
</tr>
<tr>
<td>114</td>
<td>PVC Pipes &amp; Fittings</td>
<td>Ori-Plast / Supreme / Prince / Finolex / Kisan Mouldings Ltd.</td>
</tr>
<tr>
<td>115</td>
<td>UPVC / CPVC / RWP Pipes</td>
<td>Ori-Plast / Supreme / Prince / Finolex</td>
</tr>
<tr>
<td>116</td>
<td>UPVC Casing for Bore Wells</td>
<td>Kisan Mouldings Limited</td>
</tr>
<tr>
<td>117</td>
<td>UPVC / PPR / HDPE Pipes and Fittings</td>
<td>Kisan Mouldings Limited</td>
</tr>
<tr>
<td>118</td>
<td>PVC SWR Pipes</td>
<td>Kisan Mouldings Limited / Supreme / Prince</td>
</tr>
<tr>
<td>119</td>
<td>PPR Pipes &amp; Fittings</td>
<td>Savoir-Fair Manufacturing Co. Pvt Ltd / Reliance / Vectus / Finolex / Supreme</td>
</tr>
<tr>
<td></td>
<td><strong>Other Cat of Pipes</strong></td>
<td></td>
</tr>
<tr>
<td>Ser No.</td>
<td>Materials</td>
<td>Make/Name Of Firms</td>
</tr>
<tr>
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</tr>
<tr>
<td>121</td>
<td>Conduit Steel ERW</td>
<td>Tata / Jindal / Kalinga / BEC</td>
</tr>
<tr>
<td>122</td>
<td>Conduit PVC</td>
<td>Presto Plast / Finolex / Indo American Electricals Ltd / Kalinga Gold / Richa Cables Pvt. Ltd.</td>
</tr>
<tr>
<td>123</td>
<td>PVC Casing Caping</td>
<td>Presto Plast / Finolex / Kalinga / Payal</td>
</tr>
<tr>
<td><strong>Light Fittings / Lamps</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>124</td>
<td>Frame Proof Light Fittings / Lamps</td>
<td>Bajaj / Crompton Greaves / Sudhir</td>
</tr>
<tr>
<td>125</td>
<td>Fluorescent Tube Light / CFL Fittings</td>
<td>Philips / Crompton Greaves / Havells / Surya Roshni Ltd / Bajaj / Wipro / C &amp; S Electric Ltd</td>
</tr>
<tr>
<td>126</td>
<td>FTL / CFL / PLS / HPSV / HPMV / Metal Halide Fittings / Lamps [Outdoor Lighting]</td>
<td>Philips / Crompton Greaves / Havells / Surya Roshni Ltd / Bajaj / Wipro / C &amp; S Electric Ltd</td>
</tr>
<tr>
<td>127</td>
<td>LED Light Fittings External / Internal</td>
<td>Philips / Havells / Surya Roshni Ltd / Wipro / GE / Bajaj</td>
</tr>
<tr>
<td>128</td>
<td>Switch Fuse / Changeover Switch</td>
<td>L &amp; T / Legrand / ABB / Siemens / GE / C &amp; S / Schneider / Havells</td>
</tr>
<tr>
<td>129</td>
<td>MCBs / RCCB / RCBO &amp; DB for MCBs</td>
<td>Legrand / L &amp; T [Hager] / Siemens / ABB / Schneider / GE / C &amp; S</td>
</tr>
<tr>
<td>130</td>
<td>MCCB / ACB</td>
<td>Legrand / L &amp; T / Siemens / ABB / C &amp; S / Schneider / GE</td>
</tr>
<tr>
<td>131</td>
<td>Switches / Switch Socket / Bell Push / Ceiling Rose / Regulator Piano Type / Buzzer</td>
<td>Havells / Anchor / Legrand / Schneider</td>
</tr>
<tr>
<td>132</td>
<td>Modular Type Switches / Sockets / Regulator</td>
<td>Havells [Crabtree] / Anchor [Woods] / Legrand / RR Kabel Ltd. / MK Honey Wall / Schneider / C &amp; S Electric</td>
</tr>
<tr>
<td><strong>Substation / Transformer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>133</td>
<td>Power Transformers 33 / 11 KV</td>
<td>BHEL / ABB / Siemens / Andrew Yule / Alstom / Schneider / Bharat Bijlee</td>
</tr>
<tr>
<td>134</td>
<td>Transformers 11 KV, Distribution Type Step Down / Up &lt;400 KVA</td>
<td>Voltamp / Siemens / Crompton Greaves / Alstom / Schneider / ABB / Bharat Bijlee</td>
</tr>
<tr>
<td>135</td>
<td>Transformers 11 KV, Distribution Type Step Down / Up ≥400 KVA</td>
<td>BHEL / ABB / Siemens / Areva T &amp; D / Schneider / Crompton Greaves / Bharat Bijlee</td>
</tr>
<tr>
<td>136</td>
<td>Packaged / Unified Substation</td>
<td>BHEL / ABB / Siemens / Andrew Yule / Schneider / Crompton Greaves</td>
</tr>
<tr>
<td>137</td>
<td>VCB &amp; SF6 [11 KV &amp; 33 KV] &amp; Ring Main Units</td>
<td>BHEL / ABB / Areva T &amp; D / Siemens / Andrew Yule / Schneider</td>
</tr>
<tr>
<td>139</td>
<td>Electronic Energy Meter [Tamper Proof with Optical Port]</td>
<td>Siemens / L &amp; T / Havells / HPL / Schneider</td>
</tr>
<tr>
<td>140</td>
<td>Electrical Instrumentation / Measuring Instruments Digital / Analog / Energy Meters / Volt Meter / Ammeter</td>
<td>Havells / HPL / L &amp; T / AE / Schneider / BCH</td>
</tr>
<tr>
<td>141</td>
<td>Water Heater [Geyser]</td>
<td>Bajaj / Usha / Crompton Greaves / Jaquar</td>
</tr>
<tr>
<td>142</td>
<td>Energy Saver</td>
<td>Mega Energy Solutions</td>
</tr>
<tr>
<td>143</td>
<td>Exhaust Fan / Ceiling Fan / Air Circulator / Wall Mounting Fan</td>
<td>Crompton Greaves / Havells / Almonard / Bajaj / Orient</td>
</tr>
<tr>
<td>Ser No.</td>
<td>Materials</td>
<td>Make/Name Of Firms</td>
</tr>
<tr>
<td>--------</td>
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</tr>
<tr>
<td>144</td>
<td>Capacitor Bank / APFC Panel</td>
<td>ABB / Siemens [EPCOS] / L &amp; T / BCH / Schneider</td>
</tr>
<tr>
<td>145</td>
<td>Thermoplastic Street Light Junction Box / DB</td>
<td>Hensel / Sintex / C &amp; S</td>
</tr>
<tr>
<td>146</td>
<td>Nature Switch / Street Light Timer</td>
<td>Legrand / L &amp; T / Bajaj / Schneider</td>
</tr>
<tr>
<td>147</td>
<td>LT Switch Board Panel [Indoor Wall Mounted Prewired]</td>
<td>Schneider / L &amp; T / ABB / Havells / C &amp; S</td>
</tr>
<tr>
<td>148</td>
<td>LT Control Panel / Feeder Pillar Box</td>
<td>L &amp; T / Milestone / Advance / Unilec / C &amp; S / Schneider</td>
</tr>
<tr>
<td>149</td>
<td>Steel Tubular Poles</td>
<td>Jindal Steel / National Tubing Co / Bombay Tubes &amp; Store / Calcutta Poles &amp; Tubes</td>
</tr>
<tr>
<td>150</td>
<td>Cable Joint LT &amp; HT, Hot &amp; Cold Shrinkable</td>
<td>M-Seal / Birla-3M / Denson / Raychem</td>
</tr>
<tr>
<td>151</td>
<td>Air Break Switches / HT Isolators / Gang Switches</td>
<td>Pactil / BHEL / Jaipuria Brothers</td>
</tr>
<tr>
<td>152</td>
<td>DSC / Pin Type Porcelain Insulators</td>
<td>BHEL / Jaipuria Brothers / Pactil / Southern Insulators</td>
</tr>
<tr>
<td>153</td>
<td>Diesel Generating Set Engines</td>
<td>Kirloskar Green / Cummins / Ashok Leyland / Greaves Cotton</td>
</tr>
<tr>
<td>154</td>
<td>Alternator</td>
<td>Alstom / Crompton Greaves / Kirloskar Electric / Siemens / Bharat Bijlee</td>
</tr>
<tr>
<td>155</td>
<td>Lightning Arrester [Station Class]</td>
<td>Oblum / Elpro / BHEL / Areva T &amp; D / Jaipuria Brothers</td>
</tr>
<tr>
<td>156</td>
<td>ACSR Conductor</td>
<td>Indian Aluminium Ltd / Alind / Bharat Conductors</td>
</tr>
<tr>
<td>157</td>
<td>Single Phase Preventor / Contactors / Thermal Overload Relay</td>
<td>ABB / BCH / L &amp; T / Siemens / C &amp; S / Schneider</td>
</tr>
<tr>
<td>158</td>
<td>Battery Maintenance Free</td>
<td>Exide / AMCO / Nicco / Amaron</td>
</tr>
<tr>
<td>159</td>
<td>Battery Chargers</td>
<td>Escorp / Su-Kam / Microtek</td>
</tr>
<tr>
<td>160</td>
<td>Servo Control LT Voltage Stabiliser</td>
<td>Voltamp / APLAB / Andrew Yule / Brentford / AE / Vintec [Volina]</td>
</tr>
<tr>
<td>162</td>
<td>Indicator Lamp / Selector Switch</td>
<td>L &amp; T / Siemens / GE / RR Micro / BCH / Schneider</td>
</tr>
<tr>
<td>163</td>
<td>Sluice Valve / Reflux Valve / Air Release Valve / Foot Valve / Non-Return Valve / Gate Valve / Butterfly Valve</td>
<td>Kirloskar / Leader / Zoloto / Audco / Venus / Upadhaya</td>
</tr>
<tr>
<td>164</td>
<td>DOL / Star-Delta Starter</td>
<td>BCH / Siemens / L &amp; T / ABB / Schneider / C &amp; S</td>
</tr>
<tr>
<td>165</td>
<td>Submersible Cable</td>
<td>Finolex / Havells / RR Kabel / Polycab</td>
</tr>
<tr>
<td>166</td>
<td>Centrifugal Pumps</td>
<td>Crompton Greaves / Kirloskar / KSB</td>
</tr>
<tr>
<td>167</td>
<td>Submersible Pumps</td>
<td>Crompton Greaves / Colama / KSB / Kirloskar</td>
</tr>
<tr>
<td>168</td>
<td>Bleaching Dozer</td>
<td>Ion Exchange / RMCO / Avon / Aquapura / Maic India</td>
</tr>
<tr>
<td>169</td>
<td>Chloronome Plant / Chlorinator</td>
<td>Auqa / Pearl Filters / Jesco / Advance – 2000</td>
</tr>
<tr>
<td>170</td>
<td>PVC Overhead Tank [ISI Mark]</td>
<td>Sintex / Polywell / Polycon</td>
</tr>
<tr>
<td>Ser No.</td>
<td>Materials</td>
<td>Make/Name Of Firms</td>
</tr>
<tr>
<td>--------</td>
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<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>171</td>
<td>Electric Motors</td>
<td>Crompton Greaves / Siemens / ABB / Kirloskar Electric / Havells</td>
</tr>
<tr>
<td>172</td>
<td>Monoblock Pumps</td>
<td>Crompton Greaves / Kirloskar / KSB</td>
</tr>
<tr>
<td>173</td>
<td>Chiller Units / Compressors, Scroll / Screw Type</td>
<td>Blue Star / Voltas / York / Kirloskar / Carrier / Daikin / Trane</td>
</tr>
<tr>
<td>174</td>
<td>Condenser &amp; Chiller Pumps</td>
<td>Crompton Greaves / Kirloskar / KSB</td>
</tr>
<tr>
<td>175</td>
<td>Cooling Towers</td>
<td>Paharpur / Mihir / Delta</td>
</tr>
<tr>
<td>176</td>
<td>Cooling Coil / AHU</td>
<td>Blue Star / Voltas / Zeco / Llyod</td>
</tr>
<tr>
<td>177</td>
<td>Filters</td>
<td>Blue Star / Airtech / Thermodyne</td>
</tr>
<tr>
<td>178</td>
<td>Balancing Valves</td>
<td>Leader / Audco / C &amp; R / Advance</td>
</tr>
<tr>
<td>179</td>
<td>Refrigerant Controls</td>
<td>Sporlan / ALCO / Honeywell / Danfoss / Jhonson Control</td>
</tr>
<tr>
<td>180</td>
<td>Strainer</td>
<td>Rapid Control / Emberland / Sant</td>
</tr>
<tr>
<td>181</td>
<td>Insulation Crosslink Polyethylene with Adhesive</td>
<td>Torcellen / Paramount / Thermoflex</td>
</tr>
<tr>
<td>182</td>
<td>Thermometers / Pressure Gauges</td>
<td>Hguru / Taylor / Fiebig</td>
</tr>
<tr>
<td>183</td>
<td>Thermostat / Humidistat</td>
<td>Honeywell / Jhonson Control / Danfoss / Siemens</td>
</tr>
<tr>
<td>184</td>
<td>Actuators</td>
<td>Siemens / Rapid Control / Honeywell</td>
</tr>
<tr>
<td>185</td>
<td>Heaters</td>
<td>Daspass / Racold / Bajaj</td>
</tr>
<tr>
<td>186</td>
<td>Thermostatic Expansion Valve</td>
<td>Siemens / Honeywell / Danfoss</td>
</tr>
<tr>
<td>187</td>
<td>Grills / Diffusers / Fire Dampers</td>
<td>Caryaire / Mapro / Conaire</td>
</tr>
<tr>
<td>188</td>
<td>Split Type AC / Package Type AC / Window Type AC</td>
<td>Blue Star / Voltas / Hitachi / Daikin / Carrier</td>
</tr>
<tr>
<td>189</td>
<td>Fire Pump</td>
<td>Crompton Greaves / Kirloskar / KSB</td>
</tr>
<tr>
<td>190</td>
<td>Fire Hose Real</td>
<td>Minimax / Firex / Safex</td>
</tr>
<tr>
<td>191</td>
<td>Stand Post Type Hydrant</td>
<td>Minimax / Firex / Safex</td>
</tr>
<tr>
<td>192</td>
<td>RRL Hose Pipe</td>
<td>Dunlop / Cosmos / Jayshree</td>
</tr>
<tr>
<td>193</td>
<td>Sprinkler Head</td>
<td>Minimax / Tyco / Ceasefire / Safex</td>
</tr>
<tr>
<td>194</td>
<td>Pressure Switch</td>
<td>Siemens / Honeywell / Danfoss / Schneider / Rapid Control</td>
</tr>
<tr>
<td>195</td>
<td>Fire Extinguisher [All Types]</td>
<td>Minimax / Firex / Newage / Cease Fire</td>
</tr>
<tr>
<td>196</td>
<td>Single Head Landing Valves Three / Four Way Brigade Inlet Hose Reel Drum and Shut-Off Nozzle, Aluminium Branch Pipe</td>
<td>Minimax / Safex / Superex</td>
</tr>
<tr>
<td>197</td>
<td>20mm dia Rubber Pipe</td>
<td>Jyothi / Dunlop / Minimax</td>
</tr>
<tr>
<td>198</td>
<td>Hooter</td>
<td>Safex / Honeywell / Mimax</td>
</tr>
</tbody>
</table>
45. **MATERIALS AND TESTS:**

45.1. If facility for testing of building materials for any particular test in 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.

45.2. The materials listed hereinafter shall be tested as per the frequency indicated therein.

45.3. Level of testing shown in legend as A, B & C are defined as under:

45.4. **LEVEL "A":** "Site Lab" means own site lab established by Contractor at the work site for such tests. This lab shall house all the facilities including T & P, machinery, equipment, and manpower etc., required for conducting tests. Competent technical representative as approved by the GE shall be employed by the contractor to man the laboratory. This lab shall be operative for the entire duration of the contract till its completion. Tests shall be carried out in the presence of Engineer-in-Charge to be nominated by GE or any other departmental official to be nominated by the GE. Random check of compliance of frequency of testing shall be done by GE. Setting up site laboratory is mandatory for all works costing Rs. 1.00 Crore and above. The contractor may at his option set up site laboratory for works costing less than Rs. 1.00 Crore also without any extra cost to Government.

[a] Record shall be maintained at work site. These test results shall be signed by contractor or his authorized representative and aforesaid departmental official. Random check shall be done by GE also and GE shall also sign the same in token of the check.

[b] Within 15 days of placement of Work Order No. 1, site lab shall be established and fact reported by the contractor to GE in writing who will verify the fact and satisfy himself of the facilities provided. Thereafter, GE shall issue a certificate to this effect in writing listing out equipment particulars etc., of each material test. Only after issue of this certificate by GE, the tests shall be carried out and materials so approved shall be incorporated in the work.

[c] 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.

[e] 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.

[f] 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.
45.5. **LEVEL "B":** "Command Testing Lab" means any lab of MES.

   [a] The tests shall be conducted as per frequencies laid down for these tests in these labs for which contractor shall provide all requisite facilities like samples, cubes, material etc., transportation to these labs for testing purpose. It will be contractor’s responsibility to adhere to the laid down frequency of testing. Test results shall be sent by lab to the GE whose copies can be made by contractor at his own expense. Testing charges for the tests so conducted shall be recovered at the rates indicated from the running payments. The contractor’s quoted Lumpsum is deemed to include for above provision.

   [b] Provision of Para [f] above of Level "A" shall be applicable to Level "B" also.

45.6. **LEVEL "C":** Level "C" lab stands for National Test House / SEMT Wing / Government Approved Laboratories / NABL Accredited Laboratories / Regional Research Laboratories / IIT / National Institute of Technology where such facilities exist.

   [a] Test provision contained in Para [a] of Level "B" above shall be applicable here except that contractor shall make necessary arrangement for transportation etc., to hand over the samples to these labs. Test results shall be forwarded to GE by these labs directly. The testing charges payable to these labs for conducting these tests shall be borne by the contractor and his quoted Lumpsum is deemed to include this provision.

   [b] Provision of Para [f] above of Level "A" shall be applicable to Level "C" also.

45.7. In case the contractor has not set up the site laboratory and the tests are carried out in Command Testing Lab or any other laboratory, the recovery shall be made at the applicable rates indicated hereinafter.

45.8. In case non availability of testing facilities in MES Lab, the tests shall be conducted in any outside approved labs. Testing charges of materials/cubes carried out in approved laboratory shall be as per actual and shall be directly borne by the contractor.

45.9. 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. The cost of the same is deemed to be inclusive of the rates quoted against Schedule "A".
45.10. **LIST OF SUGGESTED ESSENTIAL EQUIPMENT:**

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Name of Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cube Mould [150 +/- 0.2mm] - 12 Nos</td>
</tr>
<tr>
<td>2</td>
<td>Tamping Bar [16mm dia, 600 mm long]</td>
</tr>
<tr>
<td>3</td>
<td>Balance 12 Kg [LC 1 gm]</td>
</tr>
<tr>
<td>4</td>
<td>Balance 220 gm [LC 0.001 gm] digital</td>
</tr>
<tr>
<td>5</td>
<td>Weights</td>
</tr>
<tr>
<td>6</td>
<td>Compression Testing machines with three gauge [capacity 2000KN]</td>
</tr>
<tr>
<td>7</td>
<td>Slump Test Apparatus</td>
</tr>
<tr>
<td>8</td>
<td>Standard Test Sieve [80 to 4.75mm] Square hole, perforated plate</td>
</tr>
<tr>
<td>9</td>
<td>Standard Test Sieve [3.35mm to 75 micron] fine mesh, wire cloth.</td>
</tr>
<tr>
<td>10</td>
<td>Soft brush &amp; Camel hair brush</td>
</tr>
<tr>
<td>11</td>
<td>Lid &amp; Pan</td>
</tr>
<tr>
<td>12</td>
<td>Hot air oven [Thermostatically controlled]</td>
</tr>
<tr>
<td>13</td>
<td>Thickness Gauge</td>
</tr>
<tr>
<td>14</td>
<td>Measuring Cylinders [graduated]</td>
</tr>
<tr>
<td>15</td>
<td>Steel Tape [LC 1 mm], Steel scale [LC 5 mm]</td>
</tr>
<tr>
<td>16</td>
<td>Plywood sheet [2 No.] 3mm thick</td>
</tr>
<tr>
<td>17</td>
<td>Dish [180mm, 180mm, 40mm] of Glass or Porcelain or Glazed Stoneware</td>
</tr>
<tr>
<td>18</td>
<td>Distilled water</td>
</tr>
<tr>
<td>19</td>
<td>Moulds for casting concrete beams for testing flexural strength.</td>
</tr>
<tr>
<td>20</td>
<td>Relevant IS Codes</td>
</tr>
<tr>
<td>21</td>
<td>Concrete Hammer</td>
</tr>
<tr>
<td>22</td>
<td>Hand Penetro Meter</td>
</tr>
<tr>
<td>23</td>
<td>Vicat Apparatus</td>
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<tr>
<td>24</td>
<td>Vernier Caliper</td>
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<tr>
<td>25</td>
<td>Micrometer</td>
</tr>
<tr>
<td>26</td>
<td>Indian Standard Sand</td>
</tr>
<tr>
<td>27</td>
<td>Cube Moulds For Cement Testing</td>
</tr>
<tr>
<td>28</td>
<td>Stop Watch</td>
</tr>
<tr>
<td>29</td>
<td>Cement Cube Vibrator</td>
</tr>
<tr>
<td>30</td>
<td>Thermometer up to 300°C</td>
</tr>
<tr>
<td>31</td>
<td>Sieve Shaker for Coarse Aggregate Test Sieve</td>
</tr>
<tr>
<td>32</td>
<td>Sieve Shaker for Fine Aggregate Test Sieve</td>
</tr>
<tr>
<td>33</td>
<td>Thermometer for Hot Bitumen</td>
</tr>
<tr>
<td>34</td>
<td>Thermometer for Recording Day Temp</td>
</tr>
<tr>
<td>35</td>
<td>Humidity Recorder Meter</td>
</tr>
<tr>
<td>36</td>
<td>Timber Moisture Content Meter.</td>
</tr>
<tr>
<td>37</td>
<td>Field Procter Density Test Equipment</td>
</tr>
<tr>
<td>38</td>
<td>Cement Testing Machine for Initial / Final Setting / Consistency.</td>
</tr>
</tbody>
</table>
### MATERIAL TESTS AND THEIR RECOVERY RATES OF TESTING CHarges

#### LEGEND

- **A**: Site Lab
- **B**: Command Testing Lab
- **C**: National Test House / SEMT Wing / Government Approved Laboratories / NABL Accredited Laboratories / Regional Research Laboratories / IIT / National Institute of Technology

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.

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Material</th>
<th>Test</th>
<th>Method of Testing</th>
<th>Frequency of Tests</th>
<th>Level of Test</th>
<th>Rate per Test</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Brick</td>
<td>Compressive Strength</td>
<td>IS – 3495 [Part – II]</td>
<td>As per IS – 5454 as given under:</td>
<td>A</td>
<td>180.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water Absorption</td>
<td>IS – 3495 [Part – II]</td>
<td>Lot Size: 1001 to 10000, Sample Size: 5, Permissible Nos of defective bricks: 0</td>
<td>A</td>
<td>150.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Efflorescence</td>
<td>IS – 3495 [Part - I]</td>
<td>Lot Size: 10001 to 35000, Sample Size: 10, Permissible Nos of defective bricks: 0</td>
<td>A</td>
<td>180.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>180.00</td>
<td>Checks for visual and Dimensional characteristics shall also be carried out as per IS - 5454</td>
</tr>
<tr>
<td>2.</td>
<td>Coarse Aggregate</td>
<td>Sieve Analysis</td>
<td>IS – 2386 [Part – I]</td>
<td>One test per every 15 Cu.m of aggregates or part thereof brought to site.</td>
<td>A</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flakiness Index</td>
<td>IS – 2386 [Part – I]</td>
<td>One test per every 15 Cu.m of aggregates or part thereof brought to site.</td>
<td>A</td>
<td>90.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Estimation of Deleterious Materials</td>
<td>IS – 2386 [Part – I]</td>
<td>One test per every 100 Cu.m of aggregate or part thereof</td>
<td>A</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organic Impurities</td>
<td>IS – 2386 [Part – I]</td>
<td>One test per source of supply</td>
<td>C</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moisture Content</td>
<td>IS – 2386 [Part – II]</td>
<td>Regularly as Required</td>
<td>A</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Specific Gravity</td>
<td>IS – 2386 [Part – II]</td>
<td>One test for each source of supply</td>
<td>B</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Fine Aggregate</td>
<td>Sieve Analysis</td>
<td>IS – 2386 [Part – I]</td>
<td>One test for every 15 cum of FA or part thereof when brought to site</td>
<td>A</td>
<td>180.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test For Clay, Silt and Impurities</td>
<td>IS – 2386 [Part – II]</td>
<td>One test for every 15 cum of FA or part thereof when brought to site</td>
<td>A</td>
<td>90.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Specific Gravity</td>
<td>IS – 2386 [Part – II]</td>
<td>One test for each source of supply</td>
<td>B</td>
<td>180.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test For Organic Impurities</td>
<td>IS – 2386 [Part – II]</td>
<td>One test for each source of supply</td>
<td>C</td>
<td>180.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moisture Content</td>
<td>IS – 2386 [Part – II]</td>
<td>Regularly as required subject to 2 tests/ per day when being used.</td>
<td>A</td>
<td>180.00</td>
<td></td>
</tr>
</tbody>
</table>
### MATERIAL TESTS AND THEIR RECOVERY RATES OF TESTING CHARGES [Continued]

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Materials</th>
<th>Test</th>
<th>Method of Testing</th>
<th>Frequency of Tests</th>
<th>Level of Test</th>
<th>Rate per Test</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Cement</td>
<td>Setting Time</td>
<td>IS – 4031 – 63 Reaffirmed 1980</td>
<td>Once for each consignment or as and when Required</td>
<td>B</td>
<td>180.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soundness</td>
<td>IS – 4031 – 63 Reaffirmed 1980</td>
<td>Once for each consignment or as and when Required</td>
<td>B</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compressive Strength</td>
<td>IS – 4031 – 63 Reaffirmed 1980</td>
<td>Once for each consignment or as and when Required</td>
<td>B</td>
<td>360.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fineness</td>
<td>IS – 4031 – 63 Reaffirmed 1980</td>
<td>Once for each consignment or as and when Required.</td>
<td>B</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Structural Concrete [M – 15 Grade &amp; above]</td>
<td>Slump Test Or Compacting Factor Test Or Vee-Bee Time</td>
<td>IS – 1119</td>
<td>The Min frequency of sampling of concrete of each grade shall be as under:</td>
<td>A</td>
<td>180.00</td>
<td>Random sample shall be carried out to cover mixing units. As per IS – 456 – 2000 Clause. 14 for frequency of sampling.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compressive Strength</td>
<td>IS – 516</td>
<td>Quantity of Concrete in the work [Cu.m]</td>
<td>A</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No of samples</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 – 5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 – 15</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16 – 30</td>
<td>3</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>31 – 50</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>51 and above</td>
<td>4+1 for each Additional 50 Cu.m or part thereof</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Cement Flooring Tiles / Terrazzo Tiles</td>
<td>Water Absorption</td>
<td>IS – 1237 [Appendix &quot;D&quot;]</td>
<td>6 Tiles out of 18</td>
<td>B</td>
<td>180.00</td>
<td>Samples: 18 Tiles from each source of supply selected at Random.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wet Transverse Strength</td>
<td>IS – 1237 [Appendix &quot;E&quot;]</td>
<td>6 Tiles out of 18</td>
<td>B</td>
<td>144.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resistance To Wear</td>
<td>IS – 1237 [Appendix &quot;F&quot;]</td>
<td>6 Tiles out of 18</td>
<td>C</td>
<td>540.00</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Timber</td>
<td>Specific Gravity&amp; Weight</td>
<td>IS – 1708 – 1960</td>
<td>Minimum 3 samples from a lot of 4 Cum or 250 pieces of seasoned timber</td>
<td>B</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moisture Content</td>
<td>IS – 1708 – 1960</td>
<td></td>
<td>A</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Water For Construction Purpose</td>
<td>Test For Acidity</td>
<td>IS – 456 &amp; IS – 3015</td>
<td></td>
<td>B</td>
<td>240.00</td>
<td>Also refer clause 4.3 of IS – 456 and its subsequent sub clauses regarding suitability of water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test For Alkalinity</td>
<td>IS – 456 &amp; IS – 3015</td>
<td></td>
<td>B</td>
<td>240.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test For Solid Content</td>
<td>IS – 456 &amp; IS – 3015</td>
<td>Once at the stage of approval of source of water</td>
<td>C</td>
<td>300.00</td>
<td></td>
</tr>
</tbody>
</table>
### MATERIAL TESTS AND THEIR RECOVERY RATES OF TESTING CHARGES [Continued]

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Materials</th>
<th>Test</th>
<th>Method of Testing</th>
<th>Frequency of Tests</th>
<th>Level of Test</th>
<th>Rate per Test</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.</td>
<td>Welding of Steel Work</td>
<td>Visual Inspection Test.</td>
<td>IS - 822 - 1970 Clause - 7.1</td>
<td>100% by visual inspection</td>
<td>Work site</td>
<td>360.00</td>
<td>Specialised tests, their method and frequency to be decided on consideration of their importance by the Accepting Officer</td>
</tr>
<tr>
<td>10.</td>
<td>Timber Panelled &amp; Glazed Door/Window Shutters [Including Factory Made Shutter]</td>
<td>Dimensions, Sizes Workmanship &amp; Finish</td>
<td>IS - 1003 [Part - I]</td>
<td>Frequency of sampling from each lot shall be as under:</td>
<td>A</td>
<td>180.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strength Test</td>
<td>IS - 1003 [Part - I]</td>
<td>From each lot 5% of the factory made shutter shall be Manufacture tested for strength tests.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slamming</td>
<td>IS - 1003 [Part - I]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impact Indentation</td>
<td>IS - 1003 [Part - I]</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Shock Resistance</td>
<td>IS - 1003 [Part - I]</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Edge Loading</td>
<td>IS - 1003 [Part - I]</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>11.</td>
<td>Ply Wood [IS–303]</td>
<td>Moisture Content</td>
<td>IS – 1734 – 1983 [Part - I]</td>
<td>Six test pieces cut from each of the boards selected as per table – I shall be subjected to tests.</td>
<td>C</td>
<td>240.00</td>
<td>Sampling shall be as per IS – 7835 Table – 2</td>
</tr>
<tr>
<td>12.</td>
<td>Veneered Wood Particle Board [Medium Density] IS – 3097</td>
<td>Density</td>
<td>IS – 635 [Part – I]</td>
<td>Three test specimen from each sample [Size 150mm x 75mm]</td>
<td>A</td>
<td>60.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moisture Content</td>
<td>IS – 2360 [Part – 3]</td>
<td>Three test specimen from each sample [Size 150mm x 75mm]</td>
<td>A &amp; B</td>
<td>60.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water Absorption</td>
<td>IS – 2360 [Part – 16]</td>
<td>Three test specimen from each sample [Size 300mm x 300mm]</td>
<td>A</td>
<td>60.00</td>
<td>Sampling shall be done as per IS – 3487 Clause 2 with moisture meter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Swelling Due To Surface Absorption</td>
<td>IS – 2360 [Part – 17]</td>
<td>Three test specimen from each sample [Size 125mm x 100mm]</td>
<td>A</td>
<td>60.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Swelling In Water</td>
<td>IS – 2360 [Part – 17]</td>
<td>Three test specimen from each sample [Size 200mm x 100mm]</td>
<td>A</td>
<td>60.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Modules Of Rupture</td>
<td>IS – 2360 [Part – IV]</td>
<td>Three test specimens as per IS – 2380- 1977</td>
<td>B</td>
<td>90.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screw Withdrawal Strength</td>
<td>IS – 2360 [Part – IV]</td>
<td>Three test specimens as per IS – 2385</td>
<td>C</td>
<td>120.00</td>
<td></td>
</tr>
</tbody>
</table>
### MATERIAL TESTS AND THEIR RECOVERY RATES OF TESTING CHARGES

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Materials</th>
<th>Test</th>
<th>Method of Testing</th>
<th>Frequency of Tests</th>
<th>Level of Test</th>
<th>Rate per Test</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>PCC Hollow Blocks for Walling</td>
<td>Compressive Strength</td>
<td>IS – 2156 [Appendix &quot;B&quot;]</td>
<td>8 Blocks out of 14</td>
<td>A</td>
<td>60.00</td>
<td>Sample: 14 blocks from consignment of every 5000 blocks or part thereof.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water Absorption</td>
<td>IS – 2156 [Appendix &quot;E&quot;]</td>
<td>3 Blocks out of 14</td>
<td>B</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Density</td>
<td>IS – 2156 [Appendix &quot;A&quot;]</td>
<td>3 Blocks out of 14</td>
<td>B</td>
<td>90.00</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>PCC Solid Block for Walling</td>
<td>Compressive Strength</td>
<td>IS – 2185</td>
<td>12 Blocks out of 18</td>
<td>A</td>
<td>60.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water Absorption</td>
<td>IS – 2185</td>
<td>3 Blocks out of 18</td>
<td>B</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Density</td>
<td>IS – 2185</td>
<td>3 Blocks out of 18</td>
<td>B</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Ceramic Tiles / Glazed Tiles</td>
<td>Water Absorption Test</td>
<td>–</td>
<td>6 Tiles out of 18</td>
<td>B</td>
<td>180.00</td>
<td>Samples: 18 tiles from each source of supply selected at random.</td>
</tr>
<tr>
<td>16</td>
<td>Burnt Clay Roofing Tiles [Hand Made]</td>
<td>Water Absorption</td>
<td>IS – 3495 [Part – II]</td>
<td>6 Tiles out of 12</td>
<td>B</td>
<td>216.00</td>
<td>Sample: 12 tiles from each source of supply selected at random.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compressive Strength</td>
<td>IS – 3495 [Part – I]</td>
<td></td>
<td>A</td>
<td>180.00</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Mangalore Pattern Roofing Tiles</td>
<td>Water Absorption</td>
<td>IS – 654 Appendix &quot;A&quot;</td>
<td>6 Tiles out of 32</td>
<td>B</td>
<td>180.00</td>
<td>Sample: 32 tiles from each consignment of 3000 tiles or part thereof. These tiles shall be checked for dimensions and weight.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Breaking Load</td>
<td>IS – 654 Appendix &quot;C&quot;</td>
<td></td>
<td>B</td>
<td>120.00</td>
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</tr>
</tbody>
</table>
### PARTICULAR SPECIFICATIONS [Continued]

#### 46. DIFFERENT STAGES OF YARDSTICK:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description of Works to be Covered</th>
<th>Yard Stick Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Earth work excavation, PCC Bed below RCC Raft / Pile Cap, RCC M30 Design Mix Raft / Pile Cap, Suspected Flooring with necessary Formwork and Reinforcement other proprietary works up to FFL</td>
<td>28%</td>
</tr>
<tr>
<td>II</td>
<td>RCC M30 Design Mix for Column including Formwork and reinforcement complete from FFL to Roof Slab including floor Beams, Lintels, Roof Beams, Floor Slabs, Roof Slab including form work and reinforcement.</td>
<td>27%</td>
</tr>
<tr>
<td>III</td>
<td>RCC M30 Design Mix for Parapet Walls, Fins, Facia, Chajjas, Roof Projection etc. including Formwork and Reinforcement</td>
<td>5%</td>
</tr>
<tr>
<td>IV</td>
<td>Brick Masonry work including Half Brick Walls complete</td>
<td>5%</td>
</tr>
<tr>
<td>V</td>
<td>All Joinery works like Wooden / Aluminium Door / Window / Ventilators Chowkats, Door Shutters, Window / Ventilators Shutters / PVC Doors &amp; Shutters including Builders Hardware items and Rolling Shutters, Grills, Glazing etc. complete.</td>
<td>5%</td>
</tr>
<tr>
<td>VI</td>
<td>Flooring: PCC Sub Base, ATT for Filling under Floors, Non-Skid Ceramic Tile Flooring, Glazed Ceramic Tile Flooring &amp; Dado, Skirting, including Screed Bed, Backing Coat for Skirting/Dado and including Finishes for Brick Steps etc. any other Floorings as specified.</td>
<td>10%</td>
</tr>
<tr>
<td>VII</td>
<td>Internal Plastering, Ceiling plastering, Internal Finishes such as OBD, White Wash, Synthetic Enamel Painting to Doors/Windows etc., complete</td>
<td>3%</td>
</tr>
<tr>
<td>VIII</td>
<td>External Plastering and External Finishes such as Weather Proof Paint, etc., complete</td>
<td>3%</td>
</tr>
<tr>
<td>IX</td>
<td>Water Proofing Treatment to Chajjas, Accessible and Inaccessible Terrace and Roof Slab, Water Tank etc.,</td>
<td>4%</td>
</tr>
<tr>
<td>X</td>
<td>Plumbing/Sanitary Fittings, PVC Soil/Waste/Vent and Rain Water Pipes and Fittings, Spouts, Drains and Drain Pipe etc.,</td>
<td>3%</td>
</tr>
<tr>
<td>XI</td>
<td>Miscellaneous works such as Plinth Protection, Brick Steps, Ramps, Cupboards, ATT for Plinth Protection and any other left over items complete</td>
<td>7%</td>
</tr>
</tbody>
</table>

Total: 100%
### CEMENT SUPPLY & ACCEPTANCE REGISTER

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C. A. No. &amp; Name of Work</td>
<td>:</td>
</tr>
<tr>
<td>2</td>
<td>Control No.</td>
<td>:</td>
</tr>
<tr>
<td>3</td>
<td>Name of Manufacturer/Brand Name/Grade of Cement</td>
<td>:</td>
</tr>
<tr>
<td></td>
<td>[A] Manufacture</td>
<td>:</td>
</tr>
<tr>
<td></td>
<td>[B] Brand</td>
<td>:</td>
</tr>
<tr>
<td></td>
<td>[C] Grade</td>
<td>:</td>
</tr>
<tr>
<td>4</td>
<td>Quantity of cement &amp; Lot No. / Week No. [In Bags]</td>
<td>:</td>
</tr>
<tr>
<td></td>
<td>[a] Quantity</td>
<td>:</td>
</tr>
<tr>
<td></td>
<td>[b] Lot No./Week No.</td>
<td>:</td>
</tr>
<tr>
<td>5</td>
<td>Manufacturer’s test certificates No.</td>
<td>:</td>
</tr>
<tr>
<td>6</td>
<td>Random test Details:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[a] Physical test report from________ vide their letter No.</td>
<td>:</td>
</tr>
<tr>
<td></td>
<td>[b] Chemical test report from________ vide their letter No.</td>
<td>:</td>
</tr>
<tr>
<td>7</td>
<td>Details of Physical &amp; Chemical properties</td>
<td>Refer <strong>Annexure &quot;B&quot;</strong></td>
</tr>
</tbody>
</table>

**Annexure - "A"**
<table>
<thead>
<tr>
<th>Physical Requirements</th>
<th>Chemical Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>[As per IS - 4031]</td>
<td>[As per IS - 4032]</td>
</tr>
<tr>
<td>Specific Surface [Sq.m/Grm]</td>
<td></td>
</tr>
<tr>
<td>Soundness by Le Chatlier</td>
<td></td>
</tr>
<tr>
<td>Expansion [%]</td>
<td></td>
</tr>
<tr>
<td>Soundness by Auto-Clave Expansion</td>
<td></td>
</tr>
<tr>
<td>Expansion [%]</td>
<td></td>
</tr>
<tr>
<td>Initial setting time [Minutes]</td>
<td></td>
</tr>
<tr>
<td>Final setting time [Minutes]</td>
<td></td>
</tr>
<tr>
<td>Compressive Strength</td>
<td></td>
</tr>
<tr>
<td>Temp during testing OC</td>
<td></td>
</tr>
<tr>
<td>Standard Consistency [%]</td>
<td></td>
</tr>
<tr>
<td>Lime saturation Factor [Ratio]</td>
<td></td>
</tr>
<tr>
<td>Alumina Ion Ratio [Ratio]</td>
<td></td>
</tr>
<tr>
<td>Insoluble Residue [%]</td>
<td></td>
</tr>
<tr>
<td>Sulphuric Anhydride [%]</td>
<td></td>
</tr>
<tr>
<td>Loss on ignition [%]</td>
<td></td>
</tr>
<tr>
<td>Alkalis [%]</td>
<td></td>
</tr>
<tr>
<td>Chlorides [%]</td>
<td></td>
</tr>
<tr>
<td>Magnesium [%]</td>
<td></td>
</tr>
</tbody>
</table>

As per Relevant IS

As per manufacturer's test certificate

As per random test certificate

Remarks with signature : 

Junior Engineer [Civil] : 

Engineer - in - Charge : 

Contractor : 

Accepted/Rejected : 

Garrison Engineer : 

Remarks of BOO / Inspecting Officer / CE Zone : 

PARTICULAR SPECIFICATIONS [Continued]
PARTICULAR SPECIFICATIONS [Continued]

Annexure - "C"

IN/OUT CEMENT REGISTER

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Date</th>
<th>Cement IN</th>
<th>Cement OUT</th>
<th>Signature</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>[a]</td>
<td>[b]</td>
<td>[c]</td>
<td>[d]</td>
<td>[e]</td>
<td>[f]</td>
</tr>
</tbody>
</table>

* **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 : 


PARTICULAR SPECIFICATIONS [Continued]

STEEL SUPPLY / ACCEPTANCE FORM

Contract No. : 
Name of Work : 
Control No. : 
Details of Purchase : 
[i] Particulars of Manufacturers : 
[ii] Details of Suppliers, if any : 
Details of Test Certificate : 
[i] No. and Date : 
[ii] Particulars of Issuing Authority :

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Nomenclature and size of steel</th>
<th>IS Reference</th>
<th>Quantity [Tons]</th>
<th>Physical properties</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Actual</td>
<td>Conversion</td>
<td>IS Test Sheet</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

* As per frequency of testing given vide clause 10.3.6 above

Remarks with signature : 
Junior Engineer [Civil] : 
Engineer - in - Charge : 
Contractor : 
Accepted/Rejected : 
Garrison Engineer : 
Remarks of BOO / Inspecting Officer / CE Zone : 
PARTICULAR SPECIFICATIONS [Continued]

Annexure - "E"

TEST CERTIFICATE

| No. of Test | : |
| Name of Articles[s] | : |
| Samples submitted by | : |
| Reference to the letter No / Date | : |

Test No.

<table>
<thead>
<tr>
<th>Serial No</th>
<th>Sample [s]</th>
<th>Carbon [C%]</th>
<th>Sulphur [S%]</th>
<th>Phosphores [P%]</th>
<th>Manganese [Mn%]</th>
<th>Silicon [Si%]</th>
<th>Chromium [Cr%]</th>
<th>Nickel [Ni%]</th>
<th>Copper [Cu%]</th>
<th>Tin [Sn%]</th>
<th>Lead [Pb%]</th>
<th>Ferrous [Fe%]</th>
<th>Zinc [Za%]</th>
<th>Aluminium [Al%]</th>
<th>Impurities %</th>
<th>Wt of Za</th>
<th>UTS</th>
<th>% Elongation</th>
<th>Proof Stress MPa</th>
</tr>
</thead>
</table>

Remarks with signature : 

Junior Engineer [Civil] : 

Engineer – in – Charge : 

Contractor : 

Accepted/Rejected : 

Garrison Engineer : 

Remarks of BOO / Inspecting Officer / CE Zone : 

TEST REPORT

Name of Article material : 

Particulars Identification Mark : 

Name of the firm manufacturer : 

This is to certify that the article, the particulars of which are given has been tested in this centre another test results are as follows:

<table>
<thead>
<tr>
<th>Chemical tests on metal [Percentage by Weight]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrous</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Non Ferrous</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mechanical / Physical Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial No.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Remarks with signature : 

Junior Engineer [Civil] : 

Engineer – in – Charge : 

Contractor : 

Accepted/Rejected : 

Garrison Engineer : 

Remarks of BOO / Inspecting Officer / CE Zone :
PARTICULAR SPECIFICATIONS [Continued]

Annexure – "G"

IN / OUT STEEL REGISTER

<table>
<thead>
<tr>
<th>Ser. No.</th>
<th>Date</th>
<th>Steel IN</th>
<th>Steel OUT</th>
<th>Quantity Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Quantity [Tons]</td>
<td>Section</td>
<td>Control No.</td>
</tr>
</tbody>
</table>

*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
PARTICULAR SPECIFICATIONS [Continued]

FORMAT FOR QUALITY CONTROL PLAN
This format shall form part of Contract Agreement
[To be submitted by Contractor within 30 days of commencement of contract]

PART - I

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 : Not Applicable
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. Arrangements for electric supply made : 
9. Materials : 

<table>
<thead>
<tr>
<th>Ser. No</th>
<th>Item</th>
<th>Source as per CA</th>
<th>Contractor's plan of sourcing</th>
<th>Refer to testing clause</th>
<th>Agency for testing</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

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 exercising quality control : 
12. Qualifications/Experience of person at Serial No. 11 above : 
13. Name of supervisors with their qualifications / experience employed by contractor : 
14. Confirmation that contract relating to relating to quality of all materials and standards of workmanship and finishes and : 
15. Confirmation that requirement of tests to be conducted on materials before approval of sample and during execution, tests on workmanship, tests : 
16. Method to be adopted for maintaining records of tests result : 
17. Certificate that contractor shall maintain a log of all materials received at site as per the following format:

<table>
<thead>
<tr>
<th>Ser No.</th>
<th>Date</th>
<th>Materials</th>
<th>Quantity Received</th>
<th>Source</th>
<th>Whether as per approved sample or not</th>
<th>Tests carried out by supplier</th>
<th>Tests to be carried out before incorporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

18. General remarks by contractor of his plan of action to ensure that quality.

Date: [Signature of Contractor]
### PARTICULAR SPECIFICATIONS [Continued]

#### PART – II

[To be completed by GE before forwarding for approval by CWE]

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Verification of Serial No. 2 to 8 of Part – I</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Verification of Serial No. 9 to 18 of Part – I</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Confirmation that stage Passing Register laying down the stages and authority responsible for approving the same has been prepared, shown to contractor and kept at site.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Confirmation that all sites as require by contract has been handed over to contractor on the date fixed in Work Order No 1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Confirmation that arrangements for Government liability in supply of water and electricity have been made and no hold up on this account is expected.</td>
<td></td>
</tr>
</tbody>
</table>

Date: ___________________________  
Signature of GE: ___________________________  
Approved by CWE: ___________________________

Signature of Contractor: ___________________________  
Date: ___________________________  
Jt. Director [Contracts]: ___________________________  
For Accepting Officer: ___________________________