इंजीनियरिंग प्रोजेक्ट्स (इंडिया) लि.
(भारत सरकार का उद्यम)
ENGINEERING PROJECTS (INDIA) LTD.
(A Government of India Enterprise)

TENDER DOCUMENT

NIT No: SRO/CON/ETS/252

Civil and Finishing works for Port control Tower for the project of Provision of Administrative and Logistic Infrastructure under WP-07 and WP-5b At Naval Station Rambilli Visakhapatnam – Civil Works 04

VOLUME – II

Additional Conditions of Contract (ACC), Client Documents, Technical specification & Drawings

ENGINEERING PROJECTS (INDIA) LIMITED
(A GOVT. OF INDIA ENTERPRISE)
Corporate Office, New Delhi

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ADDITIONAL CONDITIONS OF CONTRACT

The following Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract of EPI. If there are any provisions in these Additional Conditions of Contract, which are at variance with the provisions of General Conditions of Contract, the provisions in these Additional Conditions of Contract shall take precedence.

1.1.0 INTRODUCTION

Following clauses of Additional Conditions of Contract (ACC) shall be applicable for this contract. These Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract, Instructions to Tenderers (ITT)), Notice Inviting Tender (NIT), Bill of Quantities (BOQ), Tender conditions and technical specifications & Other Tender Documents.

1.2.0 APPROACHES TO WORKSITE

The land is made available to the bidder(s)/contractor(s) free from all encumbrances as DGNP provided to EPI. The contractor shall make his own arrangement for approach to work site including borrow/ disposal area and for movement of men, materials, machineries, other equipment etc. required for carrying out the work under this contract.

The access roads/ path to the work site may not be available at all places and at all time. The contractor shall plan his work as per the availability of access roads / path at site. All drainage of works area and all weather truck able haulage roads as required by the contractor shall be constructed and maintained during the construction period by the contractor at his own cost, including portions of the road already existing. if required after obtaining approval in writing of the GE to the layout of such approaches, to convey men, materials, plants and machinery required for the satisfactory completion of work and on completion of work the site shall be cleared of all temporary approaches. The tendered rates shall, inter alia, be deemed to include for the aforesaid contingencies.

SITE VISIT AND COLLECTING LOCAL INFORMATION:

Before tendering, the tenderer is advised to visit the site, its surroundings to assess and satisfy themselves about the local conditions such as the working and other constraints at site, approach to the site, availability of water & power supply, application of taxes, cess duties and levies as applicable, nature of ground, soil and sub-soil condition, underground water table level, accommodations they may require etc., river regime, river water levels, other details of river, streams & any other relevant information required by them to execute complete scope of work. The tenderer may obtain all necessary information as to risks, weather conditions, contingencies & other circumstances (insurgencies etc.), which may influence or affect their tender prices. Tenderer shall be deemed to have considered site conditions to get satisfied himself in all respect before participating the tender.

In addition to the above, the contractor / firms are requested to prepare a proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones based upon their site visit and collected information and has to be submitted.

1.3.0 SCOPE OF WORK:

The project site for the work is clear and readily available.

i. Site clearance, surface dressing, soft rock excavation, hard rock excavation by controlled blasting
ii. Fabrication/ bar bending, reinforcement laying / binding, formation reinforcement for footing and super structure works
iii. Excavation of soil / existing ground level upto required depth, refilling with GSB or granular soil, compaction as per drawings and specifications.
iv. Plinth beam, grade beam construction, grade slab construction including form works, reinforcement laying, concreting and curing.
v. All the RCC works from plinth and above, where in EPI has completed the installation of piles, including CIVIL, architectural and finishing work for completion of buildings as mentioned below.
vi. Construction RCC elements including slabs, lintel, beams, parapet, head room works and allied structural works including all the men, machinery material and formworks, scaffolding etc.
vii. Scope includes supply of reinforcement, fabrication/ bar bending, transportation of bars to the building location and reinforcement laying / binding.
viii. Construction of block works and plastering works
ix. Internal electrical conducting and electrical works as per drawings and specification.
x. Coordination with MEP vendors / engineers for providing work front to MEP contractor and getting work front clearance
xi. Scope includes collection cubes, testing of materials and producing test results as per the requirement of EPI/ DGNP.
xii. Water proofing works at sunken area and terrace water proofing.
xiii. Construction of water tanks,
xiv. Flooring and finishing works
xv. Internal sanitary components fixing , rainwater drop-down works
xvi. SITC of doors, windows and fixtures.
xvii. The scope includes all the internal plumbing and water supply works as per BOQ and drawings.
xviii. Internal Utility related works: - Internal water supply, sewerage system, Internal RCC trenches.
xix. Electrical conduit / switch board recess refilling is under scope of civil contractor only.
xx. Site development works and Plinth production works

The following buildings are in the scope of this tender: -

Civil works & finishing works for Port control tower building

The awarded Contractor has to establish a fully furnished site office (having attached toilet facility) at the premises of the Site Location before starting the construction work.

Note:

1. EPI reserves the right to change the scope of aforesaid buildings as per priorities of DGNP and can add or delete any of the building in this tender scope. However, the Quoted BOQ rate of this tender shall remain same even after altering the building scope.

1.4.0 ORDER OF PRECEDENCE:

Clause 42.1 of GCC stands amended as under:
In case of difference, contradiction, discrepancy, dispute with regard to Conditions of Contract, Specifications, Drawings, Bill of Quantities and Rates quoted by the Contractor and other documents forming part of the contract, the following shall prevail in order of precedence.

1) Contract Agreement which includes NIT, Special Instructions to Tenderer, and Memorandum.
2) Letter of Intent / detailed letter of Work Order
3) Bill of Quantity / Schedule of Quantities
4) Additional Conditions of Contract (ACC)
5) General Conditions of Contract (EPI GCC).
6) Tender Drawings
7) Condition of Contract (DGNP),
8) Technical Specification (DGNP)
9) IAFW
10) MES technical specifications & MES 2 latest edition
11) National Building Code (Latest Edition)
12) BIS specifications

1.5.0 TIME SCHEDULE & PROGRESS

The clause No. '43.2' of General Conditions of Contract (GCC) of this Tender document shall be read as under:

The contract period for completion of entire work under scope shall be **08 (Eight) months** from the "COMMENCEMENT OF CONTRACT PERIOD" as specified. The contractor should complete total works including handing over within above specified period.

1.6.0 COMMENCEMENT OF CONTRACT PERIOD

The responsibility of the contractor shall start from the date of acceptance of LOI. The Actual date of start of contract shall be reckoned from the date of issue of e-mail/ letter/ Fax of letter for commencement of work of Tender.

1.7.0 **DEFECT LIABILITY PERIOD:** Defect Liability Period as per GCC Clause No: 74.0 is stands amended as below.

The Contractor shall be responsible for the rectification of defects in the works for a period of **24 Months** from the date completion certificate is issued by the Garrison Engineers- ATV for said buildings.

1.8.0 **SECURITY DEPOSIT CUM PERFORMANCE BANK GUARANTEE**

Clause 9.0 of GCC is amended as blow:

1.8.1 In the event of award of work, contactor shall submit security deposit @ **3% (Three Percent only)** of the contract value of the accepted tender within 21 (twenty-one) days from the date of issue of Letter of Intent (LOI). lf required, any extension of time beyond 21 days and up to 60 days may be granted by the Competent Authority. However, a penal rate of interest @12% per annum shall be charged for the delay in submission of Security Deposit after 21(twenty-one) days i.e. from 22nd day to the date of submission of Security Deposit but within 60 days after the date of issue of PO/ LOI. Further, if 60th day happens to be declared holiday in the concerned office of EPI, submission of Security Deposit can be accepted on the next working day. The SDPG shall be submitted in the form of Bank Guarantee (as per format in GCC), from any Nationalized bank / Scheduled Bank / or in the form of Insurance Security Bonds or Account Payee Demand Draft or Fixed Deposit Receipt or online Payment in an acceptable form.

1.8.2 This SDPG shall remain valid up to 90 (ninety) days after the end of defects liability period and shall kept valid by proper renewal till the acceptance of EPI/ DGNP.

1.8.3 In case the Contractor fails to submit the Security Deposit cum Performance Guarantee of the requisite amount within the stipulated period or extended period, the letter of intent will stands withdrawn and EMD of Contractor shall be forfeited.

1.8.4 In case even after 60 days from the date of LOI, bidder fails to submit the SDPG of the requisite amount, LOI will stand withdrawn and EMD of the bidder shall be forfeited.

1.8.5 In case Client increase/reduce the SECURITY DEPOSIT CUM PERFORMANCE BANK GUARANTEE percentage, the contractor shall submit the modified/amended SD PBG without any demur and protest. The contractor shall submit the modified/amended BG within 20 days from the intimation by EPIL, failing which; EPI shall be liable to deduct the amount from the Running Bills.

1.8.6 **Note: The bidder should give the undertaking in letter Head stating that "If the client DGNP increased the SDPBG percentage during the execution of work / contract period. The bidder should submit the additional BG for increase in percentage for his contract value without any demur."**

1.9.0 **RETENTION MONEY**

Following clauses shall be read in conjunction with Clause no. 10.0 of GCC.

1.9.1 Retention Money shall be deducted at 5% from each bill subject to the maximum of 5% of final contract price.

1.9.2 The Retention Money shall be refunded to the Contractor after expiry of defects liability period (referred to in Clause No. 74) or on payment of the amount of the final bill whichever is later. Refund of Retention money GCC clause stands good.

1.9.3 If the amount of Retention Money deduction in cash is more than Rs. 10.00 Lakh (Rupees Ten Lakh only), the excess amount can be refunded to Contractor against submission of Bank Guarantee of equivalent amount from a Nationalized bank / Scheduled Bank in the prescribed pro-forma of Performance Guarantee of EPI

1.10.0 SECURED ADVANCE: Clause no. 35 of GCC stands good.

In case contractor would like to avail the secured advance in such case, the necessary documents including invoices should be submitted in line with Client contract conditions and the decision of client in this regard is final.

1.11.0 Mobilization Advance: Clause no 8.0 of GCC read in conjunction with below.

1.11.1 Mobilization Advance: (a) Interest bearing mobilization advance for maximum 5% (Five percent) of contract sum shall be given to the Contractor if he/they so desire and on in specific written request, in two instalments, on production of a non-revocable Bank Guarantee (s), for the amount at least 110% of the advance on an approved form from a Nationalized/ Scheduled Bank. The Bank Guarantee (s) shall indemnify the Government against non-refund of mobilization advance and also against default on Contractor's part in performance of the Contract.

1.11.2 The rate of interest shall be 12.0% per annum, simple interest.

1.11.3 Recovery of mobilization is amended as below.

The 10% advance shall be repaid with percentage deductions from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the contractor has reached not less than 15 percent of the Contract Price or 3 months from the date of payment of advance, whichever period concludes earlier, and shall be made at the rate of 15% of the amounts of all Interim Payment Certificates until such time as the advance has been repaid, subject to the condition that the entire advance shall be completely repaid prior to the last payment due.

1.12.0 PAYMENT CONDITIONS: -

Clause no 37.0 of GCC stands good and the following clauses are also part of that,

1.12.1 Interim bills in the form of monthly running bills prepared by the contractor in soft as well as Hard copies shall be based on the quantities executed and measured.

1.12.2 Any deduction made towards, safety, ESHS, Quality issues etc. will be deducted from contractor on prorata basis.

1.12.3 The Contractor shall become entitled for payment of RA bills / Final bill etc., by the certification EIC. The Contractor shall have no claim on EPI in case the payments are delayed due to any reason whatsoever.

1.12.4 The Contractor shall become entitled to payment after certification of RA Bills by EPI and Client and without waiting for EPI's corresponding payment(s) from the Client/ Owner. However, the final RA Bill Payment will be made after receipt of EPI's corresponding payment(s) from the Client/ Owner as per GCC. Submission of each RA Bill should not be less than 3 % of work order value.

1.13.0 METHOD OF MEASUREMENT

Following clauses shall be read in conjunction with Clause no 36.0 of GCC

Mode of measurement shall be as per relevant clauses of technical specification of this tender. In case the same is not available the relevant IS 1200 in conjunction with IS 3385 shall be adopted. In case the same is also not available, the standard procedure adopted in CPWD shall be adopted. In case the same is not available in CPWD also, the measurement of the work done will be based on the mutual agreement between EPI/ DGNP/GE and contractor. In all the above cases, the interpretation of EPI / DGNP/GE will be final and binding to the contractor.

1.13.1 The excess quantity of concrete & Reinforcement steel Fe500D-CRS more than allowable wastage shall be recovered from contractor as per relevant ACC clauses.

1.13.2 Removable/ dismantling and disposal of Loose concrete above the cut-off level shall be under the scope contractor. If contractor fails to remove the cut-off level to pile cap embedded portion concrete, EPI will execute the same in bidder's risk and cost.

1.13.3 The concrete compact volume only measured for payment. Wastage should be within the limit of ACC Clause no 1.18.0 & 1.19.0.

1.14.0 TAXES AND DUTIES:

The following shall be also read in conjunction with clause no 13 of GCC:

1.14.1 The bidder/Contractor must be registered with GST and should have valid GSTIN number of the respective state of the project.

1.14.2 The bidder/contractor must submit as a compliances of GST Act, the invoices in GST compliant format.

1.14.3 Contractor's total price shall be inclusive of GST and other taxes and cess. Contractor shall submit to EPI the GST compliant tax invoice/debit note/revised tax invoice on the basis of which EPI will claim the input tax credit in its return. Since this is a works contract, the GST rate shall be as applicable presently.

1.14.4 GST charged in the tax invoice/debit note/revised tax invoice by the contractor shall be released separately to the contractor only after contractor files the outward supply details in GSTR-1 on GSTN portal and input tax credit of such invoice is matched with time of filing the monthly return. TDS under GST shall be deducted at prevailing rates on gross invoice value from the running bills).

1.14.5 Labour cess / LWF - Labour welfare fund shall be deposited by EPI @ 1% of value of work done or as applicable from to time as per the directions of Government of Andhra Pradesh by EPI. However, all the documentations and labour records shall be maintained properly by the contractor. It shall be produced to EPI / DGNP/ Govt Authorities as and when is required.

1.14.6 Seigniorage / Royalty Charges: The rate quoted by bidder shall be inclusive of all royalty / Seigniorage. If any royalty/ fee is payable to local authority, such royalty/ fee shall also be borne by the Contractor. Disposal shall be carried out strictly as per the regulations of local authority. However, the above materials shall not be removed out of Site premises without prior written authorization of the Project Manager.

1.14.7 The contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of EPI and shall also furnish such other information/document as EPI may require from time to time.

1.14.8 In case of any reduction in rate of taxes in future or the project getting exemption status prior to the last date of Bid submission or afterwards, the contractor shall pass on the benefit to EPIL immediately, failing which EPIL shall have the right to recover the differential amount from the amounts due to the contractor. Further in case of any increase in rate of taxes in future or the project losing exemption status prior to last date of bid submission or afterwards, the said increase of taxes shall be paid / reimbursed to the contractor, subject to the conditions that the client reimburses the said increased taxes to EPIL.

1.14.9 The total price quoted by the contractor shall be inclusive of all taxes and duties. However, such duties, taxes, levies, etc. which shall be notified after the last date of submission of bid and/or any increase/decrease over the rate existing on the last date of submission of Bid shall be reimbursed/recovered by the company on production of documentary evidence in support of payment actually made to the concerned authorities subject to reimbursed the same by client.

1.15.0 INSURANCE

The following shall be also read in conjunction with GCC clause no. 17

1.15.1 EPI shall take Contractor All Risks (CAR) policy, THIRD PARTY INSURANCE, marine cargo policy and Capital Plant and Machinery Policy for the whole project. THE CONTRACTOR shall assist EPI in follow up with insurance company in case of any claim related to CONTRACTOR's scope

of work. The Expenditure towards the insurance premium will be deducted from contractor running bill on prorata basis for corresponding work order value. EPI is not liable to pay any claim of the CONTRACTOR if it is not paid by insurance company due to any reasons whatsoever.

1.15.2 Workmen's Compensation Policy:-GCC clause no. 17 and 18.0 is modified as here under Contractor has to obtain workmen compensation Policy for the scope of work till completion of project. If the bidders does not submit the policy within One month from site handing over, EPI will avail the policy and expenditure towards the same will be deducted from the bidder with EPI overheads of 10%.

1.15.3 All men, materials, machinery, tools and plants, infra-structure, resources etc., as required for execution of "Works" shall be provided and arranged by CONTRACTOR for their portion of work. The amount/rate quoted in their offer by CONTRACTOR to EPI includes all charges, all direct and indirect cost of works, materials, labour, plant & equipment, all taxes , duties, levies, royalties, and labour welfare cess etc., all transportation charges including for cartage of issue material, electricity and water charges, site offices expenses, labour camp, bank guarantee charges, insurance charges(upto any port of India for imported materials only) , EPF/CPF/ Statutory contributions, preparation of all required design & detailed engineering and all required drawings etc., other expenses whatsoever, incurred on execution, completion and maintenance of the "Works" as per 'Tender Documents' and their own overheads and profit etc. CONTRACTOR shall comply with all the requirements laid down as per 'Tender Documents' as per terms, conditions, specifications, drawings, documents etc. given in the 'Tender Documents' for the completion, handing over, maintenance period etc. for the project. The contractor will not be allowed to take out equipment's from the site without the written permission of DGNP/EPI.

1.15.4 The contractor has to adhere to follow Environmental, Social, Health and Safety (ESHS), COVID-19 Manual, further guidelines released by Govt. time to time., etc. The rate quoted by the contractor is inclusive of constructing temporary approach road to site, Compliance of Environmental, Social, Health and Safety (ESHS), COVID -19 Guidelines, etc.as required for completion of work. Non conformity of Environmental, Social, Health Safety (ESHS), etc., will be viewed seriously and the EPI has rights to impose fines on the contractor as per (ESHS), manuals of EPI / IS codes.

1.15.5 The Contractor has to submit method statements before starting of the execution of works for approval of EPI / DGNP and same approved.

1.16.0 PRICE VARIATION:

Clause 16.0 of GCC of EPI stands Modified as Under .

(i) An account of any Price Variation / Escalation on whatsoever ground shall be entertained at any stage of works based on details mentioned in condition of contract of DGNP.

(ii) The periodicity for working out the variations will be three months. The first variation would be for the period of three months reckoned from the last due date for bid submission end date of tenders.

(iii) REIMBURSEMENT/REFUND ON VARIATION IN PRICES: Refer condition 63 of the General Conditions of Contracts IAFW-2249 and Condition of contract of DGNP enclosed in Volume-02.

(iv) However, the contractor will be eligible for any type of Price Variation / Escalation payment subject to release of the corresponding payment from client to EPI. No extra claim or compensation will be eligible for the follow ups or any delay occurred from client in this regard due to any reason, whatsoever.

1.17.0 QUANTITY VARIATION:

Following clauses shall be read in conjunction with Clause no 69.1 of GCC

1.17.1 The quantities given in the contract are tentative and may change to any extent (both in plus side and minus side). The quoted rates for individual items shall remain firm irrespective of any variations in the individual quantities.

1.17.2 EPI reserves the right to delete any item after awarding the work due to design change / soil condition changes.

1.17.3 No compensation becomes payable in case the variation of the final executed contract value is within the limit of plus / Minus (+/-) 20% Twenty Percentage) of awarded contract value.

1.17.4 If client approves rate revision towards quantity variation the same shall be passed on to contractor by deducting EPI tender margin for the particular package subjected to approval by EPI.

1.18.0 CEMENT AND RMC

Following clauses formed for supply of cement and RMC / Concrete for this project.

1.18.1 The contractor has to procure, storage, transport and place all types of cement, cement concrete as per technical specification, mix design and drawings provided by DGNP/EPI.

1.18.2 The contractor may install his own batching plant at site for supply of concrete required for his works. However, the bidder should meet clause no. 4, 4.5 & 4.9 of Volume-2 of the client condition of contract.

1.18.3 Else the contractor may choose for supply of concrete, the option of direct procurement of RMC from approved RMC supplier as per clause no. 4,4.5 & 4.9 of Volume-2of the client condition of contract. The approved cement shall be procured by the contractor as per the below cl no 1.18.6 to 1.18.11.

1.18.4 The contractor shall note that the arrangement of concrete supply for his works (through own batching plant or procurement through approved vendors) is fully contractor discretion. No extra claim on this account of concrete supply shall be entertained.

1.18.5 In case the contractor opts to install his own batching plant at site, the approved cement shall be procured by the contractor as per the below cl no 1.18.6 to 1.18.11.

1.18.6 Contractor has to identify the suppliers for cement from approved makes of DGNP and submit the Performa Invoice to EPI along with an indemnity bond in the prescribed format

indemnifying EPI against any possible theft / storage or any kind of damage to the procured materials.

1.18.7 EPI shall place the Purchase Order to the material supplier as per Performa Invoice submitted by contractor.

1.18.8 Payment shall be released by EPI to materials supplier only upon delivery of materials at site. Advance to materials supplier, if required, shall be paid by the contractor and the same shall be adjusted while making the payments to material suppliers against supply of material.

1.18.9 The material procured by EPI shall be handed over to the contractor immediately upon receipt at site.

1.18.10 EPI shall issue GST invoice to contractor based on the materials issued to the contractor.

1.19.0 REINFORCEMENT STEEL AND STEEL PRODUCTS

Following clauses formed for supply of reinforcement and other steel products for this project.

1.19.1 The contractor has to procure, storage, transport and placing of High strength deformed TMT (CRS) bars of Grade Fe-500D as per technical specification, and drawings provided by DGNP/EPI.

1.19.2 Contractor has to identify the suppliers for steel reinforcement from approved makes of DGNP and submit the Performa Invoice to EPI along with an indemnity bond in the prescribed format indemnifying EPI against any possible theft / storage or any kind of damage to the procured materials.

1.19.3 EPI shall place the Purchase Order to the material supplier as per Performa Invoice submitted by contractor.

1.19.4 Payment shall be released by EPI to materials supplier only upon delivery of materials at site. Advance to materials supplier, if required, shall be paid by the contractor and the same shall be adjusted while making the payments to material suppliers against supply of material.

1.19.5 The material procured by EPI shall be handed over to the contractor immediately upon receipt at site.

1.19.6 EPI shall issue GST invoice to contractor based on the materials issued to the contractor.

1.20.0 PAYMENT AGAINST EXTRA / SUPPLIEMENTARY ITEMS:

Following clauses shall be read in conjunction with Clause no 69.0 of GCC

1.20.1 No extra items shall be executed unless and until written instructions are issued by the project manager. Any extra item (including variation in specifications of listed item) executed by the contractor without the permission in writing shall not be payable. In case of extra items, contractor shall furnish detailed breakup of the rate of extra item with supporting documents with detailed cost break up duly signed by construction manager, which shall be got approved from the project manager.

1.20.2 Detailed cost breakup shall include basic cost of work, calculated as per market rates (material + labour + transport + equipment +wastage = total , then + overheads and profit upto 10% extra on total+ applicable taxes / duties).

1.20.3 Once EPI receives the approval and corresponding payment from client, the same shall be passed on to contractor as per above clause.

1.21.0 WATER &ELECTRICITY:

Clause no 44.0 of GCC stands good.

The contractor shall note that, contractor has to make own arrangement for construction power as well as for office purpose.

The contractor shall note that water can be drawn at one source on chargeable basis based on availability and contractor has to make own arrangement for transporting& storage of water

1.22.0 COMPENSATION FOR DELAY:

Clause no. 72.1 of GCC stands good.

If the Contractor fails to maintain the required progress in terms of clause72.4 or relevant clause of Additional Conditions of Contract, to complete the work and clear the Site on or before the completion date or extended date of completion, he shall, without prejudice to any other right or remedy available under the law to EPI on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below or such smaller amount as the Engineer in charge (whose decision in writing shall be final and binding) may decide on the amount of tendered value of the work for every completed day / week (as applicable) that the progress remains below that specified in Clause 72.4.1 or the relevant clause in Additional Conditions of Contract or that the work remains incomplete. This will also apply to items or group of items for which a separate period of completion has been specified.

i) For works with completion period not exceeding 3 months (as originally stipulated) @1% per day

ii) For works with completion period exceeding 3 months (as originally stipulated) @ 1% per week or part thereof.

Provided always that the total amount of compensation for delay to be paid under this Condition shall not exceed 10% of the Tendered Value of work or of the Tendered Value of the item or group of items of work for which a separate period of completion is originally given.

The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with EPI even after completion of the work.

1.23.0 Contractor has to submit the schedules of deliverables including material procurement plan for EPI/DGNP approval. In the event of failure of contractor to adhere to approved procurement schedule. EPI shall purchase the required material on behalf of contractor with its own cost and the cost of procurement including freight, loading, unloading plus epi overhead charges @10% of the landed cost of material at site shall be debited from contractor with any payable amount or from subsequent RA bill.

1.24.0 The CONTRACTOR shall be fully responsible to complete the "Works" in workmen like manner to the satisfaction of DGNP and EPI by maintaining high standard of quality and precision as per 'Tender documents', Agreements, Terms & Conditions, Specifications, Drawings etc., within the contractual completion period and within their contract value. In case Owner reduces or increases scope of work related to CONTRACTOR's portion of work, the same shall be binding on CONTRACTOR and the CONTRACTOR has to execute the same at rates paid by the Owner less EPI's margin.

1.25.0 Issues related to interpretation and claims, if any, related to CONTRACTOR's scope of work, arising out of contract between EPI and DGNP shall be referred with full justification by CONTRACTOR to EPI for settlement with Owner including arbitration with Owner, if inescapable, and outcome of such a settlement shall be binding on CONTRACTOR. EPI at its option may associate the CONTRACTOR in the above process of settlement for CONTRACTOR's portion of work. The cost & expenses on arbitration with DGNP/GE/Owner shall be shared by EPI and CONTRACTOR in proportion of CONTRACTOR's contract price and EPI's margin towards its overheads & profits. In case the award/settlement with the Owner is in favour of EPI, ninety percent of the award/settlement amount shall be shared between EPI and CONTRACTOR in proportion of CONTRACTOR's contract price with EPI and EPI's MARGIN towards its overheads & profits. The balance ten percent of the award/settlement amount shall be retained by EPI towards its administrative charges. In case the award/settlement is against EPI, the entire damages/counterclaims imposed, if any, shall be borne by CONTRACTOR alone and the CONTRACTOR shall have no claim whatsoever against, EPI in such a settlement. Further, EPI shall have no liability towards any claim of the CONTRACTOR, which is not paid by the DGNP/GE/Owner.

1.26.0 COMPLETION AND TAKING OVER

As soon as the project is finally completed, the Contractor shall inform EPI and EPI shall in turn inform to DGNP/GE/Owner. DGNP shall nominate a Board of Officers for checking/ verification of completed work as per the scope of work for final taking over the project.

1.27.0 A final certificate of rectification of all defects pointed out by the handing over taking over board shall be obtained by party.

1.28.0 **FINAL BILL**: The final bill will be submitted by the contractor within 90 days from the date of acceptance of completion of work accompanied by the following documents:

1.28.1 Completion certificate (or) Final Acceptance Certificate issued by the EPI / DGNP/ GE specifying the handing over of the work including list of inventories (fittings & fixtures).
1.28.2 No claim certificate by the contactor.
1.28.3 Duly approved by the DGNP/ GE 'As built' drawings in required sets.
1.28.4 Certified measurements.
1.28.5 All statutory approvals from various state / central govt. local bodies, if required for completion & handing over of the work as included in scope of Contractor.
1.28.6 Manufacture's guarantee of various machines / equipment's installed as part of works.

1.29.0 DRAWINGS:

1.29.1 The detailed drawings, specifications available with EPI and same will be made available to the contractor during execution of work at site.

1.30.0 TECHNICAL STAFF FOR WORK:

Following Technical staff is required to be deployed in conjunction with Technical Staff Requirement as per clause 27.0 of GCC.

Requirement of Technical Staff		**Minimum experience (Years)**	**Rate of Recovery (if the contractor not deployed)**
Qualification	**Number**		
Project Manager / Planning Engineer- Civil	1	05	Rs. 45,000/- per Month
Jr Engineer Civil (site execution, QA/QC, Billing cum Survey)	1	03	Rs. 25,000/- per Month
Site supervisor/ Foremen (Civil / Electrical/ Mech)	2	03	Rs. 25,000/- per Month
Requirement of Non-Technical Staff / office Staff			
Site Admin Assistant / Executive - For contractor	1	01	Rs. 25,000/- per Month
Site electrical helper and electricians- For contractor	1	01	Rs. 20,000/- per Month
Store keeper / watch & ward	2	01	Rs. 20,000/- per Month
Housekeeping	01	01	Rs. 15,000/- per Month

Note: (i) Manpower / Resources need to be increased by Contractor as and when required by project.
(ii) Site supervisor/ Foremen/ Safety Stewards to be deployed as and when required at site.
(iii) If the contractor failed to engage the above said manpower, the Rate of Recovery will apply by EPI on monthly basis

1.31.0 FURNISHED OFFICE ACCOMMODATION & MOBILITY AND COMMUNICATION TO BE PROVIDED BY CONTRACTOR TO EPI:

The Sub-Clause 28.3 of the Clause No. 28 of General Conditions of Contract (GCC) is deleted.

Sl. No.	**Description of items**	**Unit**	**Amount (Rs.)**
1	Safety Park including safety shoe / helmet / safety gadgets	LS	50,000.00
2.	QA / QC Lap including construction / instrument / functioning	LS	50,000.00
3.	Surveyor instruments / maintenance	LS	2,70,000/-
4	Printing cartridge and office stationary	LS	2,000/- / Month
7	Contractor has to provide	Month	

	uninterrupted power supply to EPI along with DG set Min *33* kVA for exclusive EPI office , lap & common store (If the failed to arrange, EPI will debit the actual expenses from RA bill)		

1.31.1 The above services already engaged by EPI for which the monthly charges shall be recovered from the contractors RA bills as per above table

1.31.2 In case of urgency, EPI shall procure the same and the expenditure shall be recovered after placing the work order on contractor from RA bills.

1.32.0 LABOUR CAMP:

1.32.1 The Contractor shall be responsible for accommodation, feeding and sanitary necessities, for their employed persons. The Contractor shall make his own arrangement for labour camp for his labour. No labour camp shall be allowed inside the project site. Employer shall not provide land for labour camp.

1.32.2 In case, Employer may provide the Contractor with a space for building a temporary site office and/or warehouse, which shall not be used for housing any labour or supervisory force of the Contractor. Within 2 weeks of the completion of the Contract, the Contractor shall remove and hand over to Employer the space made available in a clean and tidy condition.

1.32.3 If contractor plan to use the EPI installed labourcamp, EPI will debit the construction of labour camp on prorata basis. However, the maintenance and supply of water and electricity will under the scope of the contractor.

1.32.4 Colony / shelters to be constructed shall be situated at suitable heights where there is no danger of water (waste or rainy) accumulation; as such accumulated water ultimately leads to breeding ground for mosquitoes. Shelters constructed shall protect labourers / workers from rain, cold and heat. The material used for construction of shelters should be environmental and human health friendly. The size of each shelter should be such that there is no cramping or overcrowding.

1.32.5 Electric supply should be provided at camps for illumination purpose. Adequate potable and other water for the use of the camp residents should be provided. The quantity shall be decided considering the number of persons residing in the camp. The provisions shall not be less than 10 liters of pure and Wholesome water per head per day for drinking purposes and 100 liters of clean water per head per day for bath and washing purposes.

1.32.6 There should be proper access to the shelters. Labours residing at camp should be encouraged to maintain their camp clean by providing waste bins and waste disposal system. Facility should be created to drain out waste water. Drainage of camps/colony shall be connected to drainage system or soak tanks to avoid water accumulation.

1.32.7 Adequate toilets and washing facilities shall be provided for the labourers inside the camp. The Contractor shall make arrangement for conservancy and sanitation in the labour camps according to the rules of the local public health and medical authorities and shall generally follow the requirements of "Model Rules for the Protection of Health and Sanitary Arrangements for Workers" employed by C.P.W.D.

1.32.8 Safety & Health related posters shall be placed in the camp to increases safety and health awareness amongst the laborer. The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel residing at the camp from insect and pest nuisance, and to reduce their danger to health.

1.32.9 The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide. First-aid facility shall be provided in the camp also few workers should be trained to render first-aid.

1.32.10 Recreation facilities should be provided in the camp to entertain laborers so that after hard work they remain in camp.

1.32.11 The Contractor shall implement a comprehensive and effective vector control programme for the camp site which shall include all necessary measures to prevent the camp site from becoming favorable to the breeding or harboring of mosquitoes or other vectors.

1.32.12 Vector control shall consist of:

- Checking for mosquito breeding at least once a week.
- Larviciding all stagnant water using insecticides or anti-mosquito oil at least once a fortnight.

1.32.13 Thermal fogging at least once a fortnight and if the Site is located within a malaria – sensitive area, residual spraying of the walls at monthly intervals shall be required. The Contractor shall comply with and pay all charges levied by any Government or Public Authority with jurisdiction on matters of pollution or hygiene.

1.33.0 LABOUR SAFETY PROVISION:

Clause no 22.0 of GCC stands good and in addition to that the following shall be applicable

- The contractor has to adhere to follow Environmental, Social, Health and Safety (ESHS), COVID-19 Manual, etc. The rate quoted by the contractor is inclusive of constructing temporary approach road to site, Compliance of Environmental, Social, Health and Safety (ESHS), COVID -19 Guidelines, etc.as required for completion of work. Non conformity of Environmental, Social, Health Safety (ESHS), etc., will be viewed seriously and the EPI has rights to impose fines on the contractor as per (ESHS), manuals of EPI / IS codes.

1.34.0 TESTS AND INSPECTION:

Clause no 53.1 of GCC stands good and in addition to that the following shall be applicable

- Lab / testing equipment for pilling works have to be procured and installed by contractor. Later on expenditure can be shared after other contractor deployed.
- All works executed or under the course of execution in pursuance of this contract shall at all times be open to inspection and supervision of EPI. The work during its progress or after its completion may also be inspected, by Chief Technical Examiner of Government of India (CTE) and/ or an inspecting authority of State Government of State in which work is executed and/or by third party checks by Owner/ Clients. The compliance of observations/ improvements as suggested by the inspecting officers of EPI/CTE/ State authorities/ Owners shall be obligatory on the part of the Contractor at the cost of Contractor. Any recovery, penalty imposed by CTE due to non-performance, noncompliance of agreed condition or otherwise whatsoever the same shall be recovered from RA Bill of contractor.

1.35.0 BLASTING:

- Port Control Tower substructure works may need the blasting works. So, the contractor has to engage the licensed blasting holder for this works.
- The contractor shall be responsible of obtaining necessary permits for blasting, EPI will provide the supporting for the same
- The contractor has to arrange own safety arrangement for blasting works.

1.36.0 GATE PASS AND PERMITS:

Client conditions of gate pass entry as follows

- Photo passes will be issued to the contractor, his agent, employees, representative and work people etc. The contractor shall get the antecedents of the people likely to be employed by him verified from Civil Police and the police verification report shall be enclosed with the application requesting for issue of passes. The application for issue of passes shall contain the information like name and address of the person likely to be employed, Contract Agreement Number, date of commencement and completion. The application must have endorsement of concerned Garrison Engineer. The passes issued initially will be valid for one month and thereafter renewed for every three months. The contractor shall apply for issue of passes well in advance. The passes will be issued on payment of Rs 5/- each. In case of loss of pass, a fine of Rs. 1000/- for each pass lost will be charged for the first loss. Rs. 2500/- for the second loss and Rs. 3500/- for the third & pass will not be reissued. The contractor shall return any specific / all the passes issued to him on completion of the work or at any time on demand by the department. The contractor shall be responsible for the conduct and actions of his workmen, agents & representatives.

- 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`s or authorities in-charge of the restricted areas may at their sole discretion permit to be used. The contractor's authorized 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.

- Contractor shall provide / construct a separate gate as directed by GE and users for entry of his labour. A shed as required at entry point shall also be provided / constructed by contractor. A separate entry shall be created for entry of materials / vehicles / Equipment's etc., at the location as directed by Engineer-in-Charge.

1.37.0 TOOLS AND PLANTS / MONITORING AND MEASURING EQUIPMENT (MMES)

The minimum requirement of Plant and Machineries are mentioned below, however bidder should deploy all necessary plant and machineries required to complete the work without any extra cost to EPI.

- Formwork set – 400 sqm
- Bar Cutting Machine - 1 Nos.
- Bar Bending Machine - 21 Nos.
- Dewatering pumps - 2 Nos.
- Auto level - 2 No's
- 33 KVA DG set – 01 nos
- Batching Plant-01 nos – optional
- Silos- 1 set
- Crane – 01 nos
- Water tanker – 01 nos

1.38.0 DISQUALIFICATION:

The tenderers may note that they are liable to be disqualified and not considered for the opening of Price Bid if;

a) Representation in the forms, statements and attachments submitted in the pre-qualification document are proved to be incorrect, false and misleading.

b) They have record of poor performance during the past 10 (ten) years such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the contractor, inordinate delay in completion, consistent history of litigation / arbitration awarded against the contractor or any of its constituents or financial failures due to bankruptcy etc. in their ongoing / past projects.

c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.

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

1.39.0 Priority of work: The contractor has to deploy resources and plan the work accordingly and nothing extra shall be payable to the contractor on this account. The contractor has to ensure safety of the occupants as to avoid any hazard to occupants.

1.40.0 CONCILIATION AND ARBITRATION:

General Conditions of Contract (GCC) Sub Clause no.76.1 and 76.3 of Arbitration Clause no.76.0 are amended as given below. Sub Clause no.76.2 will remain unchanged.

Cl. 76.1 Conciliation and Arbitration: shall be read as below.

A. Before resorting to arbitration as per the clause given below, the parties if they so agree may explore the possibility of conciliation as per the provisions of Part III of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015. When such conciliation has failed, the parties shall adopt the following procedure for arbitration:

B. Except where otherwise provided for in the contract, any disputes and differences relating to the meaning of the Specifications, Design, Drawing and Instructions herein before mentioned and as to the quality of workmanship or materials used in the work or as to any other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the Contract, Designs, Drawings, Specifications, Estimates, Instructions, or these conditions or otherwise concerning the works of the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the Sole Arbitrator mutually agreed and appointed by both the parties as per the provisions of Arbitration and Conciliation Act, 2015 or any statutory modification or re-enactment thereof and the rules made thereunder. The person approached for appointment as Arbitrator shall disclose in writing circumstances, in terms of Sub-Section (1) of Section (12)

of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 as follows:

(i) such as the existence either direct or indirect, of any past or present relationship with or interest in any of the parties or in relation to the subject-matter in dispute, whether financial, business, professional or other kind, which is likely to give rise to justifiable doubts as to his independence or impartiality; and

(ii) which are likely to affect his ability to devote sufficient time to the arbitration and in particular his ability to complete the entire arbitration within a period of twelve months.

C. The Arbitrator shall be appointed within 30 days of the receipt of letter of invocation of arbitration duly satisfying the requirements of this clause.

a) If the arbitrator so appointed resigns or is unable or unwilling to act due to any reason whatsoever, or dies, the parties may mutually appoint a new arbitrator in accordance with these terms and conditions of the contract, to act in his place and the new arbitrator so appointed may proceed from the stage at which it was left by his predecessor.

b) It is a term of the contract that the party invoking the arbitration shall specify the dispute/ differences or questions to be referred to the Arbitrator under this clause together with the amounts claimed in respect of each dispute.

c) The Arbitrator may proceed with the arbitration ex-parte, if either party, in spite of a notice from the arbitrator, fails to take part in the proceedings.

d) The work under the contract shall continue as directed by the Engineer-In-Charge of EPI, during the arbitration proceedings.

e) Unless otherwise agreed, the venue of arbitration proceedings shall be at the venue given in the 'Memorandum' to the 'Form of Tender".

f) The award of the Arbitrator shall be final, conclusive and binding on both the parties.

g) Subject to the aforesaid, the provisions of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 or any statutory modifications or re-enactment thereof and the Rules made there under and for the time being in force shall apply to the arbitration proceedings and Arbitrator shall publish his Award accordingly.

Clause no.76.3 **JURISDICTION: shall be read as below.**

The courts in **Delhi/ New Delhi** alone will have jurisdiction to deal with matters arising from the contract.

1.41.0 PF & ESI CONTRIBUTION & RETURNS:

- Contractor shall submit a copy of latest PF& ESI returns and inspection reports from statutory authorities along with a copy of challans for having deposited PF & ESI contributions every month.
- PF & ESI Rate of interest and share contribution of employee and employer shall be as per Government of India latest Guidelines.

- Contractor shall fully comply all other formalities as per the PF & ESI statutory provisions and submit a copy of the same for replying to Statutory authorities in case of any complaints.
- It is the responsibility of undertake necessary care and make arrangement for transportation and treatment of his employee contractor to at ESI Hospital or any tie up hospitals of ESIC.
- Contractor should assist and guide his employees for claiming lawful benefits from ESI.

1.42.0 The clause No. 84.0 of GCC shall be replaced as under:

With the issue of Letter of Intent (LOI) / Letter of Acceptance (LOA), the event of signing of agreement shall be done only after receipt and verification of Security Deposit cum Performance Bank Guarantee (SDPG) or within such extended time, as may be granted by EPI. Subsequently, Letter for Commencement of Work (LOA) will be issued to Contractor that will be reckoned as an actual date of start of work. The cost of stamp papers, stamp duty, registration, if applicable on the contract, shall be borne by the Contractor. In case, the Contractor does not sign the agreement as above or does not start the work within schedule times his earnest money is liable to be forfeited and letter of intent consequently will stand withdrawn.

SPECIAL CONDITIONS

1. **GENERAL**

1.1 The following Special Conditions shall be read in conjunction with the General Conditions of Contracts, IAFW-2249 (1989 Print) and IAFW-1779A (Revised 1955) including Errata/ 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 herein before as well as referred to in IAFW-2249 (General Conditions of Contracts) shall mean the specifications contained in the MES Schedule.

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, and 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.

2. **INSPECTION OF SITE BY THE TENDERER:**

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 such other cogent condition etc that may affect the entire completion of work under this contract.

2.2 The tenderers shall be deemed to referred to above irrespective of have visited the site(s) and made themselves familiar with the working conditions etc, referred to above whether they actually inspect the site(s) or not. No extra payment consequent on any mistake or misunderstanding or otherwise on this account will be allowed.

3. **CONDITIONS OF WORKING AND ISSUE OF SECURITY PASSES ETC.**

3.1 The work lies in **restricted area.** Site plan is enclosed to tender documents.

3.2 **PERMISSION TO ENTER 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 ensure admission. Whether 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.

SPECIAL CONDITIONS (CONTD..,)

3.3 **ISSUE OF PHOTO PASSES:** Photo passes will be issued to the contractor, his agent, employees, representative and work people etc. The contractor shall get the antecedents of the people likely to be employed by him verified from Civil Police and the police verification report shall be enclosed with the application requesting for issue of passes. The application for issue of passes shall contain the information like name and address of the person likely to be employed, Contract Agreement Number, date of commencement and completion. The application must have endorsement of concerned Garrison Engineer. The passes issued initially will be valid for one month and thereafter renewed for every three months. The contractor shall apply for issue of passes well in advance. The passes will be issued on payment of ` 5/- each. In case of loss of pass, a fine of ` 1000/- for each pass lost will be charged for the first loss. ` 2500/- for the second loss and ` 3500/- for the third & pass will not be reissued. The contractor shall return any specific / all the passes issued to him on completion of the work or at any time on demand by the department. The contractor shall be responsible for the conduct and actions of his workmen, agents & representatives.

3.4 **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`s 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.

3.4.1 Contractor shall provide / construct a separate gate as directed by GE and users for entry of his labour. A shed as required at entry point shall also be provided / constructed by contractor. A separate entry shall be created for entry of materials / vehicles / Equipment's etc., at the location as directed by Engineer-in-Charge.

3.4.2 Lumpsum quoted shall be deemed to be inclusive of above all provisions, nothing additional cost will be paid to the contractor on this account.

3.4.3 After completion of Phase –I&II, the entire work shall be removed from the site and the same will become the property of the contractor. Cost of the above provision shall be deemed to be included in the unit rates/amount quoted by the contractor and no extra claim will be admissible on this account. The work related to entry/exit arrangement shall be completed before commencement of the main work. The contractor shall make good the disturbed surfaces to match with the original all as directed by the Engineer-in-Charge without any extra cost.

3.5 **WORKING CONDITION:** The contractor will be permitted to work at site up to 1700 hours except on Saturday, Sunday and other holidays. However, permission may be granted at the discretion of the department to work after 1700 hours and Saturday, Sunday and other holidays on the request of the contractor. The contractor shall apply well in advance (at least 7 days in advance) for such permission. The contractor shall have no claim for extra payment or compensation what so ever on account of denial of permission to work after 1700 hours or on Saturday, Sundays and on other holidays. The exact working hours, days and non-working days observed for the restricted areas, where the work are to be carried out shall be deemed to have been ascertained by the contractor before submitting his tender.

SPECIAL CONDITIONS (CONTD..,)

3.6 **SEARCH:** The persons in possession of photo passes will only be permitted to enter into the restricted area. The contractor, his supervisor, representatives and workmen, materials cars, vehicles trucks etc are liable to search at every time of entry and exist and also any number of times inside the area. The contractor shall have no claim on account of loss of time on this amount. The contractor and his agents, employees and work people shall also observe all other rules promulgated by the authority controlling the installation/area in which the work is to be carried out, i.e., prohibition of smoking and lighting, fire precautions, keeping to specific route, observing specified timings.

3.7 **FEMALE SEARCHER:** If the contractor desires to employ female labour on works to be carried out inside the area of factory, depot, park, etc and female searcher is not borne on the authorised 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/Group `D` servant) calculated for the period female labour is employed by him inside that area. If more than one contractor employs female labour 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 contractor 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.

3.8 **WORKING HOURS**: The contractor shall be allowed to work during normal working hours. However, the contractor or his workman shall be permitted to work on Saturday, Sunday (s) holiday or after normal working hours only with prior written permission from the Garrison Engineer. If in order to complete the entire work under this contract within the stipulated period of completion, the contractor wants to carryout multiple shift work, he will be allowed to do so with prior written permission from the GE and without any extra cost to the Government.

3.9 **WORKS ON HOLIDAYS:** The contractor shall not carry out any work on gazetted 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 reasons for such declarations.

3.10 **ACCESS TO RESTRICTED AREA AFTER COMPLETION OF WORKS:** After the works are completed and surplus stores, etc removed by contractor or his agents, or representatives or workmen etc they 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.

3.11 **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, any allowed by authorities to enter the restricted area, must be fitted with serviceable fire extinguishers.

SPECIAL CONDITIONS (CONTD..,)

4. **CONTRACTOR'S REPRESENTATIVES AND WORKMEN**:

4.1 Contractor attention is invited to condition 25 of IAFW-2249. The contractor shall employ only Indian Nationals as his representatives, servants 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 works. If for reasons of technical collaboration or other considerations, 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. 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 bonafide of such people. The Engineer-in-Charge shall have full powers and without giving any reason may order the contractor to immediately cease to employ, in connection with this contract, any representative, agent, servants and workmen or employees whose continued employment is in his opinion undesirable. The contractor shall not be allowed any compensation on this account.

4.2 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, and 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.

4.3 The contractor and his agents, employees and work people shall observe all the rules promulgated by the authority controlling 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.

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 whichever is higher.

5.2 Schedule of minimum fair wages is not enclosed along with the tender, but the contractor is deemed to have full knowledge regarding the minimum fair wages payable to the labour as legally effective on the day of submission of tender irrespective of the fact, the gazette notification may not have been published or that he was unaware of the increase in the minimum wages. For all purposes, the minimum wages legally effective on the date of receipt of tender shall be the basis. The minimum wages legally effective referred above are the minimum wages notified in Gazette or any local regulations whichever is higher.

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. **ROYALTY (Reference condition 14 of General Conditions of Contracts (IAFW-2249)**

6.1 No quarries on charge of department are available. The contractor shall make his own arrangements for obtaining land for quarrying sand/stones and obtaining other materials required for the work. Payment of royalties of such materials is to be borne by the contractor.

SPECIAL CONDITIONS (CONTD..,)

7. **AVAILABILITY OF DEFENCE LAND (Ref condition 24 of IAFW-2249)**

7.1 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 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 as marked in site plan can be used for accommodation of labour and canteen, however user can order contractor to vacate the area as and when user required without any excuse.

8. **SUPPLY OF WATER**

8.1. Refer Condition – 31 of General Conditions of Contracts IAFW – 2249 and Clause 1.13 of MES Schedule Part – I.

8.2. Water will be supplied by DGNP (V) at the point[s] marked on site plan / as decided by the GE at MRS location. 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 Contractor. 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. 65.00 per 1000 litres** of water consumed. Please note that water take off point is at Main Receiving Station only. Contractor has to make his own arrangement as required at site to transport the water from MRS point.

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 DGNP 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 DGNP 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 DGNP including testing of the same and his unit rate shall be deemed to include this aspect."

9. **SUPPLY OF ELECTRICITY**

9.1. Electric supply required for the work will not be made available by department. Contractor shall make his own arrangements for electric supply required for the work, no compensation whatsoever shall be allowed on this account.

SPECIAL CONDITIONS (CONTD..,)

10. **CONTRACT LABOUR REGULATION AND ABOLITION ACT**

10.1 The contractor shall be bound by the Labour Regulation and Abolition Act 1970 and rules framed there under for the workmen employed on the work. No contractor can undertake or execute his work without a license issued by Licensing Officer as per Labour Laws in force.

11. **CO-OPERATION WITH OTHER AGENCIES AT SITE OF WORK**

11.1 The contractor shall permit free access and generally afford reasonable facilities and usual conveniences to other agencies or departmental workmen to carry out their part of the work if any under separate arrangements. The contractor will not be allowed any extra payment on this account.

12. **INDIAN STANDARDS**

12.1 Materials brought by the contractor for incorporation in the work shall, unless otherwise specified in the particular specifications comply with the requirement of the latest relevant Indian Standards (IS).

13 **PERIOD OF KEEPING THE TENDER OPEN (VALIDITY OF TENDER)**

13.1 The tender shall remain open for acceptance for a period **90 (Ninety)** days from the bid submission end date.

14. **SECURITY OF CLASSIFIED DOCUMENTS**

14.1 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 to any one unconnected with this contract. 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).

15. **RECORD OF MATERIALS AND PURCHASE VOUCHERS**

15.1 The quantity of materials such as paints, water proofing compound, chemicals, and the like as applicable and as directed by the Engineer-in-Charge (The quantity of which cannot be checked after incorporation in the work) shall be recorded in measurement book and signed by the contractor and the Engineer-in-Charge as a check to ensure that the required quantity had been brought to site for incorporation in the work.

15.2 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. The contractor shall ensure that the materials are brought to site, in original sealed container/packing bearing manufacturers marking except in the case of the procurement of material(s) being less than smallest packing.

15.3 Contractor shall produce original receipted vouchers/ invoices from manufacturers and/or their authorized dealers/ agents/ 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 claiming any payment and the same will be defaced by Engineer-in-Charge as a token of verification, indicating reference to the contract number, under his dated signature. GE shall personally ensure that the contractor in each case has produced the receipted vouchers before making RAR payment to the contractor:-

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(a)	Water proofing compound	(b)	Chemical for anti-termite treatment
(c)	Paints including primer	(d)	UPVC/ Cast Iron/ DI/MS/GI pipes and fittings
(e)	Sanitary fittings	(f)	Factory made door, window and ventilator
(h)	Floor and wall tiles.	(h)	Builders Hardware
(i)	Tarfelt/ bituminous products	(j)	Admixtures and chemicals for concrete
(k)	Salt glazed stone ware pipes	(l)	Electrical and water supply fittings and fixtures.
(m)	Cables / wires / LT/HT panels and including lifts.		

16. **CLEANING DOWN (Refer Condition 49 of IAFW-2249).**

16.1 The contractor shall clean all floors, remove cement , lime or paint drops, clean joinery, glass panels etc., touch up all paint work and carry out all necessary items of work in connection therewith and the contractor shall also 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 contract sum quoted shall be deemed to include the same.

17. **CONTRACTOR'S PLANT/EQUIPMENT AT SITE**:

(a) The contractor shall furnish to the Engineer-in-Charge a distribution return of his plant/ equipment on the site of works stating the following particulars: -

(i) Particulars of plant/equipment i.e., Make, Manufacture's No., Model No. if any, Registration No., if any, capacity, year of manufacture, year of purchase etc.

(ii) Total quantity on site of work.

(iii) Location indicating quantity at the site of work.

(b) For the purpose of this condition, plant/equipment shall include vehicles, trucks and Lorries but not the workmen's tools and or any manually operated tools/equipment.

(c) The Engineer-in-Charge shall record the particulars supplied by the contractor as aforesaid, in the works diary and send a return to GE for record in his office.

(d) The first return shall be submitted immediately after any plant of equipment is brought to the site. Thereafter every week changes in the return shall be furnished in the following form:-

Sl No	Particulars of Plant/Eqpt	Total No. at Site of work	Location	Remarks
			Addition since_____ Reduction since_____	

(e) A complete return showing the upto-date position of plant/equipment at site shall be submitted on 15th of every month till the works are completed and the site cleared.

(f) The contractor's attention is invited to condition 34 of IAFW-2249 General Conditions of Contracts according to which no tool, plant/equipment shall be removed off the site without written approval of the GE.

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18. **APPROACHES**

18.1 Contractor shall make suitable temporary approaches to work site, if required after obtaining approval in writing of the GE to the layout of such approaches, to convey men, materials, plants and machinery required for the satisfactory completion of work and on completion of work the site shall be cleared of all temporary approaches. The tendered rates shall, interalia, be deemed to include for the aforesaid contingencies.

19 & 20 **- BLANK -**

21. **OFFICIAL SECRET ACT: Refer condition 2 of IAFW-2249.**

21.1 The contractor's attention is invited to the Indian Official Secret Act Particularly Section 5 thereof.

22. **GST ON WORKS CONTRACTS BY STATE AND CENTRAL GOVERNMENT, OCTROI AND OTHER DUES**

22.1 The tendered rates shall be deemed to include all duties, Octroi, GST on Works Contract and labour welfare cess, levies or any other taxes/duty etc.

22.2 **-BLANK-**

22.3 ***GST (Goods and Services Tax) is applicable for the subject work.***

23. **DAMAGE TO OTHER STRUCTURE/BUILDING**

23.1 Any damage caused to the existing structure (s) during the execution of the work shall be made good by the contractor at his cost and the site of work left clean and tidy on completion. Rectification/making good shall confirm to the standard of workmanship originally used in the work and finished work shall match with the existing work in all respects to the entire satisfaction of Engineer- in-Charge. In case of any dispute on this account the matter shall be referred to the GE, whose decision in writing shall be final, conclusive and binding.

24. **FOREIGN EXCHANGE/IMPORT LICENSE**: No foreign exchange and/or import license will be arranged by the Department in connection with the work under this contract.

25. **LOSS OR DAMAGE ON ACCOUNT OF ENEMY ACTION**

(a) If as a result of enemy action, the contractor suffers any loss or damage, the Govt shall reimburse to the contractor such loss or damage, to the extent and in the manner hereinafter provided:

(i) The loss suffered by him on account of any damage or destruction of his plant/equipment (as defined in condition 17(b) above) or materials or any part of parts thereof. The amount of loss assessed by the Accepting Officer of the contract on this account shall be final and binding.

(ii) Compensation paid by him under any law for the time being in force to any workmen employed by him for any injury caused to him or the workmen's legal successors for loss of the workmen's life.

(b) No reimbursement shall be made nor shall any compensation be payable under the above provisions unless the contractor had taken Air Defence Precautions ordered in writing by GE or in the absence of such orders, reasonable precautions. No reimbursement shall be made nor shall any compensation be payable for any plant/equipment or materials not lying on the site of work at the time of enemy action.

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26. **PERMIT FROM LOCAL AUTHORITIES FOR PLYING VEHICLES**:

26.1 Contractor shall make his own arrangements for obtaining necessary permit from local authorities for plying his vehicles for the work in accordance with the rules and regulations of the land.

27. **REGISTRATION FEE TRADE TAX. INCOME-TAX ETC.:**

27.1 Tendered contract sum amount shall also be deemed to include the payment of all taxes like registration fee, if any, Trade tax. Income Tax and other taxes/levies to be paid to the Govt of AP or Central Govt., already in force and as may be modified from time to time. The contractor may ascertain full details in this respect from the concerned departments.

28. **RECORD OF CONSUMPTION OF CEMENT:**

28.1 For the purpose of keeping a record of cement procured and consumed in works the contractor shall maintain a pucca bound register in the form approved by the Engineer-in-Charge showing daily consumption quantity used in works and the balance in hand. The contractor's representative and the Engineer-in-Charge shall sign the daily in token of their verification of its correctness. The check will not, however, absolve the contractor of his responsibility to justify the consumption of cement at the time of finalisation of his accounts. The register shall be kept at site in the safe custody of the contractor during progress of the work and shall, on demand, be produced for verification of inspecting officers.

29. **BLANK**

30. **QUALIFIED TRADESMEN:**

30.1 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)/Similar reputed and recognized 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/semi-skilled tradesmen required in each trade. The contractor shall submit the list of such tradesmen along with requisite certificates to GE for verification and approval. If the tradesmen are found to have inadequate skill to execute the work of their trades, leading to un-satisfactory workmanship, the contractor shall remove such tradesmen within a week after written notice to this effect by the GE and shall engage other qualified tradesmen after prior approval of GE. 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.

31. **SETTING UP OF SITE LABORATORY BY THE CONTRACTOR**

31.1 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's/ instruments as well as the equipment's or any other equipment which obviously required at site for immediate testing which can be feasible to provide at site as per the requirement of CA and as directed by GE without any extra cost to the Govt.

(i) Compressive (Crushing) strength testing machine.
(ii) Timber moisture content meter.
(iii) Weight/Weighing measuring machine.
(iv) Sieve set both for fine and coarse aggregate.
(v) Cube moulds for cement testing and concrete testing.
(vi) Cone for slump test.
(vii) Field proctor density test equipment.
(viii) Cement testing machine for initial/final setting/consistency.
(ix) Working platform.

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

31.3 A list of equipment/instruments with their brief details viz, capacity/size, least count as applicable, shall be submitted by the contractor to GE approval within 02 weeks of placement of Work Order No.1.

31.4 After obtaining approved list of equipment/instruments from GE, site lab shall be established by the contractor and face reported by the contractor to GE in writing who will verify the fact and satisfy himself of the facilities provided, condition of the equipment/instruments, their calibration certificate etc. Thereafter GE shall issue a certificate to this effect in writing. Listing out equipment particulars etc. Only after issue of this certificate by GE, the tests shall be carried out and materials so approved shall be incorporated in the work. If any equipment/instrument is found unsuitable by GE, the same shall be removed/corrected without any extra cost of Government and tests on these equipments shall be carried out only after taking written approval from GE.

31.5 The above said equipments/instruments as mentioned above shall be exclusively used for this subject contract only by the department and by the contractor. The contractor shall employ a Qualified/experienced Lab technician to carry out the material testing as per procedures laid down in relevant IS Codes as amended from time to time.

31.6 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.

31.7 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.

31.8 The cost for the equipment's/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.

31.9 For further details refer Particular Specifications here in after.

31.10. The Contractor shall strictly follow, at all stages of work, the stipulations contained in the Indian Standard Safety Code or its equivalent British Standard and the provisions of the safety code and the provisions of the safety rules as specified in the General Conditions of the Contract for ensuring safety of men and materials.

32. **SPECIMEN SPECIAL CONDITION FOR ADOPTION OF CRITICAL PATH METHOD IN LIEU OF TIME AND PROGRESS CHART:-**

(a) 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 will be submitted in four copies within two weeks from the date of handing over the site

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(b) During the currency of the work, the contractor is expected to adhere to the time schedule and this adherence will be a part of contractor's performance under the contract. During the execution of the work, the contractor is expected to participate in the reviews and updating of the network under taken by the GE. These reviews 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 revisions of the schedule as a result of the review will be submitted by the contractor to the GE within a week who will approve it after due scrutiny. The contractor will adhere to the revised schedule thereafter. In case of contractor disagreeing with revised schedule the same will be referred to the Accepting Officer, whose decision will 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.

(c) The Contractors shall mobilise an employ sufficient resources to achieve the detailed Schedule within the broad frame work of the accepted method of working and safety.

(d) No additional payment will be made to the contractor for any multiple shift work or other incentive methods contemplated by him in his work schedule even though the time schedule is approved by the department.

33. **CONCILIATION**

(a) Consequent to enactment of the Arbitration and Conciliation Act 1996, and with an objective to encourage settlement of disputes through conciliation, President has accorded sanction to include special Condition for Conciliation is the MES contracts to be concluded by Zonal/Project Chief Engineers. Amendment of Conciliation Act 1996 as under:-

(i) As per Sub Section 5 of Section 12 of Arbitration and Conciliation Act 1996 inserted through Arbitration & Conciliation (Amendment) Act 2015, any person who has past or present relation with either of the parties shall be intelligible for appointment as arbitrator. However, under the proviso of Sub Section 5 of Section 12, parties may agree for waival of this provision by an express agreement in writing.

(ii) A Sample of written agreement is hereby enclosed as annexure to this contract and either of parties can initiate the agreement and forward to the other party. The second party shall forward this to the appointing authority duly signed, if agreed.

(iii) The agreement gives waival only to Sub Section 5 of Section 12 Arbitration and Conciliation act 1996. However, all the other sections of the arbitration and Conciliation (amendment) Act 2015 shall be applicable.

(b) On finalization of conciliation proceedings, the settlement agreement shall be signed by Accepting Officer on behalf of Union of India after ascertaining the availability of funds.

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(c) In case the net total amount of payment involved in the settlement agreement exceeds Rs. 2.00 lakhs, Accepting Officer will consult next higher authority i.e DGNP(V) and obtain clearance before conclusion of Conciliation proceedings.

(d) The amount of settlement agreement shall be treated as as agreed amount payable under the contract and such payment shall be processed through a hand receipt.

33.1. **SCOPE OF CONCILIATION**

33.1.1 This is applicable to contract concluded by Zonal/Project Chief Engineers.

33.1.2 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 irrespective 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 the application to parties.
(d) Disputes relating to non-return of schedule 'B' store over issued to contractor.
(e) Any other dispute 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 lakhs or one percent of the contract amount whichever is less.

33.2 **COMMENCEMENT OF CONCILIATION PROCEEDINGS**

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

(b) Conciliation proceedings shall commence when, the other party accepts in writing the invitation to conciliate.

(c) 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.

33.3 **NUMBER OF CONCILIATIONS:** There shall be a Sole Conciliator.

33.4 **APPOINTMENT OF CONCILIATOR :** All disputes brought out in para 33.1.2 (a) to (c) above shall be referred 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 the Director General Naval Projects, Visakhapatnam or in his absence the Officer Officiating as the Director General specifically delegated by the DG in writing.

33.5 **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.

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34. **MATERIALS AND SAMPLES**

(a) Refer Condition 10 of IAFW-2249.

(b) The materials and articles, which have been specified from certain makers/ manufacturers, shall be of makes/manufactures as specified. If the manufacturers specified in tender documents make both ISI marked and conforming to ISI, the materials/articles shall be ISI marked.

(c) The materials and articles, which have not been specified in tender documents by makes/manufacturers, shall be as under:-

(i) If ISI marked materials are being manufactured the same shall be ISI marked. For list of ISI marked manufacturers refer website of BIS i.e. www.bis.org.in.

(ii) If ISI marked materials are not being manufactured the same shall be conforming to IS specifications.

(d) Materials of local origin shall be as specified and conforming to samples kept in GE's office. The tenderer is advised to inspect sample of materials which are displayed in the office of GE, before submitting his tender. The tenderer shall be deemed to have inspected the samples and satisfied himself as to the nature and quality of materials, he is required to incorporate in the work irrespective of whether he has actually inspected them or not.

(e) The contractor shall not procure materials and articles unless the samples are first got approved by the GE.

35. **HANDING OVER OF SITE**

35.1 Site for execution of work will be available as soon as the work is awarded. In case it is not possible to make the entire site available on the award of work, the contractor will have to arrange his working programme accordingly. No claim whatsoever, for not giving entire site on award of work and for giving site gradually, will be tenable.

36. **SPECIAL CONDITION FOR REIMBURSEMENT/REFUND ON VARIATION IN "TAXES DIRECTLY RELATED TO CONTRACT VALUE"**

36.1 The rates quoted by the Contractor shall be deemed to be inclusive of all taxes (including GST on materials, GST on Works Contracts, turnover tax, labour welfare cess/tax etc. which are applicable as per GST), 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 sub para (36.2) here in below.

36.2 (i) The taxes which are levied by Government at certain percentage rates of Contract Sum/amount shall be termed as "taxes directly related to Contract value" such as GST on Works Contract, turnover 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 for bid submission. Any increase in percentage rate of "taxes directly related to Contract value" with reference to prevailing rates on last due date for bid submission 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 bid submission end date shall be refunded by the Contractor to the Govt. /deducted by the Government from any payments due to the Contractor. Similarly, imposition of

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any new "taxes directly related to Contract value" after bid submission end date shall be reimbursed to the Contractor and abolition of any "taxes directly related to Contract value" prevailing on the bid submission end date shall be refunded by the Contractor to the Govt. /deducted by the Government from the payments due to the Contractor.

(ii) 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.

(iii) 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 authorized 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.

(iv) Reimbursement for increase in percentage rates/imposition of "taxes directly related to Contract value" shall be made only if Contractor 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.

37. **PAYMENT TERMS & CONDITIONS:** Payments terms shall be all as per Condition 64 of IAFW-2249 General Conditions of Contracts subject to the following:-

37.1 The contractor may at intervals of not less than 15 days may submit claims on IAFW-2263 for payment of advances on account of work done and of materials delivered in connection with this contract.

37.2 In the case of this lump sum contract, the contractor shall also be entitled to be paid during the progress of work 85%(eighty five percent) on production of paid vouchers for the value of any materials which are in opinion of the Engineer-in-Charge in accordance with the contract and which have reasonably been brought on the site and proof of purchase in connection therewith and or adequately stored and protected against damage by weather or other cause, but which have not, at the time of the advance been incorporated in the works, provided always that payment shall not be made under these periodical certificate in respect of perishable materials(the discretion of the GE as to what is perishable, being final and binding).

37.3 The GE shall from time to time certify the sum to which the contractor is entitled after retaining the reserve.

37.4 Provided further, the contractor may be paid advance on account to the full value of the materials like fittings and fixtures and other manufactured items which do not lose their identity as decided by GE only, brought on the site, on his furnishing guarantee Bond[s] from a scheduled bank for the amount of retention money which should otherwise be recoverable from contract.

37.5 Items like bricks, pre-cast concrete articles etc though might come under the category of manufactured items shall not be included in the list, since they lose their identity after incorporation in the work.

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37.6 The bank Guarantee Bond (s) 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[s] if and when necessary, as directed by the Accepting Officer or shall furnish fresh Guarantee Bond [s] similar value in lieu.

37.7 Any certificate relating to work done or materials delivered may be modified or corrected by any subsequent interim certificate or by the final certificate and no certificate of GE supporting an advance payment shall of itself be conclusive evidence that any work or materials to which it relates are in accordance with the contract. 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 to any one unconnected with this contract. 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).

37.8 All payments due under this contract shall be made by means of ELECTRONIC FUNDS TRANSFER. The amount will be credit to their existing account with any bank, participating ECS, located at ECS enable centre. The condition 66 of IAFW 2249 stands amended to this extent. The tenderers shall furnish the following details within 30 days from the acceptance of the contract. **INFORMATION REQUIRED [MANDATORY DETAILS]**

1. Name of the suppliers, Bank & Branch (As per Account)
2. Suppliers Name (As per Account) & GST No.
3. Suppliers Bank Account No.
4. NEFT IFSC Code of suppliers
5. MICR Code
6. Account type (Ex Savings / Current)
7. Contact Number
8. E-Mail ID

Director / Authorised signature
(Signature of the Vendor / Contractor)

38 **MS PROJECT [Monitoring Software]:**

38.1 The time and progress chart to be prepared using MS Project software 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 GE and 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.

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39. **ADVANCE ON ACCOUNT OF MATERIAL WHICH DOES NOT LOOSE IDENTITY** (Condition 64 of IAFW-2249 – Advance on account)

39.1 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 & Sanitary fittings

(c) Electrical fittings & fixtures, LT Cables

(d) Water supply pipes, fittings & fixtures

(e) Any non-perishable materials which do not lose its identity, at the discretion of GE.

39.2 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.

39.3 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.

40. **LABOUR (REGULATION & ABOLITION) ACT**

40.1 Contract labour (Regulation & Abolition) Act 1970 is applicable to MES Contractors. Rates quoted by the tenderer shall be deemed to take into account the cost, etc., required to comply with the provisions contained in the said act and the rules framed under the said act.

40.2 Refer Condition 58 of IAFW-2249. The 'Schedule of Minimum Wages' as published vide Govt. of India Notification as applicable on date of receipt of tender forms part of these tender documents. However, the contractor shall not pay wages lower than minimum wages for labour as fixed by the Govt. of India/ Union territory under Minimum Wages Act or Contract Labour (Abolition and Regulation Act), whichever is higher.

40.3 The fair wages referred to in condition 58 of IAFW-2249 will be deemed to be the same as the minimum wages referred to above as upto date from time to time.

40.4 Schedule of Minimum Wages is not enclosed along with the tender documents. However Contractor shall be deemed to have verified the minimum fair wages payable as on the last due date of the receipt of the tender.

40.5 The Contractor shall have no claim whatsoever, if on account of local factors and/or regulations, he is required to pay the wages in excess of minimum wages as described above during the execution of work.

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

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42. **DIGITAL RECORD OF EXECUTED WORKS**:

42.1 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.

42.2 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.

42.3 Contractors shall consider all such provisions in their quotation before quoting the tender and their quoted rates shall have deemed to include all the incidental expenses [direct or indirect] required for such provisions and nothing extra will be entertained on this account.

42.4 Photographs of all stages shall be submitted along with every RAR by the contractor otherwise a sum of Rs. 50,000/- shall be restricted for each stage of work.

43. **REIMBURSEMENT/REFUND ON VARIATION IN PRICES: (Refer condition 63 of the General Conditions of Contracts IAFW-2249)**

43.1 Increase or decrease in prices of Cement, Steel and other materials shall be adjusted on the basis stipulated hereinafter irrespective of the actual variation in prices (to the contractor).

43.2 **GENERAL NOTES:**

43.2.1 The periodicity for working out the variations will be three months. The first variation would be for the period of three months reckoned from the last due date for bid submission end date of tenders.

43.2.2 Wholesale price index for Cement/ Mild steel (Long Products)/ all commodities are published every month. Thus the index applicable for any day shall be the one applicable for the preceding month.

43.2.3 As the adjustments are to be made on a quarterly basis, commencing from the last due date for submission of tender. RARs should be timed in such a manner that the gross value of work done up to the corresponding date is readily available.

43.2.4 The monthly index numbers of wholesale prices for Cement/ Mild steel (Long Products)/ all commodities published by the Economic Advisor to Govt. of India, in the first instance, are generally termed 'Provisional'. Final Index Numbers for the corresponding month published subsequently is to be ensured and that the variation are worked out based on the 'Final Index numbers'. These are available on website http://eaindustry.nic.in.

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43.3 CEMENT:

43.3.1 The cement cost component for the contract as a whole shall be taken as Kc% of value of works executed under the contract, Value of Kc given herein below:

Accordingly, value/cost of cement consumed in the work as well as that lying at site for which reimbursement/refund is applicable shall be:

$$VMc = \frac{(Kc \times Vg)}{100} + Vc$$

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

$$EMc = (VMc2 - VMc1) \times \frac{(C1-C0)}{C0}$$

Where

EMc= Variation in prices of cement to be adjusted.

Kc= Constant representing the percentage cost of Cement as compared to **the total value of work under the contract as a whole. The value of Kc shall be 12 (Twelve) only**.

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

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

C1 = Wholesale Price Index for Cement (**Base Year 2011-12=100**) published by Economic Adviser to the Government of India as on the date of commencement of the period of reckoning. In case the original contract period is extended under condition 11 of General Conditions of Contracts (IAFVV-2249), the Price Index as applicable on the date of commencement of the last period of reckoning before the original completion date (s) (phase wise except where phasing has been done only for sample quarter/block) shall only be applicable during the extended period. If phasing has been done for only sample quarter/sample block, the price index as applicable on the date of commencement of the last reckoning period before the original completion date of the project as a whole shall only be applicable during the extended period.

C0 = As per C1 but the index as on the last due date of Bid Submission.

Note: Irrespective of type of cement incorporated by the contractor, the wholesale price index considered for C0 and C1 shall be for **Portland Slag Cement** for which Wholesale Price Index is published by Economic Adviser to the Government of India.

VMc2= Amount of cement up to the last date of the period of reckoning for which variation is adjustable as worked out as per formula for VMc.

VMc1= As per VMc2 but as on date of immediate preceding period of reckoning.

Note: No adjustment in prices shall be made for any work done with cement brought at site after the stipulated date of completion of the work under the contract except as contemplated under definition of C1.

SPECIAL CONDITIONS (CONTD..,)

43.4 STEEL:

43.4.1 The steel cost component for the contract as a whole shall be taken as Ks% of value of works executed under the contract, Value of Ks given herein below:

Accordingly, value/cost of steel consumed in the work as well as that lying at site for which reimbursement/refund is applicable shall be:

$$VMs = \frac{(Ks \times Vg)}{100} + Vs$$

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

$$EMs = (VMs2 - VMs1) \times \frac{(S1-S0)}{S0}$$

Where

EMs= Variation in prices of steel to be adjusted.

Ks= Constant representing the percentage cost of Steel as compared to **the total value of work under the contract as a whole. The value of Ks shall be 20 (Twenty) only**.

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

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

S1 = Wholesale Price Index for Mild Steel (Long products) (**Base Year 2011-12=100**) published by Economic Adviser to the Government of India as on the date of commencement of the period of reckoning. In case the original contract period is extended under condition 11 of General Conditions of Contracts (IAFVV-2249), the Price Index as applicable on the date of commencement of the last period of reckoning before the original completion date (s) (phase wise except where phasing has been done only for sample quarter/block) shall only be applicable during the extended period. If phasing has been done for only sample quarter/sample block, the price index as applicable on the date of commencement of the last reckoning period before the original completion date of the project as a whole shall only be applicable during the extended period.

S0 = As per S1 but the index as on the last due date of Bid Submission.

VMs2= Amount of steel up to the last date of the period of reckoning for which variation is adjustable as worked out as per formula for VMs.

VMs1= As per VMs2 but as on date of immediate preceding period of reckoning.

Note: No adjustment in prices shall be made for any work done with cement brought at site after the stipulated date of completion of the work under the contract except as contemplated under definition of S1.

SPECIAL CONDITIONS (CONTD..,)

43.5 OTHER MATERIALS (EXCEPT CEMENT & STEEL):

43.5.1 The material cost component except cement & steel for the contract as a whole shall be taken as KoM% of value of works executed under the contract, Value of KoM given herein below:

Accordingly value/cost of other materials consumed in the work as well as that lying at site for which reimbursement/refund is applicable shall be:

$$VM = \frac{(KoM \times Vg)}{100} + (VoM - VB)$$

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

$$EM = (VM2 - VM1) \times \frac{(W1 - W0)}{W0}$$

Where

EM = Variation in prices of material to be adjusted except cement & steel.

KoM= Constant representing the percentage cost of other material except cement & steel as compared to **the total value of work under the contract as a whole. The value of KoM shall be 29.50 (Twenty nine point five zero) only**.

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

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

VB = Value of all materials (out of Vg and VoM) (except cement & steel) issued under schedule 'B' plus value of all materials (except cement & steel) brought and paid or payable to contractor under Prime Cost Sum and/or Star Rate (s).

W1 = Wholesale Price Index for all commodities (**Base Year 2011-12=100**) published by Economic Adviser to the Government of India as on the date of commencement of the period of reckoning. In case the original contract period is extended under condition 11 of General Conditions of Contracts (IAFVV-2249), the Price Index as applicable on the date of commencement of the last period of reckoning before the original completion date (s) (phase wise except where phasing has been done only for sample quarter/block) shall only be applicable during the extended period. If phasing has been done for only sample quarter/sample block, the price index as applicable on the date of commencement of the last reckoning period before the original completion date of the project as a whole shall only be applicable during the extended period.

W0 = As per W1 but the index as on the last due date of Bid Submission.

VM2= = Value of material (except cement & steel) up to the last date of the period of reckoning for which variation is adjustable as worked out as per formula for VM.

VM1= As per VM2 but as on date of immediate preceding period of reckoning.

Note: No adjustment in prices shall be made for any work done with cement brought at site after the stipulated date of completion of the work under the contract except as contemplated under definition of W1.

SPECIAL CONDITIONS (CONTD..,)

43.6 REMBURSEMENT/REFUND ON VARIATION IN PRICES: WAGES OF LABOUR (Refer Condition 63 of IAFW-2249)

43.6.1 Increase or decrease in price consequent on variation in wages of labour shall be adjusted on the basis stipulated here-in-after irrespective of the actual variation in price-wages of labour to the contractor.

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

$$El = \frac{Kl}{100} \times Vg1 \times \frac{(L1-L0)}{L0}$$

Where

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

Kl = Constant representing the percentage of cost of Labour element as compared to **the total value of work under the contract as a whole. The value of Kl shall be 20 (TWENTY) only**.

Vg1 = Grass value of work done at contract rates during the period of reckoning less value of work paid or payable to the contractor based on actual cost (eg. Star Rate (s), work executed under prime cost sum etc,) during the period of reckoning.

L1 = Minimum wage in rupees of an unskilled adult male mazdoor as fixed under any law, statutory rule or order as on the date of commencement of the period of reckoning.

L0 = As for L1, but the minimum wage in rupees of an unskilled adult male mazdoor as on the bid submission end date. If labour wages on the bid submission end date are increased afterward with retrospective effect the value of L0 shall be fixed keeping in view the following aspects:

(a) If the increase/decrease in wages of labour are made known to the public by any media before receipt date of tender but the same is officially notified thereafter giving retrospective effect, the value of L0 shall be as per notification though made subsequently.

(b) If a net – wage comprises a fixed basic wage and living allowance revised from time to time based on consumer priced index (CPI) and increase in CPI is made known to the public by any means before the date of receipt of tender, the L0 will be revised wages corresponding to revised CPI, though the formal notification for the net wage (considering the revised living allowance corresponding to revised CPI) is made subsequent to date of receipt of tender.

(c) In case the Labour Enforcement Officer makes the announcement before the date of receipt of tender but gazette notification is made subsequently making wages applicable with retrospective effect, the value of L0 shall be as per gazette notification subsequently made.

(d) If the increase/decrease in wages of labours is notified/announced subsequent to receipt of tender with retrospective effect without making the same publicly known by means of publicity/media prior to the date of receipt of tender, then, the value of L0 shall be as per wage known at the time of receipt of tender.

SPECIAL CONDITIONS (CONTD..,)

NOTES:

i. No adjustment, whatsoever, due to variation in prices of materials on account of coming into force of any fresh law or statutory rule or order as provided in Condition 63 of IAFW-2249 or otherwise than provided in this condition shall be made.

ii. No adjustment in prices shall be made for any work done with materials brought at site after the original date of completion of the work as mentioned in work order No 01 under contract except as contemplated under definition of C1, S1 and W1 hereinbefore.

iii. Periodicity of working out the escalation on account of variation in prices will be three months. The last calculation shall however be done for the value of work at contract rates and materials lying at site for incorporation in the work as on date of completion or extension thereof as mentioned in Note ii above. Valuation of RARs is to be timed in such a manner that relevant date required for quarterly calculation under this condition is available from RARs. In case on these dates no RAR is preferred by the contractor, dummy RAR would be prepared & shall be kept on record duly technically checked and audited. Amount payable relevant to work done and materials collected in quarter will be worked out after firm whole sale price indices for the relevant quarter are available. Once the amount adjustable for any quarter is worked out, the same shall be adjusted as and along with advance on account payment in the subsequent RAR (s).

iv. Any dispute arising out of interpretation or application of this Special Condition shall be referred to the Accepting Officer whose decision shall be final and binding.

v. For the purpose of calculation of retention money, liquidated damages, GST on works contracts, deduction of income tax at source and recovery of water charges (in case of un metered supply) the value of contracts as revised by the above price variation will be taken into account.

vi. In cases, where value of VM2 - VM1 works out to minus on account of higher utilisation of schedule B' stores (i.e value of Schedule B stores under contract as a whole is higher than KoM value) and the reimbursement on account of variation in prices of materials (except Cement & Steel) works out to be negative in spite of the Wholesale Price Index for All Commodities published by Economic Adviser to Government of India going up from W0, reimbursement on account of variation in prices of materials shall be treated as "Nil".

SPECIAL CONDITIONS (CONTD..,)

43.7 **REIMBURSEMENT/REFUND ON VARIATION IN PRICES FOR LIFTS:** The price quoted shall be deemed on the cost of raw materials, components and labour as on the date of submission of the tender and the same shall be deemed to be related to the Wholesale Price Index Number for the metal products and the All India Average Price Index Number for Industrial Workers (General Index) as specified below. In case of any variation on these Index numbers, the price shall be subject to the adjustment up or down in accordance with the following formula:

$$P = \frac{P_0}{100}\left[15 + \frac{55MP}{MP_0} + \frac{15W_0(D)}{W_0} + \frac{15W_0(I)}{W_0}\right]$$

Where:

P = Total amount payable i.e. amount of contract as accepted for lifts including variation in price in accordance with the above price variation formulae.

P_0 = Amount of Schedule "A" for Lifts" as accepted.

MP_0 = Wholesale Price Index Number for metal Products as published by the office of the Economic Advisor, Ministry of Industries, Government of India (base year 2011-12=100) as on Bid submission end date.

W0 = All India Average Consumer Price Index Number for industrial Workers (Base Year 2001=100) (General Index), as published by the Labour Bureau, Ministry of Labour, Govt. of India. The above index numbers ie MP0 and W0 are those published by Government as prevailing on the first working day of the calendar month three months prior to the bid submission end date.

MP = Whole Sale Price Index Number for metal products as published by the office of the Economic Advisor, Ministry of Industry, Government of India in their weekly bulletin Revised Index Number of Wholesale Price (base 2011-12 = 100)

The applicable Wholesale Price Index Number for metal products would be that prevailing on the 1st Saturday of the month covering the date three months prior to the date of delivery of the first lot of manufactured materials for each elevator separately.

W0(D) = All India Average Consumer Price Index Number for industrial workers (base 2001 = 100) (General Index) as published by the Labour Bureau, Ministry of Labour, Government of India. Applicable All India Average Consumer Price Index Number for industrial workers as published by the Labour Bureau, Ministry of Labour, Government of India, would be for the month, three months prior to the date of delivery of first lot of manufactured materials.

W0(I) = All India Average Consumer Price Index Number for industrial workers (base 2001 = 100) (General Index) as published by the Labour Bureau, Ministry of Labour, Government of India. The Applicable All India Average Consumer Price Index Number for industrial workers as published by the Labour Bureau, Ministry of Labour, Government of India, would be for the month, three months prior to the date of completion of the installation.

SPECIAL CONDITIONS (CONTD..,)

Notes: -

(a) The date of delivery shall be the date of which the first lot of manufactured materials for each elevator is notified as being ready for inspection and despatch (in the absence of such notification the date of manufacturer"s despatch note shall be considered as the date of delivery)

(b) The date of completion of each elevator shall be the date on which the work is certified as completed and is available for inspection (in the absence of such notification the date of the manufacturer"s note intimating such completion shall be considered as the crucial date) or the contracted completion date for such installation or part of installation (including any agreed extension thereto) whichever shall be earlier.

(c) The Index Number for metal products is published weekly, but if there are any changes, the same are incorporated in the issue appearing in the following week. For the purpose of this price variation clause, the final index figures shall apply

(d) No adjustment, whatsoever, due to variation in prices on account of coming into force of any fresh law or statutory rule or order as provided in Condition 63 of IAFW-2249 or otherwise than provided in this condition shall be made.

44. **DISPUTE RESOLUTION BOARD [DRB] [CONDITION – 71 OF IAFW – 2249 GENERAL CONDITIONS OF CONTRACTS REFERS]**

44.1 During execution of the works or after completion or after determination / cancellation / termination of the contract all disputes between the parties to contract arising out of the contract [except those for which decision of Accepting Officer or any other officer [CWE and/or GE] is expressed to be final and binding], including any disagreement by either party with any action, inaction, opinion, instruction, certificate or valuation by the Accepting Officer or his nominee, the matter in dispute shall, in the first place be referred to the Dispute Resolution Board [DRB]. In case of disagreement with the decision of such DRB, any party may invoke arbitration clause.

44.2 The Constitution of the DRB shall be a three-member body as under:

[a]	**Chairman**	:	Joint DG [Contracts] of the concerned Command Chief Engineer, Where Joint DG [Contracts] is not posted in the Command, any other Chief Engineer / Brigadier level Officer posted in CE Command shall be nominated by Command CE at his sole discretion.
[b]	**Member 1**	:	Colonel / Director rank officers of Command CE or any other Zonal CE be nominated by Command CE
[c]	**Member 2**		

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

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

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

SPECIAL CONDITIONS (CONTD..,)

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

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

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

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

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

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

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

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

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

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

44.16 Any dispute referred to the DRB and having been decided by the DRB and not objected to by either party within 30 days shall attain finality and shall not be preferable to arbitration.

44.17 Accepting Officer shall ensure implementation of the decisions of the DRB which attain finality, i.e. except those which are objected by him or by contractor within 30 days as per para 46.12 above.

44.18 Findings and decision of DRB shall be admissible as evidence, to the extent permissible as per law, in the subsequent Arbitration and/or litigation.

44.19 DRB Chairman / Members shall not, in any case, be liable to be called as witness or to produce any evidence in any Arbitration or departmental proceedings of any kind.

44.20 During execution of work the disputes may be referred to the DRB as per the requirement of each party after having exhausted the decision making process provided in the contracts. In case of completion of work or after determination / cancellation / termination of the contract all the disputes including payment / non-payment / delay in final bill shall e simultaneously referred to the DRB within six months of completion / determination / cancellation / termination of the contract.

44.21 The department case before the DRB shall be presented by Accepting Officer himself and/or Dir [Contracts] of CE zone assisted by CWE and his DCWE [Contract], GE and his AGE [Contracts] and any other officer and legal counsel nominated by Accepting Officer. The contractor may present his case by himself and/or by his nominated representatives & authorised legal / technical counsel.

SPECIAL CONDITIONS (CONTD..,)

45 **REFERENCE CONDITION No. 25 OF IAFW – 2249:**

45.1 The requirement of Engineering Staff for this tender shall be as under:

[i] Three Degree holder in Civil Engineering, Two Degree holder in Electrical Engineering and One Degree holder in Mechanical Engineering from Government recognised Institution or equivalent with at least **5** years' practicable experience of works.

AND

[ii] Five Diploma holder in Civil Engineering, Three Diploma holder in Electrical Engineering and Two Diploma holder in Mechanical Engineering from Government recognised Institution or equivalent with at least **5** years' practicable experience of works.

AND

[iii] One of the Engineers should have the capability to use Project Management software such as MS Project / Primavera in all projects.

AND

[iv] The firm should employee one Safety Engineer with minimum experience of 5 years.

46. **SPECIAL T&P/MACHINERY/TRANSPORT**:

46.1 The requirement of T&P for this tender shall be as under:

Sl.No.	SPECIAL T&P/MACHINERY/TRANSPORT	Minimum Nos required
1.	Vibrators (Needle and Plate type)	04
2.	Tower/Builder's hoist	04
3.	Steel shuttering with spans, props etc (Sqm)	15000 Sqm
4.	Trucks/Tippers	06
5.	DG Sets 5KVA/10KVA	04
6.	Total stations	04
7.	Concrete cube testing machine (Hydraulically operated)	01
8.	Fully automatic concrete batching plant	01
9.	Transit Mixers	05
10.	Concrete pumps	03
11.	Concrete mobile weigh batchers	02
12.	Cranes	02
13.	Excavators (Power shovels/draglines)	02
14.	Bull dozers	01
15.	Road Rollers	02
16.	Drilling Machines	04
17.	Water Browser	05

SPECIAL CONDITIONS (CONTD..,)

46.2 The T&P employed by the contractor shall be as per panning in MS Project. The list of T&P shown is tentative and is to be increased as per site requirement. No additional payment will be made if more T&P is required for execution of work and is brought by contractor to the site.

47. **OUTPUT OF ROAD ROLLER**

47.1 Refer Condition 15 of IAFW-2249.

47.2 Where road rollers are hired by the Department to contractors, log book for each road roller shall be maintained by the Department for recording hours of working of the road roller. In case, however, when the contractor procures road roller (s) from sources other than the Department, a log book for each road roller engaged by the contractor 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 authorized representative and by the Engineer-in-Charge.

47.3 To ensure proper consolidation, roller must work for at-least the number of days assessed on the basis of output given herein-under. If the road roller has not worked for the number of days so assessed, recovery shall be affected 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 provision shall not, however absolve the contractor of his responsibility of properly consolidating surfaces as required under the provisions of the contract.

47.4 Output of Road Roller per day of Eight hours:

[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

SPECIAL CONDITIONS (CONTD..,)

[d] Consolidation of Premixed Carpet Including Seal Coat:

[i]	20 mm thick [Compacted Thickness]	:	744 Sq.m
[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 two parts broken stone metal and one 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.

47.5 The number of hours / days assessed for proper consolidation and number of hours / days 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 will proceed to next stage of work.

48. **Mobilisation Advance Non-Revocable Bank Guarantee**: Mobilisation Advance would be operated through as Escrow Account.

48.1 Mobilisation Advance:

(a) Interest bearing mobilization advance for maximum 10% (Ten percent) of contract sum shall be given to the Contractor if he/they so desires and on in specific written request, in two instalments, on production of a non-revocable Bank Guarantee (s), for the amount at least 110% of the advance on an approved form from a Nationalised/ Scheduled Bank. The Bank Guarantee (s) shall indemnify the Government against non-refund of mobilization advance and also against default on Contractor's part in performance of the Contract. The rate of interest shall be 10% per annum, simple interest.

(b) The first installment of mobilization advance shall be 50% of advance and shall be paid to the Contractor within 30 days of acceptance of Bank Guarantee(s) of 110% of the same amount furnished by him, by the Accepting Officer. The second installment of the balance amount shall be paid to the Contractor after 6 months of payment of the first installment provided Bank Guarantee (s) for corresponding amount increased by 10% has/have been furnished by the Contractor, at least one month in advance and accepted by the Accepting Officer.

SPECIAL CONDITIONS (CONTD..,)

(c) The total amount of mobilization advance, together with interest shall be recovered from the payments made to the contractor against "Advance on Account", under condition 64 of IAFW-2249, MES General Conditions of Contracts.

(d) The amount of mobilization advance shall be recovered in monthly instalments as stipulated hereinafter.

(i) Against the first instalment of mobilization advance, the first instalment of recovery shall be effected from the 'Advance on Account' payment made immediately following the payment of mobilization advance and the last instalment of recovery shall be effected during the third month preceding the month in which the due date of completion stipulated in first Work Order falls. The various instalments of recovery shall be of equal amounts.

(ii) Against the second instalment of mobilization advance of contract sum the first instalment of recovery shall be effected from the 'Advance on Account' payment made immediately following the payment of mobilization advance of contract sum and the last instalment of recovery shall be effected during the third preceding the month in which the due date of completion stipulated in first Work Order falls. The various instalments of recovery shall be of equal amounts. The recovery in instalments of this mobilization advance of contract sum shall be in addition to the recovery in instalments of the mobilization advance (first instalment) vide sub Para d (i) above.

(e) The Contractor may furnish one Bank Guarantee or a number of Bank Guarantees equal to number of installments for recovery, each to match the quantum of recovery to be effected from the 'Advance on Account'. In case recovery is not possible to be effected from any particular 'Advance on Account' for reasons on non submission of claim for payment of 'Advance on Account' or for any other reasons whatsoever, the recovery due shall be made by encashing the Bank Guarantee.

48.2 ESCROW ACCOUNT: Procedure for operation of joint Escrow Account for Mobilisation Advance is as under: -

(a) The joint Escrow account for mobilization advance shall be opened in any Nationalised/Scheduled Bank and it shall be operated by the employer's representative ie Garrison Engineer (GE) and authorized representative of the contractor. The mobilization advance into the Escrow account shall be made against a non- revocable Bank Guarantee (s) for an amount at least 110% of the amount of the mobilization advance. The mobilization advance shall be made in two instalments as per the stipulated conditions of the contract agreement.

(b) The employer's representative ie GE shall be responsible to operate the account on behalf of Accepting Officer and the authorized representative of the contractor will be co- signatory to the account.

(c) Escrow account will be opened by the contractor with the Escrow Agent (Nationalised/Scheduled Bank) with the mobilization advance paid to the contractor after acceptance of the Bank Guarantee bond of requisite value. The amount of mobilization advance can be transferred by GE to the Escrow account through digital route.

SPECIAL CONDITIONS (CONTD..,)

(d) The payment from Escrow account shall be made to meet bonafide expenditure on the project including the following:-

(i) Procurement of construction material, stores, equipment and machineries required for the project.

(ii) Hiring of service of any nature including skilled/ unskilled labour to be employed on the project/muster rolls for payment made on this account.

(iii) Repair and maintenance of machinery, tools, plant, vehicle etc used on the project.

(iv) Any other bonafide expenditure, unforeseen but related to the project and verified by the GE.

(e) The payment by the contractor from the Escrow account shall be released by the bank on receipt of written authorization from GE.

(f) The cash book and e-summary of transaction shall be maintained by the GE office and it will be signed by both the GE and contractor's representative authorized to receive payment.

(g) The internal audit of the Escrow account shall be co-responsibility of GE and the contractor.

(h) The bank charges for opening and operation of Escrow account shall be borne by the contractor..

(j) The cheque shall be issued in the form of crossed cheque to payee's accounts only. In case of digital transfer of amount of mobilization advance, an authority letter will be issued by GE to the Accounts Officer,

(k) The Escrow account shall be operated within the provision of terms and conditions of the Escrow agreement. In case of any conflict between the contractor and GE for Escrow account procedure, this agreement shall prevail and the decision of CWE of the area shall be final and binding.

(l) The Escrow account shall be closed immediately on recovery of mobilization Advance through an agreed instrument of closure signed by both parties. Government will not bear any liability due to failure to close the account.

(m) By operation of the Escrow account, the contractor is not relieved of his obligations under the contract agreement with respect to completion of the project on time within the amount mentioned in the contract agreement.

(n) The role of Escrow account is limited to ensure smooth flow of finance to the project in hand by channelling project payment for speedy execution of the project. Every Escrow account will be specific to a project and will in no case be used for any other project.

(o) Escrow agreement shall remain in full force and effect so long as amounts remain outstanding from the contractor in respect of the mobilization advance or its obligations to Government, unless terminated earlier by the mutual consent of both parties or otherwise in accordance with the provisions contained in this agreement.

Signature of contractor
Date:

[T Venkata Ratnam]
DD (Contracts)
For Accepting Officer

SPECIAL CONDITIONS (CONTD..,)

Annexure
to clause No. 33 (a) (ii)

AGREEMENT

FOR APPOINTMENT OF ARBITRATORS

1. A contract was concluded between DDG&CE, DGNP, Naval base, Visakhapatnam – 530014 and M/S_____ on_____for_____ _____ _____bearing CA No_____.

2. WHEREAS certain disputes have arisen in the above contract and both the parties are desirous for appointment of arbitrator(s) to adjudicate upon the disputes.

AND WHEREAS as per para 8 of the arbitration and conciliation (amendment) the applicability of the Sub Section 5 and Section 12 of the Arbitration and Conciliation Act 1996 by an express agreement in writing.

3. We both parties to the agreement, hereby agree for appointment of arbitrators from panel of arbitrator published by Ministry of Defence by the Director General Naval Project (Visakhapatnam).

Signature of contractor
Designation:
Name:
_____ 2022

Signature of Accepting officer
Designation:
Name:
_____ 2022

Signature of Witness

1. _____
   _____
   _____
2. _____
   _____
   _____

PARTICULAR SPECIFICATIONS [Contd...]

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 [2020] [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 deemed to include the same.

1.7 In the event of any discrepancy between various documents forming part of the tender, the following order of precedence shall be observed [Ref condition 6A of IAFW-2249] :-

(a) Description of Schedule 'A' including notes therein.
(b) Particular Specifications
(c) Drawings including notes thereon.
(d) MES Schedule (SSR).
(e) Indian Standard specifications/Code of practice.

NOTES: - In case no provision is made in (a) to (d) above, Indian Standard Specification/Code of Practice shall be followed.

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.

PARTICULAR SPECIFICATIONS [Contd…]

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.

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 [2009]. 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 BLANK.

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 In case timbering to uphold sides of excavation is required and specifically ordered by the GE in writing, it shall be paid for as deviation order. Lump sum quoted by the contractor shall not include use of timbering to up hold sides of excavation.

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 become the property of the Government.

2.6 Blasting of rock is prohibited, However, controlled blasting of rock with all safety precautions can be allowed with prior permission from GE and users. Excavation in hard rock (if met with during excavation) shall be done by chiseling or by any other agreed mechanical method by a prior written order of the GE. Hard rock obtained from excavation shall be dumped at low lying area at a distance not exceeding 10KM from the site as directed by GE/ Engineer-in-charge and lumpsum quoted by the bidder shall include the above provision. The Contractor may use the stone obtained from excavation for Schedule 'A' Part-I (Buildings & Structures) after testing and approval of GE. Testing charges shall be borne by the contractor. The nature and type of rock met with, will be decided by the GE whose decision shall be final and binding. Entire Stone obtained from excavation in respect of Schedule 'A' Part-I (Buildings & Structures) shall be entered in the measurement book duly signed by the contractor and Engineer-in-Charge. **The rate of recovery for the hard rock used in Schedule 'A' Part-I (Buildings & Structures) only shall be Rs. 850/- per Cum on "To be abstracted" MB quantity (i.e., without considering voids)**

2.7 BLANK.

2.8 DEWATERING: 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. 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 excavation in foundation of buildings and soil obtained from surface dressing shall be removed, deposited and levelled at places, to a distance upto 10.0KM as directed by the Engineer-in-Charge, without any extra cost to Department.

PARTICULAR SPECIFICATIONS [Contd…]

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 [2009]. Hard core shall be provided at location and to the thickness as indicated on drawings. Thickness of hard core shown on drawings shall be the consolidated thickness.

2.11 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, levelled, 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 of any lead 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.

3.0 PRE-CONSTRUCTION ANTITERMITE 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 except for Serial Item No. 24 to 35.** 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: 1978], as per IS 6313 Parts I & II of 2001. Concentration by weight percent of chemicals shall be as indicated by the manufacturer and shall be used for different stages of treatment as stipulated in relevant IS.

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 check-up 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 [Contd...]

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 Parts I &II of 2001 should be available at site.

3.9 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** or **Rs. 50000/- whichever is higher** 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. [c] Pour card for site organization indicating, location of concrete, type of concrete, water cement ratio, proposition 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: 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. 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: Fine aggregate for concrete work shall confirm to materials specifications and grading within the limits of **grading zones II or III** all as specified in clause 4.4 to 4.4.7.3 of MES Schedule Part-I. Contractor may without any extra cost in lieu of river sand use manufactured sand (crushed stone sand) produced from hard granite/basalt/black trap stone, having cubical shaped particles with grounded edges of ground gradation zone II/III as per IS 383-1970 as applicable. In the market it is known as M-sand/ Robo sand/I-sand etc. For pricing deviations, SSR rates shall only be applicable without any price adjustment for manufactured sand. **However manufactured sand shall be used only in concrete and masonry works.** For plastering, river sand shall only be used. The sand shall be stored at site in dumps. The contractor shall take necessary precaution to avoid contamination or risk of shovelling 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.

[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.

PARTICULAR SPECIFICATIONS [Contd...]

4.5.4 SOURCES OF PROCUREMENT:

4.5.4.1 Cement [All type of cement] shall be procured by the contractor from any of the following main producers of cement:-

Sl. No	Company name & Brand	Address
i.	The Associated Cement Companies Ltd. Brand: **"ACC"**	414-421, Splendor Forum (4th Floor), 3, District Centre, Jasola, New Delhi-110044, Ph-011-46583600
ii.	Ultra Tech Cement Ltd Brand: **"ULTRATECH"**	'B' Wing , 2nd Floor, Mahakali Caves Road, Andheri (East), Mumbai-400093, Ph-022-66917800
iii.	The **India Cement**	Dhun Building, 827, Anna Salai, Chennai-600002
iv.	Dalmia Cement (Bharat)Ltd Brand: **"DALMIA INFRA PRO"**	Dalmiapuram, Distt- Truchirappalli, Tamil Nadu-621651
v.	Century Cements Brand: **"CENTURY"**	Industry House, 159, Church gate, Reclamation, Mumbai – 400020, Ph-022 22023936
vi.	Saurashtra Cement Brand: **"SAURASHTRA"**	Gala No A-1, Ground Floor, Udhyog Sadan No 3 MIDC, Central Road, Andheri (East), Mumbai-400093 Ph-022 32955557/67, Mo-9320290081
vii.	The Ramco Cements Ltd. (Formerly Madras cement) Brand: **"RAMCO"**	Auras Corporate Centre , 98-A Dr. Radhakrishnan Salai, Mylapore, Chennai-600004, Ph-044 28478666
viii	Mangalam Cement Ltd Brand: **"MANGALAM"**	PO Adityanagar, Morak, Dist-Kota, Rajasthan-326520 Ph- 9351468076
ix.	Birla Corporation Ltd Brand**: "BIRLA"**	Birla Building (3rd & 4th Floor) 9/1, R.N Mukherjee Road Kolkata-700001, Ph-033 30573700
x.	Orient Cement Brand: **"ORIENT"**	5-9-22/57/D, 2nd and 3rd Floor, GP Birla Centre, Adarsh Nagar, Hyderabad -500063, Pin-044 23688600
xi.	Nuvoco Vistas Corporation Ltd (Formerly Lafarge Cement) Brand: **"NUVOCO"**	Equinox Business Park Tower-3, East Wing, 4th Floor LBS Marg, Kurla (West), Kurla Mumbai, Maharashtra-400070
xii.	Shree Cement Brand**: "SHREE"**	Bangur Nagar, Beawar, Dist-Ajmer, Rajasthan-305901, Ph-01462228101-06
xiii.	J K Cement Brand**: "JK"**	Kamla Tower, Kanpur - 208001
xiv.	J K Lakshmi Cement Ltd Brand**: "JK LAKSHMI"**	Jaykaypuram, Dist-Sirohi, Rajasthan -307019, Ph – 02971-244409/10
xv.	Jaypee Rewa Cement Brand**: "JAYPEE"**	Jaypee Nagar, Rewa-486450, MP
xvi.	Ambuja Cement Ltd Brand**: "AMBUJA"**	Kodinar, PO-Ambujanagar, Taluka – Kodinar, Dist – Junagadh, Gujarat -362715 Ph 02795-237000
xvii.	My Home Industries Ltd Brand**: "MAHA CEMENT"**	9th floor, Block -3, My Home Hub, Madhapur, Hydrabad – 500081, Ph 040- 44119100/200
xviii	JSW Cement Ltd, AP Brand**: "JSW PSC"**	JSW Centre, Opp MIMRDA Ground, Bandra Kurla Complex, Bandra [East] Mumbai - 400051
xix	Sagar Cements Ltd Brand**: "SAGAR"**	Plot No. 111, Road No. 10, Jubilee Hills, Hydrabad – 500 033 Ph : 040 - 23351571

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 carryout 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.

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:

[a]	PCC in Foundation & PCC in Foundation of Dwarf Wall	PCC 1:4:8 Type D2 [using 40 mm graded stone aggregate] by volume
[b]	Concrete Pre-Cast Blocks, Padding and Coping.	PCC 1:3:6 Type C1 [using 20mm Graded stone aggregate] by volume
[c]	PCC in all Other Situations	PCC 1:2:4 Type B1 [using 20mm graded stone aggregate] by volume
[d]	RCC works as in Sub-structure.	Design Mix controlled concrete of Grade **M40** or contractor may use **RMC-M40 Design Mix** without any extra cost.
[e]	RCC works as in Super structure.	Design Mix controlled concrete of Grade **M35** or contractor may use **RMC-M35 Design Mix** without any extra cost.
[f]	RCC work in water retaining structures, Static water tanks swimming pool, Diving pool, Balancing tank etc.,	Self-compacted concrete of Grade M40.
[g]	All other RCC works except mentioned above	Design Mix controlled concrete of Grade M40.

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.

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 M40 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 from approved manufacturers as given below:

[i] FOSROC Chemicals [India] Ltd.

[ii] Roffe Construction Chemicals Pvt. Ltd.

[iii] STP Speciality Chemicals Ltd.

[iv] CICO Technologies Ltd

[b] Para 5.5 of IS 456: 2000 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 carry out the design mix and preliminary tests: -

[i] College of Engineering, Andhra University

[ii] College of Engineering, GITAM University

[iii] Material Testing House [India] Ltd., Visakhapatnam.

[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 / Govt approved labs at Visakhapatnam or 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 its correct value. To this effect determination of moisture content in both fine and coarse aggregate should be made as frequently as possible. The frequency for a given job shall be determined by the Engineer-in-Charge. According to weather conditions the amount of water to be added shall be adjusted to compensate 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 M40 grade 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.

4.8.8. **ACCEPTANCE CRITERIA:** As per Clause 16 of IS – 456.

4.9. **READY MIXED CONCRETE [RMC]:**

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

[a]	IS – 4926	-	Ready Mixed Concrete	-	Code of Practice	
[b]	IS – 9103	-	Concrete Admixtures	-	Specifications	
[c]	IS – 8112	-	OPC Grade 43 or Portland	-	Specifications	or
	IS – 455	-	Portland Slag Cement	-	Specifications	or
	IS – 1489	-	Portland Pozzolana Cement	-	Specifications	
[d]	IS – 456	-	Plain and Reinforced concrete	-	Code of Practice	

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.

[i] M/s. RMC Ready Mix India Pvt. Ltd.

[ii] M/s. Associated Cement Co Ltd

[iii] M/s. Birla Ltd

[iv] M/s LAFARGE Aggregates & Concrete Pvt Ltd, Visakhapatnam

[v] M/s. Ultratec Concrete / Lafarge A & C

[vi] M/s. Vipasana Concrete, Visakhapatnam

[vii] M/s. Sarvani RMC, Visakhapatnam

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.

[iii] STP Speciality Chemicals Ltd, 16, NGN Vaidya Marg, Mumbai – 400 023.

[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.

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 ANNEX – 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 with-out extra payments so as to produce the work complying with the strength requirements as per IS – 456. The contractor will have no claim whatsoever on this account.

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 equipment's 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.

PARTICULAR SPECIFICATIONS [Contd...]

[h] No extra water shall be added to the concrete mix after it has left the batching plant. The contractor shall take adequate precautions to protect concrete in transit from the effects of the weather.

[j] Pumping operation whenever commences shall proceed continuously so as to prevent "Cold" joints between placed sections. Concrete less than 6 cubic metres may be deposited manually. Concrete for columns may be deposited manually.

[k] The delivery line of the pump shall be 100 mm dia or greater and pump shall be capable of pumping concrete containing 20 mm nominal size aggregate.

[l] The pump shall have receiving hopper and pumping chamber shall be capable of pumping at least 15 Cum of concrete per hour against horizontal delivery head of at least 90 m and / or a vertical delivery head of 20m.

[m] Pumping lines shall be of approved metallic type laid to avoid bends the joints in pumping lines shall be sealed tight to prevent leakages.

[n] All equipment's, 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 replaced, the following procedure shall be adopted:

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

[p] Due to mechanical malfunctioning, if concreting is required to be stopped, necessary precautionary measures shall be taken by the contractor. Cost of any additional work caused due to these stoppages shall be contractor's responsibility.

[q] No concreting shall be commenced until formwork and reinforcement and other preparatory work required are completed, inspected and approved by the Engineer-in-Charge / GE.

[r] The contractor shall take adequate precautions and strengthening measures to strengthen the shuttering as required to withstand the pressure that will be created due to pumping of concrete.

[s] Slump of concrete shall be as per IS – 456 and as specified. The workability shall be within the following limits on the specified value as appropriate:

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

[t] Slump test shall be carried out at site by the contractor in the presence of Engineer-in-Charge / JE. 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 - 2000 [durability criteria]. The minimum cement content in design mix concrete shall be 360Kg/Cum for Super Structure and 400Kg/Cum for Sub Structure [Foundation / PBs]

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 1/3 cum of concrete to be discharged from the truck mixer prior to taking any samples. Take required number of samples from the remainder of the load avoiding sampling the last cubic meter of concrete. Thoroughly re-mix this composite sample either on a mixing tray or in the sampling bucket and proceed with the required testing.

[b] In addition to the tests carried out by the RMC manufacturer at the plant site, sampling and testing of concrete shall be carried out at the site after delivery as per IS – 456 by the department along with the representatives of the contractor at contractor's expense.

[c] Samples from fresh concrete shall be taken as per IS – 1199 and cubes shall be made, cured and tested in accordance with IS – 516 for 7 / 28 days compressive strength. The samples shall be taken as follows:

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

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 M40 [Design Mix] Ready Mixed Concrete [RMC], shall be as per Pro-rata rates of Ready Mixed Concrete [RMC] M35 [Design Mix] concrete given in SSR 2020.

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 75mm thick in PCC 1:3:6 type C-1 using 20mm graded stone aggregate over 75mm 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].

4.15. **PILE FOUNDATION AND PILE CAPS:**

4.15.1 Pile foundation shall be provided all as per details shown in drawings [Read in conjunction with Notes mentioned in the drawings] and to the specifications mentioned hereinafter. The tenderer has to quote unit rates for drilling or boring through the strata mentioned in Schedule "A" up to required depth and disposal of spoil mixed with Bentonite slurry.

4.15.2 The disposal of spoil shall be done to a distance exceeding 1km but not exceeding 1.5km as directed by the Engineer-in-Charge, without any extra cost to Department. GE's decision regarding the type of strata shall be final and binding. Actual level at which pile is to be founded / rested shall be as ordered by GE in writing.

4.15.3 The contractor shall cater for use of Bailer, Drill and/or chisels etc or any other method to bore / drill through any type of strata.

4.15.4 The bore hole drilled shall be thoroughly cleaned before positioning of reinforcement cage.

4.15.5 **GUIDE RING:** The steel guide ring of internal diameter equal to the diameter of the pile plus a clearance of a minimum of 25mm and a maximum of 50mm shall be provided to facilitate the smooth functioning of bail or chisel etc. The wall of the guide ring shall be absolutely vertical and shall be concentric with the pile centre. The guide ring shall be at least one meter deep. The necessary steel required for this shall be arranged by the contractor.

4.15.6. **BENTONITE SLURRY:**

4.15.6.1 A fresh water mixed with Bentonite slurry [Sodium Montomoreillinite Slurry] shall be used for supporting the sides of the bore. The properties of Bentonite shall be maintained as given below:

[a] The density of freshly prepared bentonite shall be 1.034 to 1.10 Grams / ml whereas density of slurry mixed with deleterious compound in borehole shall be taken as 1.25 Grams / ml.

[b] The Marsh Cone viscosity when tested by Marsh Cone shall be between 30 to 60 seconds.

[c] The differential free swell shall be more than 540 percent.

[d] The PH value shall be between 9 to 11.5.

4.15.6.2 Routine field tests of slurry viscosity using marsh funnel shall be carried out and this slurry reclassified. The contractor shall ensure to keep the slurry level in the bore as high and constant as possible to avoid damaging surges, produced by the action of clues, loss of slurry in soil and other causes. The slurry has as tendency to loose viscosity, get settled and increase the density resulting in insufficient and establishing properties. The contractor shall ensure filtration and a high immediate yield value of slurry.

4.15.6.3 Bentonite constant of 16 KG/Cu.m gives sufficient thick slurry and shall be maintained throughout the boring operation. Base exchanged Bentonite concentration shall be maintained between 4 to 7 by weight.

4.15.6.4 After penetration of clay strata and on entry more permeable strata the artesian water head present at site shall be suitable countered by use of increased slurry head and density.

4.15.6.5 The said content in the Bentonite powder shall not be more than seven percent [7%]. Testing of the slurry at the base of the trench shall be carried out by special samplers or by using samples obtained viz. the submersible pumps. Sand content shall be measured by screening the slurry on a 200 mesh sieves [Micron] deep. Sampling shall be carried out every time before placement of the reinforcement cage. Reuse of the slurry in a second and subsequent bore shall be permitted only after carrying out the necessary Marsh funnel, PH Value and Density tests. Generally, the slurry immediately above the rising concrete shall be diverted to disposal pits rather than treating the same. Additives up to a limit of 0.5% by weight of the slurry are permitted. The contractor shall ensure adoption of suitable bentonite clay mixer, lump breakers, fillers and centrifugal pumps for circulation etc. He shall ensure a clean layout using proper capacity mixing tanks, re-circulation tanks, disposal pits, circulation trenches and pipe lines, suitable lined tanks shall be used to avoid break down due to side wall collapses. While drawing out the used and stored slurry, the slurry from the top only shall be drawn and the pits cleared to remove the settled solids.

4.15.7 **BORING OF PILES:**

4.15.7.1 Borehole data shall be as specified in Schedule "A", as shown on drawing and as directed at site. Boring shall be carried out through any type of strata up to a depth as indicated in drawing and spit to be disposed to a distance exceeding 1.50 Km and not exceeding 5.00 Km as directed by the Engineer-in-Charge. The ground shall be roughly leveled and the position of the piles marked and bore shall be made by any suitable boring tool. After the bore is made to the required depth, enlarging of the bore shall be carried out by means of an under-reaming tool 2 to 2.5 times of the dia meter of the bore where specified and directed. In, ground with high water table and having unstable pile bores, boring shall be carried out using a suitable drilling fluids as directed by Engineer-in-Charge.

4.15.7.2 For boring normal spiral as modified augers and under reamed tool having arrangement to avoid back suction shall be used, where the drilling fluids is used the holes shall be cleaned of all soil cuttings before concreting.

4.15.7.3 **CAST-IN-SITU-BORED PILES:** Cast-in-situ bored piles shall be cast to dimensions and depths shown in drawings. Tenderer shall specifically inform the GE in writing before commencement of piling work, the method to be proposed to adopt and submit along with the weight and drop of hammer/chisel, number of drop per minute, weight of boring or as directed conforming to the general requirement mentioned in these documents. The load per running metre & HP of motor etc. are also to be mentioned.

4.15.8 **CONCRETE:**

4.15.8.1 **CONTROLLED CONCRETE:** Controlled concrete shall be Design Mix M40 Grade concrete [using 20mm graded stone aggregate] as specified in IS – 456. The minimum requirement of cement for controlled concrete shall be **400 kg per cum for piles and pile caps.** The actual quantity of cement for controlled concrete of grade M40 shall be ascertained by the tenderer as per Design Mix as specified hereinbefore vide Clause No. 4.8.4 & 4.8.5. No claim whatsoever arising due to any excess cement [over minimum requirement as per IS] incorporated in the work as per design mix shall be admissible. Contractor while quoting shall take into account the actual requirement of cement. The design mix for piles shall be got done by the contractor from any of the Institutes / Labs as specified in Clause No. 4.8.3.3 herein before separately and shall be got approved from GE in writing. However, for pile caps, the design mix of super structure controlled concrete shall be adopted. The slump for piles shall be 150 mm to 180 mm. All other aspects in respect of controlled concrete shall be all as specified hereinbefore vide Clause No. 4.8.3, 4.8.4, 4.8.5, 4.8.6, 4.8.7 & 4.8.8 as applicable for piles.

4.15.9 **PLACING AND COMPACTING OF CONTROLLED CONCRETE:**

4.15.9.1 The bottom of the bore holes shall be cleaned off al the spoils and sediments before placing concrete so that the bases of piles shall be free from loose materials, concreting of bore holes shall commence as soon as possible after cleaning. A bore hole which is not cased be left un-concreted for more than 2 hours. It shall be cleaned thoroughly before placing concrete. Concreting under water shall preferably be done in one operation. Adequate standby plant shall be catered for this purpose.

4.15.9.2 Concrete shall be preferably placed by a tremie pipe. ½ Kg of granulated vermiculite shall be used in tremie pipe before poring initial concrete to ensure that concrete does not get mixed with slurry. The tremie pipe shall extend up to the bottom of the bore hole at the start and may be withdrawn in section as level of the concrete rises in the bore hole at the start, but its discharge end shall at all times be embedded in the concrete to a minimum depth of one metre. Placing of concrete shall be continuous and the tremie pipe shall be held concentric in the hole. In the case of concreting inside casing which is subsequently withdrawn the concrete shall be placed in sufficient quantity to ensure that during withdrawal of casing a sufficient head of concrete is maintained to prevent the inflow of soil and water. Sufficient care shall also be exercised in extracting the casing such that the freshly placed concrete is not lifted up-along with casing in which case, the entire concrete including the reinforcement shall be taken off, the pile shall be thoroughly of casing pile: Extraction of casing shall be done in such a way that no necking or shearing of the concrete in the shaft takes places. During the extraction of the casing, slump of concrete shall be observed and when required, additional quantity of concrete shall be placed up to the original ground level as directed by the Engineer-in-Charge so that the pile is formed up at least 100 cm above the cut off level.

4.15.9.3 Payment for concrete in piles will be made from founding level to cutoff level only, based on quantity theoretically arrived by multiplying cross sectional area of pile and length of pile between cut off level and founding level. The contractor shall have no claim what so ever on this account. The contractor shall consider this aspect while quoting the tender.

4.15.10 **REINFORCEMENT BAR BENDING SCHEDULE:** The contractor shall submit to the GE for scrutiny and approval, detailed reinforcement bar bending schedule, four weeks in advance of due date of commencement of any particular item of concrete work, while working out the reinforcement bar bending schedule the contractor shall ascertain from the Garrison Engineer the length of bars likely to be made available and this schedule shall be soon made keeping the wastage/off cuts of bars to bare minimum without hampering technical requirement. The fabrication of reinforcement of concrete works shall be commenced only after bar-bending schedule is approved in writing by the Garrison Engineer / Engineer–in–Charge.

4.15.11 **REINFORCEMENT:** High strength deformed TMT (CRS) bars of **Grade Fe-500D** shall be procured by the tenderer and shall be as specified hereinafter. The reinforcement shall be properly tied and fixed to prevent any displacement and distortion while concreting is in progress. Clear cover shall be as shown on drawings to reinforcement including binders/helical. The reinforcement of piles shall be extended to the length shown on drawings as dowel bars from cut off level.

4.15.12 **FINISH OF PILES:** Controlled concrete in piles shall be cast to piling platform level to permit overflow of concrete for visual inspection. Concrete may be placed up to the original ground level as directed by the Engineer-in-Charge or to a minimum height of one metre above cut off level to permit removal of all laitance and weak concrete before capping. This shall not be measured for payment made for laitance concrete.

PARTICULAR SPECIFICATIONS [Contd...]

4.15.13 **RECORDS:** The contractor shall maintain careful and comprehensive record, during the driving of piles, showing the following and necessary data in a tabular form in respect of each pile:

[a] Serial Number [with reference to plan] of the pile.

[b] Date on which the pile is cast and the quantity of concreting carried out in each day.

[c] Total depth of pile

[d] Strata Chart.

Two copies of the above records shall be signed by the contractor and the Engineer-in-Charge, and submitted to the department.

4.15.14 **PERMISSIBLE DISPLACEMENT:** The permissible displacement for any pile form their designed position shall not be greater than the following:

[a] Pile group with pile dia not exceeding 600mm : 75 mm or D/4 whichever is less.

4.15.15 **TESTING OF PILES:**

4.15.15.1 The initial and routine load test of piles shall be carried out all as specified in Appendix "A" to IS – 2911 [Part – IV] on pile(s) selected / approved by the Garrison Engineer for testing. The test loads for routine load test shall be one and half times of the design load or a higher load as directed the Garrison Engineer. The loads for various piles shall be taken as described on drawings. All requirements such as loads set of dial gauges and all other appliances shall be provided at site by the contractor and the quoted rates for test shall be deemed to include for all the aforesaid provisions.

4.15.15.2 The initial and routine pile load tests shall be carried out in accordance with IS – 2911. Minimum initial load test and routine test will be carried out 2% minimum and rounded off to the next higher round figure. In case failure of initial load test, the matter will be reported to Accepting Officer. In case of fault on the part of contractor no payment shall be made to the contractor for rejected pile. Decision of Accepting Officer is final and binding.

4.15.15.3 **REPLACEMENT OF DEFECTIVE PILES:** The piles that are found defective shall be pulled out or left in places as directed by the Garrison Engineer without affecting the performance of the adjacent piles. As a result of redesign all additional work required to compensate for the defective piles, whether pulled out or left in position will be provided by the contractor at his own expenses as directed by the Garrison Engineer. Payment for the defective pile will not be made. Payment for provision of new pile as per re-design will however be made.

4.15.15.4 **CONTROL OF ALIGNMENT:** The pile shall be bored and under-reamed where specified as accurately as possible vertical or to the specified depth. As a general guide the permissible positional deviation shall not be greater than 75 mm or D/4 whichever is less at the level of bottom of pile cap and shall not exceed 2 percent [about 1% from the specified inclination] ["D" is diameter of the item]. Where the deviation in the alignment of the barrels more than that specified, corrective measure as approved shall be taken at the contractor's cost in the form of increasing pile size. Provision of extra reinforcement to the pile etc work shall be carried out in precision manner as per latest IS provisions.

4.15.16 **MS LINER:** Permanent mild steel liners shall be provided as per approved design and shall be procured by the tenderer and shall be as specified hereinafter. MS liner fabricated out of plain MS plate confirming to Fe-410-WB (Gde E-250 Quality B/BR), including rolling to required diameter welding the joints, strengthening wherever required, providing stiffeners, lifting hooks, including all T & P required.

PARTICULAR SPECIFICATIONS [Contd...]

4.16 **CONCRETING FOR SWIMMING POOL: -** Loose pockets of soil if encountered shall be completely removed and back filled with compacted moorum. Nominal cover to reinforcement in swimming pool shall be as under:- (a) RCC Base slab & walls of pool - 50mm (b) Roof slabs - 30 mm (c) Beams - 45mm (d) Columns - 45 mm (e) Footings - 50 mm

4.16.1 Suitable de-watering system be provided during execution so that foundation concrete shall be placed in dry condition. Dewatering shall continue till sufficient dead load is attained to counter uplift water pressure.

4.16.2 The concreting of base slab/side wall start from the deeper portion of swimming pool and proceed towards shall over portion.

4.16.3 The concreting of base slab/side wall shall be carried out in panels with vertical/horizontal construction joints as indicated in the drawing.

4.16.4 When the base slab panels are cast the side stretches standing over them also shall be cast along with the base slab in one operation up to a minimum height of 400 mm above the top of base slab with horizontal constructions joint provided in as shown in details.

4.16.5 The concreting beyond the construction joint vertical & horizontal shall be continued preferably with 12 hours of forming the construction joint to avoid deferential shrinkage at inner face. In order to ensure the proper bond between old and mew concrete surface, bonding chemical shall be used.

4.16.6 **Concreting for Balancing chamber** :-

(a) The entire RCC base slab along the side wall up to height of 400 mm (Min) shall be cast in one continuous operation i.e. there will be no vertical construction joints in base slab. The number of horizontal construction joints inside wall shall not exceed 2 each horizontal construction joints in side walls shall be at one horizontal level there shall be no vertical construction joints in side wall.

(b) The rate of filling of water in swimming pool and balancing tank shall be at 300 mm depth per day and the testing of pool and tank for water tightness shall be as per IS-6494.

4.16.7 **Construction Joints: -**

(a) When the concreting is stopped for the day it shall be terminated at the construction joints.

(b) The joints shall be horizontal.

(c) The surface film of the first placed concrete should preferably be removed whilst the concrete is still green to expose the aggregate and leave a sound irregular surface. This may be effected by spraying with water or air and water assisted by the light brushing where necessary.

(d) Before starting the concrete works over this surface shall be treated with water resistant rubberized (EPOXY) bonding agent. Over this 50 mm the concrete with 8 mm down aggregate shall be poured and further concreting continued. Epoxy bonding chemical shall be of food grade.

(e) No of horizontal construction joints in side wall shall not more than as given under: -

Swimming pool - 01 No,
Diving pool - 02 Nos (Deeper portion in swimming pool),
Balancing tank - 02 Nos (as applicable)

5. **FINISHING CONCRETE BY VACCCUM DEWATERING METHOD FOR SWIMMING POOL** Vacuum dewatering method will be used to remove excess water from the laid concrete and filter pad and suction mat shall be laid on the freshly laid concrete which will not allow cement paste to flow out, and the suction pump are then started immediately to remove the excess water. The suction time normally is 20 to 30 minutes. This vacuum process will enable to remove 15 to 25% of water content making the surface hard enough to enable to carry the floating operation. The top surface after removal of mat shall be floated with a mechanical skim floater with trowelling blade to enable the top surface to grind and give a uniform water resistance surface on top. Under no circumstances neat cement be sprinkled directly on concrete surface to absorb bleed water as surface scaling may occur later. Similarly water should not be applied between trowelling operations as it may cause surface weakness. Minimum two passes shall be carried out. The surface shall then be watered and cured as per clause 13.32.10 of SSR part -I.

6.0 **PRECAST CEMENT CONCRETE SOLID/HOLLOW BLOCK MASONRY:**

6.1 **Irrespective of what is shown on drawings for Sch 'A' Part -I Buildings, all buildings shall be with precast concrete block masonry. External panel walls in framed construction shall be PCC solid block of grade 'D'. All other walls shall be with PCC Hollow Block masonry of grade 'A'**. In case of load bearing constructions, all walls shall be built in PCC solid blocks. However, for framed construction, panel walls, other than external panel walls, the first course of wall above plinth beam/plinth band and one course below all RCC works like lintel/floor beam/floor slab/roof beam/roof slab and roof band etc shall be with precast PCC solid block and the balance PCC block masonry walls in that panel wall shall be built with precast PCC Hollow Blocks.

6.2 PRECAST CEMENT CONCRETE BLOCK: The size of the concrete block solid and Hollow shall be 400 X 200 X 200mm and `400 X 200 x 100 respectively. The size if block for 300mm thick wall shall be 400 X 300 X 200 mm. The blocks will be machine moulded with mix prepared in a mechanical mixer and manufactured as per IS: 2185 (Part –I) 1979. The class grade and density shall be as under:-

Type of Block	Minimum average compressive strength at 28 days	Classification	Block Density
Hollow Block	45 Kg/Cm2	Grade 'A'	Not less than 1500 kg/m3
Solid Block	50 Kg/Cm2	Grade 'D'	Not less than 1800 kg/m3

The physical requirements viz dimensions, density, compressive strength, water Absorption, Drying shrinkage and Moisture movement of the block shall conform to IS: 2185 (Part I) 1979.

6.2.1 The crushed stone aggregates of nominal size 12.5mm graded and conforming to the requirements of `IS:383 -1970 shall be used. The grading of the combined aggregate (ie fine and coarse) shall conform as near as possible to the requirements indicated in IS:383 -1970. It is also recommended that the fineness modulus of the combined aggregate shall be between 3.6 and 4.0. The mix proportions of the concrete used in manufacture of the blocks shall be 1:3:6 in case higher quantity of cement and lower proportion of aggregates in required to achieve the specified strength and compliance to the IS:2185 (Part I) 1979, the same shall be provided without any additional cost. Sampling and Testing shall be as per IS: 2185 (Part –I) 1979. A sample of 20 block shall be taken from every consignment of 5000 blocks or part thereof of the same size and same batch of manufacture. All the 20 blocks shall be checked for dimensions and inspected for visual defects. The other tests shall be as under:-

(a) Block density - 3 Blocks

(b) Compressive strength - 8 Blocks

(c) Water absorption - 3 Blocks

(d) Drying shrinkage and lateral to Moisture movement - 3 Blocks

(e) Reserve for retest for drying shrinkage and moisture movement if need arises. - 3 Blocks

6.2.2 The criteria for conformity of the lot shall be as specified in IS:2185 (Part I) 1979. The cost of PCC blocks for testing and testing charges shall be borne by the contractor. The manufacturer of PCC blocks shall issue a certificate that these masonry units conform to the requirement of IS : 2185 Part I 1979. The blocks shall also bear the identification for the manufacturer and the grade of the unit supplied.

6.3 Unless otherwise specified here-in-after precast cement concrete block masonry shall be built in CM 1:6 for 200mm thick and 300 mm thick wall and CM 1:4 for 100mm thick wall.

6.4 Precast PCC masonry wall of 100mm thick shall be constructed over PCC sub base in ground floor and from top of RCC slab in upper floors in case of concealed beam/beam not shown on drawings. PCC masonry wall 100mm thick having height more than 1.5m shall be reinforced with two 8mm dia MS bars horizontally at every forth course starting from floor level and anchored in walls at junctions. The anchorage length shall be not less than 100mm. Unless otherwise shown be provided with depth 150mm at lintel or opening height level with 4 Nos of 10mm dia deformed bars as longitudinal reinforcement and 8mm dia deformed bar stirrups at 100mm centre to centre.

6.5 In the event of deviation precast PCC block masonry shall be priced at the applicable rates in MES schedule (Part II) for materials and labour with contractor's percentage as applicable irrespective of size aggregate specified.

6.6 The particular of sources/manufacturers of PCC solid/Hollow block shall be approved by GE. However the same can be manufactured at site confirmed to the requirement all as specified hereinbefore.

6.7. Width of concrete lintels, beams, cills, columns and the like coming in conjunction with block masonry walls/pillars shall be kept to the actual width of masonry work of that place unless offsets have been specifically shown; in which case, the width as shown on drawings shall be maintained.

6.8 Center line dimensions of rooms, verandahs etc., shown in drawings shall be maintained. Internal and overall dimensions, if at variance from whatever shown in drawings, shall be deemed to have been amended accordingly. The dimensions for various height shall be maintained as shown on the drawings.

6.9 **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 @ 3% by weight of cement.

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 equivalent 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 AND JOINERY

8.1 TIMBER

8.1.1 Timber for all joinery and wood work shall conform to specifications given in clause 7.3 of the MES Schedule and shall be within the permissible limits of defects defined in clauses 7.4 and 7.5 of the MES Schedule Part-I.

8.1.2 Timber shall be well seasoned, whether air or kiln dried at the discretion of the Contractor but without any price adjustments. The moisture content of timber shall not exceed the limits laid down vide clause 7.7 of the MES Schedule. Adequate number of tests shall be carried out by the Engineer-in-charge to determine the moisture content in the timber to be used in the work and the Contractor shall provide necessary facilities for test as required by the Engineer-in-charge without any extra cost to Government. Testing charges shall also be deemed to be included in lump sum quoted by the Contractor for Schedule-„A" Part-I

8.2 PRESERVATION OF TIMBER

(a) Preservative anti-termite treatment shall be carried out to all wood work and joinery fabricated by the Contractor at site. Factory made ply/boards are deemed to be provided with anti-termite treatment.

(b)Chemical used for anti-termite treatment to wood work and joinery shall be copper NAPTHANATE, ASCU or any other chemical specified in IS-401, applied in any one of the manners specified in ibid IS.

(c) The species of timber for joinery/furniture items fabricated at site and prefabricated wood products i.e. particle board, etc. shall be as specified hereunder:

(i) Fully panelled or partly paneled / glazed/wire gauzed shutters Factory made shutters with styles/rails of Second class hard wood as per IS-1003 (Part-I) of species LAUREL/ BIJASAL/BENTEAK/VENTEAK/ SAL, to be obtained from list of approved manufacturers given in Appendix-B'(FSC/PFSC Certified Chain of custody Certified products. Make: Greenply/ Archidply/ equivalent)

(ii) Frames of built-in cupboards / cabinets and furniture items, if indicated of timber Second class Hard wood (Sal)(FSC/PFSC Certified Chain of custody Certified products. Make: Greenply/ Archidply/ equivalent)

(iii) Wooden pelmets: Pelmets of particle boards shall be provided as specified hereinafter.

(iv) Edging/beading for particle/ block/ medium density fiber board exposed to view in shutters, shelves and tops of built-in furniture, cupboards and cabinets Teak/Shishamwood. (FSC/PFSC Certified Chain of custody Certified products. Make: Greenply/ Archidply/ equivalent)

(v) Gutties plugs cleats / stoppers, beading and fillets for shutters and frames Second class hardwood (Sal/Kalasiris/Chaplash/ Hollock)

(vi) All other woodwork and joinery not otherwise specified Second class hardwood (Sal/ Kalasiris/Chaplash/ Hollock). (vii) Door frames Second class hardwood (Sal)

8.3 FACTORY MADE PANELLED DOOR SHUTTERS:

(a) Panelled door shutters and glazed / gauged shutters shall be factory made shutters conforming to IS-1003 (Part-I). Styles and rails shall be kiln seasoned and chemically treated by pressure process as per para 5.5 of IS-401 (under vacuum pressure). The dimensions and overall sizes shall however be as shown on drawings.

(b) The thickness of door shutters shall be as shown on drawings and if not shown on drawings, the same shall be 35mm.

(c) Panelled shutter shall be provided with suitable size wooden beading all round the panel insert on both the sides of the shutter.

8.4 FACTORY MADE SKELETON SHUTTER FOR MOSQUITO PROOF DOORS:

(a) Mosquito proof shutters where indicated on drawings shall be of factory-made skeleton shutters conforming to IS-1003 (Part-I) with second class hard wood styles and rails of species specified here-in-before and wire gauze as shown on drawings. The dimension and overall size shall however be as shown on drawings.

(b) Timber shall be of kiln seasoned and chemically treated by pressure process as specified in para 5.5 of IS-401 (under vacuum pressure).

(c) Other treatments to timber surfaces such as tarring, painting etc. shall be carried out in addition.

8.5 Factory made panelled / skeleton shutters shall be obtained from any one of the manufacturer"s inspection and approval. Sample shutters shall be got approved from the GE before placing bulk order.

8.6 Factory made panelled / skeleton shutters may be obtained from any other manufacturer, provided the same fulfill the following requirements:

(a) Shall conform to the specification given above. (b)Standard and quality are equal or superior to that of the products mentioned above. (c)Is approved by the GE in writing before incorporation in the work.

8.7 Factory made shutters shall be brought to site before applying the primer and the shutters shall be got passed by the Engineer-in-charge before application of the primer.

8.8 PLYWOOD: All plywood where indicated on drawings shall be 18/19mm thick marine ply with 1.2mm thick laminate (as approved) on both sides

8.9 WORKMANSHIP:

(a) Joinery shall be wrought all over. Timber surface exposed to view shall be wrought and for surface not exposed to view shall be clean sawn. The workmanship and fixing of joinery shall be as per Clauses 8.11 to 8.24 of MES Schedule.

(b) The dimensions of the various components of joinery (other than block board shutters) shown on drawings, wherever at variance, shall supersede the standard dimensions mentioned in the MES Schedule. However, for pricing deviations involving any joinery work, the rates in the MES Schedule for the corresponding joinery shall be applicable.

(c) Unless otherwise specified, all work both carpenter's and joineries shall have full dimension shown on drawings except that an allowance of 1.5mm shall be allowed for each wrought face. Wooden beads and fillets shall however, hold the full dimensions as shown on drawings. The Contractor shall also maintain the overall sizes of the doors and windows, etc. as shown on drawings.

(d)Timber member"s upto 3m length shall be in one piece.

(e) Plugging to walls shall be done with wooden plugs as per clause 7.29 of the MES Schedule and specified hereinbefore.

(f) 2mm thick PVC sheet to a height 200mm shall be provided to both sides and also at bottom edge of all door shutters of kitchen, unless other material is indicated on drawings.

(g) Vertical members of wooden doorframes shall be embedded 40mm deep below FFL. All door shutters shall have 2 to 3mm clearances above FFL.

8.10 FLUSH DOOR SHUTTER : Unless otherwise specified on drawings flush door shutter shall be 35mm thick with both side laminated, solid core, factory made shutter made as per IS: 2202 (Part-I-1999) and shall be ISI marked. Styles and rails shall be without any joint and be made of non-coniferous timber hard wood (Hollock / Mirantee / Bonsum/ Ben Teak) with moisture contents not more than 12% and dimension as given in IS code. The face panel comprising of plywood or cross band and face veneers shall be glued by hot pressed process. Over all finished thickness of face panel shall not be less than 3mm while the thickness of face veneer shall not be less than 0.6mm. Block board core shall fully confirm to the requirement specified in the IS code. All timber used shall be well seasoned and chemically treated. Adhesive shall be phenol formaldehyde synthetic resin BWP type specified in IS: 848- 2006. All dimensions shall be finished dimension & manufactures test certificate for test specified in IS: 2202 (Part I) shall be rendered.

8.10.1 The Contractor shall submit machine numbered paid vouchers from the authorized dealer/ manufacturer for the total quantity of the flush door shutters supplied under each consignment. At the time of delivery of flush doors at site, delivery challan alongwith invoices shall be submitted by the Contractor to the GE. Each consignment received at the site shall be inspected by the GE. The original invoice shall be defaced by the GE and kept on record at the site office. Colour shall be as approved by GE.

8.10.2 The Excise duty paid gate pass shall be submitted by the Contractor to the GE for each consignment of flush door shutter dispatched by the factory holding valid BIS certification and brought at site for incorporation in the work.

8.10.3 On receipt of the shutters at site, the samples of door shutters shall be tested in any approved laboratory as instructed by the GE. From each lot of approximately 700 shutters, one shutter shall be selected at random by the GE. The cost of the door shutters selected as samples, their transportation to the laboratory and the cost of testing by the laboratory shall be borne by the Contractor and shall be deemed to be included in the lump sum rates quoted in Schedule-"A" Section-I. Flush doors to be provided with teakwood beading as per drawings and painted to match the door shutter. Bottom of the flush door be painted with two coats of synthetic enameled paint before fixing. Flush door shutters to be provided as per drawings, shall be with teak wood beading 6mm thick all round.

8.11 PERFORATED PARTICLE BOARD FOR ACOUSTIC PURPOSES

(a) The perforated particle board tiles shall conform to IS: 3129-1985 and shall be of 12mm thick unless otherwise indicated on drawings. Fixing and workmanship shall be as detailed on drawings, as specified in MES clause 12.4 of SSR Part-I and as directed by the Engineer-inCharge.

(b) The tiles shall be placed over the grid frame work and held in position using standard spring aluminium clips. Each edge of the tile shall be clamped at least at one point. The tiles shall be painted with one coat of oil bound distemper of specified shade before being fixed in the aluminium grid frame work and the finishing second coat after erection.

(c) The cleats shall be finished with a coat of red oxide primer and 2 coats of synthetic enamel paint all as specified here in after before fixing.

8.12 FRP DOORS:

(a) FRP door shutters and frames shall be provided at locations as shown on drawings

(b) FRP doors shall be of make as specified here in after.

(c) The thickness of FRP shutters & thickness of FRP shall be as shown on drawings. Shutters shall be in depressed panel and of design and colour as approved by the GE and shall be consisting of extra reinforcement on edges. The core of shutter in styles and rails area shall be of polyurethane foam. The panel area shall have ply-FRP sandwich construction having 4mmthick ply to have embedded wooden blocks for taking fixtures. Shutter shall have recesses to take hinge to fix wooden frame. The whole shutter shall be resistant to mild acid /alkali. Aluminium iron mongery to FRP shutter shall be fixed as per manufacturer"s instructions.

8.13 POWDER COATED ALUMINIUM ANODISED WINDOWS / DOORS AND VENTILATORS/PARTITION: Powder coated aluminium anodised doors / windows / ventilators including grills shall generally confirm to clause 10.37 of MES Schedule Part I and shall be provided at locations and as per the details shown on drawings. Powder coated aluminium anodised doors/windows/ventilators shall be made out of extruded aluminium anodised sections. Powder coating shall not be less than 50micron thick. Sections of Aluminium doors / windows / ventilators shall be obtained from any of the firm as listed in here in after. Glazing of aluminium doors / windows / ventilators shall be with sheet glass ordinary quality conforming to IS: 2835-1977 and thickness of sheet glass irrespective of whatever mentioned in drawing shall be 5.50mm. Glazing for WC/ toilet shall be figured glass conforming to IS-5437, 1969 and thickness shall be 4mm. Glazing for all the external doors and windows shall be 5.5mm thick toughened glass or higher thickness if shown in drawing. All fittings to aluminium doors / windows / ventilators shall be as per the manufacturer"s instructions.

8.13.1 Where shown in the drawings, Aluminium anodised windows and ventilators shall be provided with Aluminium anodised grills all as shown on drawings. The Contractor may procure the aluminium anodised sections from the other manufactures as given in here in after or equivalent to sections of Jindal Aluminium Company. In case the weight of sections is more than that of "Jindal Aluminium Company". No extra cost shall be paid on this account.

8.13.2 Where shown on the drawings, aluminium anodised windows and ventilators shall be provided with fly proofing shutters of aluminium XPM jalli 24gauge thickness and average 1.40mm width of aperture to be provided all as specified/shown in drawing. Aluminium door shall be provided with fly proofing shutters and grills of specification have been shown in drawings.

8.13.3 Where shown in the drawings, Aluminium anodised windows and ventilators shall be provided with Aluminium anodised grills of DG 104 (10mm) of make Decogrille or equivalent. All other specifications for these aluminium doors/ windows/ ventilators shall be as per the relevant drawings mentioned in the list of drawings.

PARTICULAR SPECIFICATIONS [Contd…]

8.14 uPVC DOOR WITH FRAME:

8.14.1 Wherever shown on drawings uPVC doors shall be provided. uPVC factory made integral leaf (shutter) and frames shall be provided wherever shown on drawings. The frame made of uPVC extruded sections of size as mentioned on drawings, corners of the door frame shall be jointed with galvanised brackets and SS screws, joints mitred and plastic welded. The hinge side vertical of the frame reinforced by galvanised MS tube. The shutter made of styles & rails of uPVC sections as shown on drawings with inbuilt decorative moulding edge on one side jointed by means of plastic/ galvanised MS tubes. The shutter panel shall be factory made with 12mm thick water proof exterior MDF particle board panel for flush door / 5mm thick glass for glass door / wiremesh mosquito proof shutter wih fibre reinforced mesh. The panel / glass/mesh shall be fitted with EPDM rubber gasket as per manufacturer's instructions. Irrespective of what is shown on drawing frames shall be fixed with expandable fasteners or lug plates as per manufacturer's instructions. All builders' hardware shall be of aluminium except butt hinges, which shall be stain less steel ISI marked. The uPVC doors shall be provided with all builder's hardware articles. Frames and shutters shall be of colour as approved by GE. uPVC doors shall be fixed as per manufacturer's instructions.

8.15 uPVC SLIDING WINDOWS / VENTILATORS WITH FRAME:

8.15.1 Wherever shown on drawings uPVC Sliding windows 2/3 track & Ventilators shall be provided. uPVC factory made integral leaf (shutter) and frames shall be provided wherever shown on drawings. The frame made of uPVC extruded sections of size as mentioned on drawings, corners of the frame shall be mitered cut and fusion welded at all corners. The shutter made of styles & rails of uPVC sections as shown on drawings with inbuilt decorative moulding edge on one side. The shutter panel shall be factory made with uPVC multicavity sections of size as shown on drawings with 5mm thick glass for glass door and mosquito proof shutter wih fibre reinforced mesh. The glass/mesh shall be fitted with EPDM rubber gasket as per per manufacturer's instructions. Irrespective of what is shown on drawing frames shall be fixed with expandable fasteners or lug plates as per manufacturer's instructions. All builders' hardware shall be of aluminium except butt hinges, which shall be stain less steel ISI marked. The uPVC doors shall be provided with all builder's hardware articles. Frames and shutters shall be of colour as approved by GE. uPVC doors shall be fixed as per manufacturer's instructions.

8.15.2 Where shown in the drawings, Aluminium grill shall be provided with Aluminium anodised grills of DG 104 (10mm) of make Deco grille or equivalent fixed with aluminium flats & rivets as shown on drawings. All other specifications for these aluminium doors/ windows/ ventilators shall be as per the relevant drawings mentioned in the list of drawings.

8.15 PLY WOOD, MARINE 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/ Marine Ply 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 pre-laminated particle board in all situations shall be flat pressed three layered exterior grade ISI marked [IS-12823] Gde I, type II with pre lamination of approved shade on one side and balancing white on other side bonded with phenol formaldehyde synthetic resin adhesive.

PARTICULAR SPECIFICATIONS [Contd…]

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 Helical door springs 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.

9.4 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 as shown on drawing of reputed make and of shape shown on drawing. Brackets shall be fixed to wooden plugs embedded in wall.

9.5 TOWER BOLTS: Aluminium anodized tower bolts shall comply with IS: 204 (Part-II) specifications for tower bolts, Part-II non-ferrous metals. The shape and size of tower bolt shall be as indicated. The type and size of tower bolt shall be as specified in respective item. Barrel and tower bolts, wherever possible shall have the knob integral with bolts. In case it is not possible to provide a single piece construction of bolt, the knob may preferable be fitted to the bolts with a pin or alternatively screwed and riveted to the bolts, and its shape may be round as directed. Where diameter of bolt of particular size of tower bolt is not stated in the IS, the bolt shall be of 10mm dia upto size 125mm and 12mm dia for sizes 150mm and above.

9.6 SLIDING DOOR BOLTS: Where shown on drawings sliding door bolts shall be of aluminium anodised all as per IS- 2681 of 1979 and 9.5.2 of MES Schedule 2009 Part-I (Specifications). The dia of bolt unless otherwise shown on drawings shall be 16mm.

9.7 HANDLES: Handles for doors shall be aluminium anodized fabricated type as specified in clause No.9.11 of MES Schedule Part-I, and sizes of handles shall be provided as indicated in drawings.

9.8 HYDRAULIC DOOR CLOSER: Aluminium doors shall be provided with aluminium die cast body door closer, hydraulically regulated designation No 2, universal type conforming to IS 3564 and shall be as specified in Clause No 9.16 and 9.16.1 of MES Schedule 2009 Part-I (Specifications).

9.9 DRAPERY ROD: Drapery Rod shall be provided in all the quarters at the places shown on typical floor plan and shall be of high strength aluminium rod powder coated thickness 40-60micron outer dia 19/20mm and inner dia 16mm with plastic rings made of ABS plastics for all quarters. The brackets shall be of galvanized steel 1.6mm thick. The drapery rod shall be of make approved by GE.

PARTICULAR SPECIFICATIONS [Contd...]

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.

[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 [2009]:

[i] Standard quality structural steel of Grade E 250 [Fe-410W Quality B/BR] 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.

[c] Galvanised Steel Sheets [Plain & Corrugated]: Galvanised steel sheets [Plain and Corrugated] shall conform to IS–277. Unless otherwise specified the sheet shall be of Galvanised Class – 4. Grade of zinc coating shall be as per clause 10.29.1 of MES Schedule Part – I.

[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** 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 who are manufacturing **corrosion resistant steel reinforcement**:

[i] M/s. Shyam Steel Industries Ltd. [For Fe 500, Fe 500 D & CRS] , Brand: "**Shyam"**

[ii] M/s. Steel Exchange India Ltd. [For Fe 500, Fe 500 D & HSCRM], Brand : "**Simhadri TMT"**

[iii] M/s. JSW Steel Ltd. [For Fe 500, Fe 500 D, Fe 550D & CRS] , Brand : "**Neosteel"**

[iv] M/s. Kamachi Industries Ltd [For Fe 500, Fe 500 D, Fe 550, Fe 550D & HCRM], Brand : "**Kamachi"** (8-40mm)

[v] M/s. Gallantt Metal Ltd [For Fe 500, Fe 500 D & CRS] , Brand : "**Gallantt TMX"** (8-32mm)

10.2.2.2 **Structural Steel: -** Structural steel supplied by the contractor shall be procured directly from following primary producers.

[i] **Steel Authority of India Limited [SAIL]** [ii] **Rashtriya Ispat Nigam Ltd [RINL]**

[iii] **Tata Iron & Steel Company [TISCO or Tata steel] (Brand TATA)**

[iv] **Jindal Steel and Power Limited [JINDAL]**

10.2.2.3. In no case Structural steel of all sizes shall be allowed to be procured from other than the above mentioned producers.

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

SerNo.	Nominal Size	Frequency
[a]	STEEL FOR CONCRETE REINFORCEMENT:	
1	Bars size less than 10 mm	1 Sample [3 specimens] for each test for every 25 tonnes or part thereof
2	Bar size 10mm to 16 mm	1 Sample [3 specimens] for each test for every 35 tonnes or part thereof
3	Bar size over 16 mm	1 Sample [3 specimens] for each test for every 45 tonnes or part thereof
[b]	STRUCTURAL STEEL:	
4	Tensile Test	1 Test for every 25 tonnes of steel or part thereof
5	Bend Test	1 Test for every 25 tonnes of steel or part thereof

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

10.6.2. CWE / GE 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 own 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 SSR/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 10.11

PARTICULAR SPECIFICATIONS [Contd...]

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 finalized by GE in consultation with contractor and same will be incorporated in CPM chart so that supply of steel is monitored in a way to avoid any delay in completion of the work. The schedule of supply of steel will be vetted by CWE from time to time.

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 stone aggregate in the wall/mix of concrete as per the columns.

10.13. **STAINLESS STEEL WIRE MESH:** Provide stainless steel wire mesh for mosquito proofing irrespective what is indicated on the drawings. The stainless steel wire mesh shall be of wire cloth 0.45 mm nominal dia of wire and average width of aperture 1.40 mm fixed with 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 wherever shown on drawings. MS grills shall be fabricated with MS bars / flat to required size all as per the details shown on drawings. MS Grills shall be fixed to chowkats with suitable GI screws all as directed. All the surfaces of grills shall be treated with paints as specified hereinafter for steel surfaces.

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.

PARTICULAR SPECIFICATIONS [Contd...]

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 in Appendix 'B' and shall conform to IS 6248.

10.22 **MS LOCKERS**: Steel lockers shall be of factory made (body, shutter and Shelves shall be made out of 1mm thick MS plain black sheet) all as shown on drawings. MS plain black sheet shall confirm to relevant IS and procured from the main producers of steel like RINL, TATA, SAIL etc as approved by GE. All joints/welding/fixing shall be done all as shown on drawings and with standard workmanship. The lockers shall be provided with proper locking device as per 'Godrej' pattern as approved by GE. The handle shall be made as per 'Godrej' pattern. All steel surfaces internally and externally shall be treated with two coats of synthetic enamel paint over a coat of red oxide primer. Painting shall be done with spray machine. The welding joints shall be filed smooth. The surface shall be thoroughly cleaned and prepared prior to application of painting. All other details shall be provide as shown on drawings.

10.23 **COLLAPSIBLE STEEL GATES**

10.23.1 Collapsible steel gates shall be of approved design and top hung type. These shall be with single or double leaves as indicated. It shall be any one of the make specified in list of makes.

10.23.2 Rolled steel channels for vertical supports, flats for crossing, and tee and flats for top and bottom runner shall be mild steel conforming to IS 2062-2006. Roller wheels shall be of grey iron casting generally conforming to grade FG 150 of IS 210-1993 and shall be capable of taking the weight of the gate. Rivets used shall not be less than 6mm and shall be of snap headed type. Other fittings such as folding stoppers, fixing hold fasts, locking cleats, brass handles on both sides and cast iron rollers shall be of approved design and size.

10.23.3 The dimensions and other particulars shall generally be as under, unless otherwise indicated. The dimensions given are normally for a collapsible gate of maximum height of 3m

(a) MS Channel = Hot rolled medium channel 18x9x3mm. (b) Flats for crossings = 18x5 mm.

(c) Tee and flats for top and bottom runners with a minimum web of 40x12mm and flange of 40x6mm.

(c) The distance from centre to centre of channel pickets = 10 cm.

10.23.4 The bottom and top runners are fabricated separately with necessary holding fixtures for burying in the ground or fixing in the lintel respectively. The gates shall be provided with locking arrangement so that locking with padlock can be done.

10.23.5 Collapsible gates may be fixed under the lintels or fixed on outside/inside of the wall as indicated. Gates shall be fixed moveable on top and bottom channels with swinging arrangements on either side. Single leaf collapsible gate can be with single panel collapsible at right or left end. Fixing of collapsible gates shall be carried out in a workman like manner, the gate shall open and close smoothly and easily, the bottom runnel' shall be sunk level with floor. The gate shall be cleaned of all rust and mill scales etc. The wheel shall be fitted with ball bearing for width of opening more than l.5m.

10.24 **GRILL DOOR**: Grill door shall be provided as per size as shown on drawing. The door shall be painted with two coats of synthetic enamel paint over a coat of red oxide zinc chrome primer.

11. RCC ROOFING:

11.1 GENERAL

(a) 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.

(b) 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.

(c) 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.

(d) Area below/around the location where water tank is to be placed shall be suitably raised with PCC 1:2:4 type B0 to drain off the over flow/ leakage water effectively.

(e) All joints and changes in direction should be cured with cement mortar [1:3] mixed with SBR Latex @ 200 ml per bag of cement and cured before laying membrane by torching. All angles and abutment should be sealed with extra care to ensure full bondage.

11.2 WATER PROOFING TREATMENT OVER ROOF SLAB [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] mixted with WPC shall be provided to achieve the slope as indicated in drawings.

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

[a] 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] mixted with WPC@5% of weight of cement shall be provided to achieve the slope as indicated in drawings.

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

[c] Cement slurry @ 3 Kg/Sqm shall be provided over cleaned roof surface.

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

[e] After setting & drying cement screed, the surface shall be painted with one coat of cold applied bituminous primer @ 2. 0 kg per sq. m, all as described in paras 11.44.5 of MES Schedule Part-I.

[f] Atactic polypropylene polymeric modified prefabricated water proofing membrane five layered reinforced with non woven polyester matt of minimum 3mm thick weight not lessthan 3 Kg/Sq.m shall be laid using butane torch application over entire roof surface and on vertical surface up to grooves as applicable [or as per manufacturers recommendation] with over laps of 100mm in both the directions. 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 Govt.

[g] Finally it shall be finished with a coat of bituminous aluminium primer @ 0.20 Kg/Sqm in two coats.

[h] Proper care shall be taken to provide similar treatment near junction of roof and parapet to avoid any leakage through junction. Benching (gola) of concave shape 80mm radius at junctions of roof/ terrace with parapets / side walls with PCC (1:2:4) Type B-0 where applicable shall be provided

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 [f] above and:

[b] Hydraulically pressed cement concrete tiles 200 X 200 X 22 mm size, colour and shape as approved by GE, 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 exc. 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.

11.4.2 Poly water proofing membrane on top of Chajjas shall not be required and remaining specification for Water proofing shall be applicable to chajjas.

11.5 **MATERIAL**

11.5.1 Atactic polypropylene polymer (APP) modified prefabricated membrane shall be 3 mm thick, weight not less then 3kg/Sqm with five layered reinforced with non woven polyester matt all as described in paras 11.44.2.2 of MES Schedule Part-I.

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 in presence of approved applicator 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 carryout flooding test by forming earthen bunds over the roof at suitable intervals as desired by GE. Water will be ponded for three days and leakage / seepage noticed shall be rectified by the contractor to the satisfaction of GE at no extra cost to Government. 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 water proofing treatment 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 carryout 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 30cm above top of coving in case of roof slab.

11.10. **HDPE WATER TANK:** Rotational moulded polyethylene water storage tanks [Triple 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.

11.11. **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.

11.12 **RCC OVER HEAD TANKS**

11.12.1 RCC overhead tanks shall be provided all as per details shown in drawings with following specifications: -

(a) RCC M40 (Design Mix) mixed with Algi proof integral water proofing compound confirming to IS: 2645 as per Manufacturer's instructions.

(b) Water proofing plaster shall be carried out as per described in drawings.

(c) Inlet, Outlet, Washout and overflow pipes, valves shall be provided as per the drawings and as directed. Construction joint shall be provided as per standard engineering practice all as directed by the Engineer-in-Charge.

(d) Contractor shall submit written guarantee for the effectiveness of the water proofing treatment carried out for a period of 10 years. **3% of the cost of water proofing treatment at contract rates subjected to a minimum of Rs. 20000/ each tank (Rupees Twenty Thousand only)** shall be retained from the payment due to the contractor. Alternatively, contractor shall submit fixed deposit receipt for the said period and amount in favour of the GE. The guarantee amount shall be released to the contractor after successful completion of the guarantee period.

(e) Testing of RCC over Head Tank for water tightness: Testing shall be done in accordance with IS-3370. The Over Head Tank shall be filled with water very slowly upto half the depth and allowed to remain for a period of 7 days. Thereafter water shall be filled to the full rated capacity and shall be allowed to remain for a further period of 7 days. The structure should not show any sign of leakage or sweating during this period. The drop in water level during during 24 hours after the Over Head Tank is filled to full capacity shall not exceed 115mm. Any leakage or sweating noticed shall be rectified and complete water tightness shall be achieved by the contractor to the entire satisfaction of Engineer-in-Charge. Water required for testing the Over Head Tank shall be supplied by the DGNP(V) at the rate as specified here-in-before.

(f) The Over Head Tank after completion/Testing and till handed over to the department shall be filled with water and shall not be kept dry under any circumstances by the contractor.

(g) Rest of the specifications all as shown/described in the drawings and as specified here-in-before and the Lump Sum quoted shall deemed to include in rate quoted.

(h) Lumpsum quoted shall deemed to include the plastering over Slab of 10mm thick with CM 1:3 including water proofing compound and finishes of plaster surfaces. Necessary records of tests shall be maintained duly signed by the Engineer-in-Charge and representative of the Contractor and shall be countersigned by the GE.

11.13 RCC UNDERGROUND SUMPS:

11.13.1 Provide RCC **Underground Sump** all as shown on drawing. All internal and external surfaces, water proofing treatment of **Underground Sump** shall be provided all as specified in drawings. The Lumpsum quoted shall deemed to include cost of ladders, water level indicator, railings, rungs, aluminium mosquito proofing wire mesh, inlet / outlet / wash out /overflow pipes.

11.13.2 The specifications as specified herein before for Schedule "A" Part – I shall be applicable.

11.13.3 **EXCAVATION:** Excavation and earthwork required for the tank is included in the Lumpsum and shall be as specified herein before.

11.13.4 **CONCRETE:** Type of the concrete for the RCC sump shall be **RCC M-40 Design Mix concrete** [controlled concrete] **mixed with Algi proof integral water proofing compound** confirming to IS: 2645 as per Manufacturer's instructions.

11.13.5 **STEEL:** Steel for concrete reinforcement shall be of high strength deformed steel CRS bars of grade Fe-500D produced by thermo mechanical treatment process [TMT steel bars] as specified herein before.

11.13.6 **MS RUNGS:** Irrespective of shown on drawing or not**,** Rungs shall be provided. It shall be 20mm MS rod@300mm centre to centre staggred, bent to shape and fixed in position. Exposed faces of rungs shall be painted with two coats of synthetic enamel paint over a coat of primer all as specified herein before.

11.13.7 **WATER PROOFING TREATMENT:**

(i) BASE SLAB

(a) Lean concrete surface shall be rendered with 10mm thick screed in cement mortar [1:3] mixed with water proofing compound as per manufacturer's instructions and one layer of APP polymeric modified bitumen water proofing membrane minimum 3mm thick weight not lessthan 3 Kg/Sq.m shall be laid as per manufacturer's instructions and protected by provision of 40mm thick plaster in CM 1:3 in two layers.

(b) Special threaded nozzels (for injection of grout) of 12mm dia length equal to half of the depth of slab be placed in a grid pattern during concreting at 1.5m c/c all over the slab. The nozzels should be kept plugged during concreting to keep out grit & dirt.

(c) A non shrink polymeric waterproofing grouting compound mixed with neat cement slurry be injected through the nozzels under pressure not excedding 2kg/Sqcm to ensure that grout runs through all pours and cracks and sealing them after injection is over. The nozzels shall be sealed off with sealing compound.

(ii) WALLS:

(a) Special threaded nozzels (for injection of grout) of 12mm dia length equal to half of the depth of wall shall be placed in a grid pattern during concreting at 1.5m c/c all over the walls. The nozzels should be kept plugged during concreting to keep out grit & dirt.

(b) A non shrink polymeric waterproofing grouting compound mixed with neat cement slurry be injected through the nozzels under pressure not excedding 2kg/Sqcm to ensure that grout runs through all pours and cracks and sealing them after injection is over. The nozzels shall be sealed off with sealing compound.

(iii) After complete operation of above mentioned treatment, the inside surface of walls and top surface of the flooring shall be made rough with hacking tool, washed with water and wire brush to remove all loose materials and shall be treated with two coats of plaster as first coat with **15mm thick plaster in cement mortar [1:3] and second coat with 10mm thick plaster in cement mortar [1:3] both the treatments shall be mixed with water proofing compound** as per manufacturer's instructions. The second coat shall be applied after allowing for the first coat to harden.

(iv) The outside surface of side walls including vertical edge of slab and top of outside projection of base slab shall be treated with with **15mm thick plaster in cement mortar [1:3] mixed with water proofing compound** as per manufacturer's instructions and allowed for curing.

(v) Apply one coat of polymer modified cementatious base slurry (such as tape crete or equivalent) as bonding material on rendered smooth inside surface of side wall and top surface of base slab.

(vi) Apply two coats of polymer modified cementatious base slurry (such as tape crete or equivalent) as bonding material on rendered smooth outside surface of side walls including vertical edge of slab and top of outside projection of base slab.

11.13.8 Testing shall be carried out as specified in drawing. Testing of water proofing treatment shall be done by filling the tank with water and impounding for 48 hours. Contractor shall give written guarantee for effectiveness of water proofing for **10 [Ten] Years** from the certified date of completion of entire work. An amount of **Rs. 50,000.00 [Rupees fifty thousand only per each sump]** shall be retained from the amount of final bill as guarantee amount. However, the guarantee amount will be released to the contractor if a fixed deposit receipt in favour of GE for equal amount for 10 years is submitted by the contractor from any scheduled bank. The fixed deposit receipt or the guarantee amount retained from the final bill shall be released to the contractor after the expiry of the guarantee period satisfactorily.

11.13.9 **HYDRAULIC TESTING:** Structure shall be tested strictly in accordance with IS – 3370, Part – I for water tightness. The contractor shall provide all necessary tools and plants required for the testing at his own cost. Water required for testing shall be supplied by the DGNP(V) at the rate as specified here-in-before. The contractor shall make all the necessary arrangements to fill the tank to the maximum level as required for testing. The contractor shall rectify all the defects listed out during testing, due to leakage, sweating, etc to the fullest satisfaction of the GE.

11.13.10 The Lumpsum quoted by the tenderer shall be deemed to include all the cost thereof and no extra claim in this respect shall be entitled.

11.13.11 The UG Tank / sump after completion/Testing and till handed over to the department shall be filled with water and shall not be kept dry under any circumstances by the contractor.

11.13.12 Necessary records of tests shall be maintained duly signed by the Engineer-in-Charge and representative of the Contractor and shall be countersigned by the GE.

11.14 **WATER PROOFING TREATMENT FOR SWIMMING POOL: -**

(i) Base Slab: -

(a) Lean concrete surface (PCC 1:4:8) shall be rendered with 10 mm thick screed in CM 1:3 and finished smooth one layer of High Density Polyethylene Membrane (HDPE) 4-5mm thick as per manufacturer instructions.

(b) The RCC slab should then be cast in the M-40 (Design Mix) Self compacting concrete integrated with hydrophilic crystalline waterproofing admixture in dry powder from strictly as per manufacturer's instruction.

(c) The coats of polymer modified cementations base slurry (such as tape crete / Nitocote CM210 (FOSROC /Pidilite/STP) be applied over the rendered smooth inside surface of base slab before placing the tiles on the bedding mortar.

(ii) Walls : -

(a) High Density Polyethylene Membrane (HDPE) 4-5mm thick outside wall as per manufacturer instructions will be place on the formwork as strictly as per manufacturer instructions.

(b) The RCC wall should be cast in the M-40 (Design mix) Self compacting concrete integrated with hydrophilic crystalline waterproofing admixture in dry powder from strictly as per manufacturer's instruction.

(c) After completing operations the inside surface of the walls should be made rough with a hacking tool washed clean with water and wire bush so as to remove all the loose materials and apply cement plaster in 1:3 mix 10mm thick.

(d) WATER SWELLABLE WATER STOPS AT STARTER JOINTS: Providing and applying water swellable-basic polymer-hydrophillic waterstops **Supercast SW20** and equivalent at all construction joints, Supercast SW20 shall have unrestrained volumetric expansion up to 300%, shore a hardness of 25 to 35, Hydrostatic pressure resistance of 100mtrs. Supercast SW20 (FOSROC) shall be fixed to the concrete using Supercast SWX a gun grade hydrophilic adhesive. Application of Nitobond SBR and equivalent for horizontal/day/construction joints.

(d) Apply one coat of polymer modified cementations base slurry (Such as tape Crete/ Nitocote CM210 (FOSROC/Pidilite/STP) as a bonding material on rendered smooth inside surface of side wall and tip surface of base slab before placing the tiles on the bedding mortar.

11.15 **WATER PROOFING TREATMENT FOR BALANCING TANK :-**

(a) After the side walls are constructed and allowed to undergo the specified curing the inside surface of the wall and the flooring should be made rough with a hacking tool washed clean with water and wire brush so as to remove all the loose materials and water proof cement plaster 1:3 mix with suitable proportion of any integral water proofing compound should be applied in two coasts the first coat being 12mm and the next 10mm thick. The second coat should be applied after allowing a time interval of 24 hours for the first coat to harden.

(b) The outside surface of the side walls including vertical edge of base slab and top of outside projection of base slab should be treated with water proof rendering in a similar manner but in this case only one coat of plaster 12 mm thick will be applied instead of two successive coats.

11.16 **Testing After Construction:** -

(a) It is detrimental to keep the water retaining structures dry as it may lead to formation of cracks so it is imperative that before curing of last cast portion of pool is completed water arrangement for testing the pool shall be kept ready at site so that testing can be commenced immediately

(b) The pipes and special fixtures should be fixed in position before concreting operation so that these are built in the time of construction. These specials should be provided with puddle collars for proper grip with concrete.

(c) The proportion of water proofing compound to be added to the water proofing plaster of balancing tank shall be as per manufactures instructions.

(d) The rate of filling of water in swimming pool and balance tank shall be 300 mm depth per day and the testing of pool tank for water tightness be as per IS:6494

(e) The construction of swimming pool deep excavation is involved. Therefore, adequate precautions shall be taken by the contractor, so that any adjoining existing structures are not endangered. Further adequate precautions for shoring/shuttering shall be incorporated as directed by the GE.

(f) The joints will be filled by sealing compound. The physical requirements of sealing compound must satisfy as laid down in IS: 1834-196. The sealing compound should be of grade 'B'

(g) The tentative location of construction joints shall be shown on drg. These indicates the max. no of constructions joints no of constructions joints can be less than the number of joints indicated.

(h) The proportion of water proofing compound to be added to the water proofing plaster of balancing tank shall be as per manufactures instructions

(i) The pool/balancing tank shall not be emptied during the period of high ground water table.

(j) No part of construction shall have any contact with expansive soil and all constructions shall be separated from expansive soil by 600 thick layer of approved moorum. Quoted rate shall be inclusive of this aspect.

PARTICULAR SPECIFICATIONS [Contd...]

11.17 **GUARANTEE FOR WATER PROOFING TREATMENT TO SWIMMING POOL& BALANCING TANK:**

11.17.1 Water proofing treatment shall be carried out all as specified. Also method of construction for concreting (RCC work), construction joints, testing etc shall be followed all as specified in Drawing and relevant details in structural drawings.

11.17.2 Contractor shall submit written guarantee for the effectiveness of the water proofing treatment carried out for a **period of 10 years**. A sum of **Rs. Five Lakhs only** shall be retained from the payment due to the contractor. Alternatively, contractor shall submit fixed deposit receipt for the said period and amount in favor of the GE. The guarantee amount shall be released to the contractor after successful completion of the guarantee period.

11.17.3 Should the GE at any time during construction or reconstruction or prior to the expiry of period of ten years after the water proofing treatment has been completed as per the contract, find water leakages in the structure, the contractor shall on demand, in writing from GE, forthwith undertake at his own expenses such treatment as may be necessary to render the said structure free from leakages for a period of ten years from the certified date of completion and in the event of his failing to do so within the period, to be specified by the GE in his demand aforesaid, the GE may undertake such treatment at the risk and cost in all respects of the contractor.

11.17.4 Testing of for water tightness: Testing shall be done in accordance with IS-3370. The swimming pool and balanceing tank shall be filled with water very slowly upto half the depth and allowed to remain for a period of 7 days. Thereafter water shall be filled to the full rated capacity and shall be allowed to remain for a further period of 7 days. The structure should not show any sign of leakage or sweating during this period. Any leakage or sweating noticed shall be rectified and complete water tightness shall be achieved by the contractor to the entire satisfaction of Engineer-in-Charge.

11.17.5 The swimming pool after completion/testing and till handed over to the department shall be filled with water and shall not be kept dry under any circumstances by the contractor.

11.17.6 Necessary records of tests shall be maintained duly signed by the Engineer-in-charge and representative of the Contractor and shall be countersigned by the GE.

11.17.7 For the purpose of testing of swimming pool and balancing tank, the water will be supplied by the Dept for free of cost.

11.18 **Construction of Swimming Pool:** Following important facts shall be carefully followed during construction stages of any Swimming Pool: -

11.18.1 The workability of the design mix should be suited to the conditions in the forms and the w/c ratio maintained as low as possible for strength requirements.

11.18.2 The use of plasticizers in the mix shall be considered depending upon the levels of supervision enforceable at the construction site.

11.18.3 Aim of concreting shall be to achieve an impermeable, dense concrete avoiding any honey-combing.

11.18.4 Entire floor and 30 cm height of wall If swimming pool shall be casted in one go to avoid any subsequent leakage problems in the floor. Remaining portion of wall can be cast in subsequent batches by allowing proper construction joints. No construction or expansion joints will be permitted in the floor pool.

11.18.5 Apply water swellable-basic polymerhydrophilic waterstops **Super cast SW20 (FOSROC or equivalent chemical in Dr. FIXIT or chemical as approved by GE)** add all construction joints as per manufacturers instruction irrespective whatever is shown in drg or elsewhere.

11.18.6 The RCC work of swimming pool shall be followed by two 20 mm thickness screed bed layers for making proper leveled surface for tiling.

11.18.7 Waterproofing treatment for swimming pool construction shall be three fold as follows: -

(i) Use admixtures during concreting of floor and walls.

(ii) Use waterproofing compounds in the two screed plaster layers.

(iii) Use tile adhesive for tiling of the pool.

11.18.8 Before commencing the work of tiling in the pool, a no-leakage test should be carried out. The fixing of pipes to be embedded in the concrete should be provided with puddle flange or collars for ensuring water tightness.

11.18.9 Following piping materials are recommended for filtration plant and circulation system of swimming pools:-

(a) For pump suction piping - HDPE pipes of 10Kg/sq.cm shall be provided for ease of handling, laying and maintenance.

(b) For pump to filter section – Mild Steel pipes in heavy gauge shall be provided for ease of fabrication and sturdiness.

(c) For filter to pool entry point section – HDPE pipes of 10Kg/sq.cm shall be provided for ease of handling, laying and maintenance.

(d) For pool jet piping which is concealed in concrete, UPVC piping in 10Kg/sq.cm rating shall be provided.

11.18.10 Following valves types and materials are recommended for filtration and circulation system.

(a) C.I Butterfly Valves with neoprene coating shall be used for pool systems.

(b) C.I. Diaphragm valves, rubber lined shall be used for filter piping as they are simple and quick to repair and maintain.

(c) Polypropylene Valves are corrosion free, easy to handle and require very little maintenance and hence shall preferred as first choice.

11.19 **PRE ENGINEERED GALVALUME SHEETS ROOFING & TRUSS**

11.19.1 GENERAL: Various component of the steel structure such as steel trusses in roof where shown on drawings shall be fabricated, assembled and erected carefully by the contractor. The centerline dimensions shall be strictly achieved.

11.19.2 TRUSS: MS angle iron/channel/pipes etc. and other steel members in rafters, purlins and false rafter shall be all as shown on drawings. If thickness of gusset plate not indicated on drawings, it shall be 10 mm thick. Base plate/sole plate and anchor plates etc shall be provided as indicated. Holding down bolts shall be made to shape and size as shown. Purlins & wind tie shall be provided as per drawings and where numbers of purlins are not indicated on drawings, the same shall be as under:-

(a) For length of sheet not exceeding 1.52m – 2Nos.

(b) For length of sheet exceeding 1.52m but not exceeding 2.40m – 2 Nos. purlin at the ends and one additional purlin in the center of sheet.

(c) For length of sheet exceeding 2.40m – 2 Nos. purlins at the ends and minimum 02 Nos. purlins at equal spacing in between ends. One additional purlin shall be provided under the eave of roof sheeting supported over false rafters and projections.

11.19.3 Irrespective of whatever thickness shown on drawings, the Galvalume sheet shall be of minimum 0.50 mm thick total coated thickness, 550 Mpa minimum yield strength and shall conform to physical specifications of ASTM A-792 or AS-1397 or equivalent. The steel sheet shall be coated with hot dip metallic Aluminium zinc Alloy (55% Aluminium, 43.5% Zinc, 1.5% Silicon) coating AZ 150 (minimum 150 gm/sqm total on both sides). The painting system shall comprise 20 micron colour coating of super modified polyster with Silicon on exposed surface over a priming coat of 5 micron and on reverse side alkyd back coat of 5 micron over 5 micron primer. The paint shall be of shade as approved by GE. The galvalume sheet shall have maximum pitch of 250mm c/c and minimum 28mm crest depth in length. The profile shall confirm to IS: 513, 277 and 14246. Fixing shall be carried out as per manufacturer's instructions. Make of Galvalume sheet shall be as specified here in after.

11.19.4 The manufactures test certificate for the chemical and mechanical propertieis of steel must be submitted by contractor for approval to GE prior to the installation /fixing and/or claiming payment as material laying at site. Contractor shall also submit purchase vouchers from manufacturer or their authorized dealer, manufacturer's test certificate in original before claiming payment for galvalume sheets. The manufacture of sheet should submit related documents for expected product service performance of pre painted metal sheet as per relevant AS/ASTM.

11.19.5 Manufacture's recommended installation methodology shall be adopted for installation of roofing including profiled sheet, capping, trims, flashing, gutter and all types of accessories considered for roofing. Fasteners shall be used for fixing roofing system as per manufacturer's recommendation.

11.19.6 Base material for coloured galvalume substrate steel sheet shall conform to the specifications of relevant ASTM or equivalent.

11.19.7 Roofing sheet shall be crest fixed to purlins with hot dip galvanized self-drilling fasteners with integral EPDM washers (one fastener on each crest). Fasteners shall also be provided on side laps @ 500 mm c/c (max) for roofing as well as wall cladding. Penetrations and laps in sheet shall be sealed by using proper sealant. Profiled HDPE filler shall be provided where ever required to close voids between cappings and troughs of the sheet to provide a weather tight exterior. Purlins shall be bolted to top flanges of rafters and purlin laps shall be as per relevant IS/ASTM/AS codes as applicable.

11.19.8 All laps of roof panels shall be sealed with a continuous ribbon of tape sealer.

11.19.9 Minimum laps for galvalume steel sheets in roofing and wall cladding shall be:-
(a) End Laps - 150mm (b) Side Laps - One Corrugation.

PARTICULAR SPECIFICATIONS [Contd…]

11.19.10 Flashing and trims shall be provided at the gable, rack, corners, caves, curves, transition, expansion joints, ridge, joints with translucent sheets, framed openings and wherever necessary to provide for weather tightness and finished appearance. These shall conform to the physical specifications of relevant ASTM/IS specifications and have desired minimum yield strength as specified.

11.19.11 Wall flashing and trims (gable, corner, framed opening, joints with supporting structure of hangar door, accessories, etc) are manufactured from same color, finish and thickness as of wall panels and as per manufacturer's recommendation.

11.19.12 Roof flashing and trims (parapet flashing, transition trims, expansion joints trims and ridge caps) are manufactured from same color, finish and thickness as of roofing and as per manufacturer's recommendation.

11.19.13 Formed peak panel matching the slope and profile of adjointing panels shall be provided alongwith the building ridge and shall be of same color, finish and thickness as of roofing and as per manufacturer's recommendations.

11.19.14 SEALANT. Special grade of silicon sealant non-hardening, neutral cure type of approved make and grade shall be applied at all side laps and end laps (with flowable mastic) as per manufacturer's recommendations and approval by Engineer-in-Charge. Sealer for side lap, end laps and self –flashing windows shall be two-way self adhesive tapes 6mm wide 5mm thick asbestos fiber filled, pressure sensitive. The sealer shall be non-asphaltic, non-shrinking, non-drying and non-toxic and shall have superior adhesion to metals, plastics and painted surfaces at temperatures from 50 degree to 104 degree centigrade.

11.19.15 FASTENERS. Standard fasteners shall be No. 14, Type 'A', self –tapping sheet metal screws with metal and neoprene washers. All screws shall have hexagonal heads, colour coated to match roof and wall sheeting and made of zinc plated /coated steel conforming to relevant IS/ASTM codes. The panel clip shall be fastened to structural members with Scrubolt fastener as per manufacturer's recommendation. The size of the fastener shall be calculated as per the design load and approved by concern authority.

11.19.16 RIDGE: Ridge shall be of section shown on drawings and shall be made of pre engineered galvalume sheet and shall be fixed to purlins with 8 mm dia GI hook bolts and nuts and bitumen and washers which fix the sheet to the purlin as shown on drawings.

PARTICULAR SPECIFICATIONS [Contd...]

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.

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

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:** Provide cement concrete floors over PCC sub-base slabs at locations all as shown on drawings and as specified in Schedule of Finishes Drawing. The surface shall be finished even and smooth using extra cement. The surface shall be cured efficiently by water ponding as directed by Engineer-in-Charge. Glass dividing strips of 3mm thick sheet glass as indicated in drawings shall be provided in cement concrete floors except in situations where concrete floor is laid in alternate panels. The width of the glass dividing strips shall be 3mm less than the thickness of top finished layer of concrete. The top of the strip shall flush with the floor finish. Where thickness of the concrete floor finish is more than 50mm, the flooring shall be carried out in alternative panels without using dividing strips. Cement concrete flooring cast-in-situ shall be laid in panels and size of panel shall be as specified in clause 13.23.1 of MES Schedule Part-I. Unless otherwise specified in drawings PCC finish floor topping as in ground floor shall consist of 50mm thick PCC (1:2:4) type B-1 laid over 100mm thick PCC (1:4:8) type D-2 over well rammed earth filling and 50mm thick PCC (1:2:4) type B-1 over cement slurry @ 3Kg/Sq.metre for otherthan ground floor unless specified otherwise here in after.

12.2.1 PCC floors in Parking / Shafts / Hard Standing / Ramps unless otherwise specified elsewhere, shall consist of 100mm thick PCC (1:2:4) type B-1 over 75mm thick PCC (1:4:8) type D-2 over well-rammed earth. Floor topping shall be chequred finish.

12.2.2 RCC SHELVES: The finished thickness of RCC shelves and platforms where shown of RCC in drawings shall be as shown on drawings. In case the thickness of shelves has not been indicated on drawings it shall be as under:-

(a) Shelves of wardrobes/cupboards/cabinets in living accommodation etc. - 40mm.

(b) Shelves in garages/other situations except in situation in para (a) above - 75mm.

12.2.3 MOORUM FILLING: Moorum filling under floors shall be carried out as per clause 3.21 of MES Schedule 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.

12.02.3.1 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. Moorum shall be filled in layers not exceeding 25cm each, watered and well rammed. Moorum filling shall be compacted up to 95% modified proctor density. Before placement of hard core, plate load tests shall be conducted on the moorum filling. The bulk modulus of soil prepared shall not be less than 50,000 KN/Cu.m. Testing charges shall be born by the contractor.

12.2.4 Sand for cushioning shall be as per clause 3.22 of MES Schedule Part – I.

12.2.5 Hard core and plain cement concrete shall be all as specified hereinbefore.

12.3 **REINFORCED CEMENT CONCRETE FLOOR:** Provide Reinforced Cement Concrete with **M-40 Design Mix Concrete or Ready Mix Concrete [RMC]** all as specified hereinbefore. RCC floor shall be laid over PCC sub-base, hardcore and Moorum filling as specified in Drawing and location of sand cushioning is tentative and shall be as directed by GE, depending upon water table level. Method of laying RCC in flooring shall be of VDF [Vaccume Dewater Flooring] system.

12.4. **GREEN MARBLE STONE FLOORING:** Mirror polished Green marble flooring shall be laid where shown in schedule of finishes/drawings. 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 laid over 20mm thick screed in CM [1:4] 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 20mm thick screed in CM [1:4] over 25mm thick PCC 1:2:4, Type B-0 laid over RCC Slab 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. **GRANITE SLAB FLOORING / DADO / WALL CLADDING:** The granite slabs shall be of best quality and of colour and size as approved by the GE or as specified in Schedule of Finishes. The thickness of the slabs shall be 18 to 20mm unless otherwise specified in Schedule of Finishes with permissible tolerance of +/-3%. The stone shall be hard, durable, sound, tough, and regular in shape, uniform in colour and free from soft veins, cracks, flaws, decay and weathering. The contractor shall get samples of granite slabs/ tiles approved by the GE for their colour. Every slab/core shall be machine cut to the required size and shape. Laying and polishing shall be carried out all as specified in clauses 6.20.5 to 6.20.8 of MES Schedule Part – I.

12.6. **COLOURED NON SKID CERAMIC TILE FLOORING:** Provide **COLOURED** non skid ceramic tile flooring at locations all as specified in schedule of finishes Drawings. Non-skid ceramic tiles shall be flat, true to shape, sound and free from flaws and other manufacturing defects. Ceramic tiles shall conform to IS – 15622, Grade B–I[a] for Toilets and B–I[b] for other locations for floor tiles and Grade B–III for wall tiles and shall be of first quality. Unless otherwise specified in drawing the size of the tiles shall be 450x450x 7 to 8mm thick. The shade / pattern / design of the tiles shall be as approved by GE. The tiles shall be set, jointed in neat cement slurry and pointed flush in white cement mixed with pigment to match the colour of tile wherever applicable and laid over 15mm thick screed in CM [1:4] over 20mm 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 20mm thick PCC 1:2:4, Type B-0 laid over RCC Slab. The tiles shall be laid as per pattern described by GE. The workmanship shall be all as specified in clause No.13.40.2 of MES Schedule Part – I. The top surface of RCC slab shall be cleaned with hard wire brush and cement slurry @ 1.2 KG / Sq.m shall be applied before laying the floor.

12.7. **COLOURED GLAZED CERAMIC TILE DADO/SKIRTING:** Coloured glazed ceramic tiles dado/skirting shall be all as mentioned in schedule of finishes Drawings. The size of tile shall be as mentioned in Drawings, Grade B-III. The tile shall be plain, coloured, Type B-III, Grade-I quality and shall conform to IS – 15622 and shall be got approved by the GE. The tile shall be set over cement screed / backing, jointed in neat cement slurry and pointed with white cement mixed with pigment, to match the colour of the tile. The dado thickness projecting from the rendered wall surface shall be flushed using cement mortar 1:3. The top level of the flushed surface shall be finished to a true line as directed. The height of dado shall be as specified in drawings as per location. Unless not specified in drawings the height of dado shall be 1.50M for W/C, and shall be 2.10 M for bathrooms.

12.8. **CHEQUERED CEMENT CONCRETE TILES:** Chequered cement concrete tiles be all as mentioned in Drawings. Unless otherwise shown on drawings the size of chequred cement concrete tiles shall be 200mm x 200mm x 20 to 25mm thick. The colour and pattern of the tile shall be all as approve by GE. The tiles shall be bedded, jointed and pointed with coloured cement to match the colour of tiles, laid over 15mm thick screed in CM [1:6] over 20mm thick PCC 1:2:4, Type B-0 over 75mm thick PCC [1:4:8], Type D–2 sub base over rammed earth in Ground Floor and laid over 15mm thick screed in CM [1:4] over 20mm thick PCC 1:2:4, Type B-0 laid over RCC Slab.

12.9. **VITRIFIED TILE FLOORING:** Coloured Vitrified tiles of size 600X600X 9 to 10mm for flooring shall be of the premium quality hard, sound, dense, **Double Charged** and homogenous in texture, free from defects, machine cut and factory mirror polished, Mohr hardness shall not be less than 7 and conforming to relevant IS. The tiles are classified under group B1a of the international Standard for Ceramic Tiles ISO – 13006 and European Standard EN: 176. Tiles shall be laid over 15mm thick screed in CM [1:4] over 20mm 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 20mm thick PCC 1:2:4, Type B-0 laid over RCC Slab. The shade and the size shall be as approved by GE. The tiles shall be laid with a border of different dark shade to the width as directed by the GE. Joints shall be pointed flush using polymer based cementatious tiling joint filler to match the shade of the tile.

12.10 CERAMIC TILE FLOORING: Provide ceramic tile flooring at locations all as shown on drawings and as specified in schedule of finishes drawing. Unless otherwise specified in drawing the size of the tiles shall be 450x450x 7 to 8mm thick. The tiles shall be plain, first quality, Grade B-I[a], and shall confirm to relevant IS-15622. The shade shall be as approved by GE. 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 20mm 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 20mm thick PCC 1:2:4, Type B-0 laid over RCC Slab. The tiles shall be laid as per pattern described by GE, set, jointed in cement slurry. Joints shall be pointed flush in white cement mixed with pigment to match the colour of tile wherever applicable. The workmanship shall be all as specified in clause No.13.40.2 of MES Schedule Part I.

12.11 KOTA STONE FLOORING & SKIRTING/DADO

12.11.1 Kota stone shall be 18-20mm thick and Quality of Kota green Stone shall be as per Clause 13.47.1 of MES Standard Schedule, Part-I. Dressing of stone shall be done as per Clause 13.47.2. Kota stone shall be of size 55cm x 55cm with tolerance plus/minus 5% and 18mm to 20mm thick. Smaller sizes may be adopted to accommodate within the floor dimensions keeping as near as possible.

12.11.2 Kota stone shall be laid as defined in Clause 13.47.3 of MES Schedule, Part-I. In case of flooring on ground floor, sub base shall consist of 75mm thick PCC 1:4:8, type D-2. Bedding mortar (Screed) shall be in cement mortar (1:4) and thickness of screed shall be 20mm average. In case of providing Kota stone flooring on floor other than ground floor, stone shall be laid over cement screed in cement mortar (1:4), 20mm thick (average thickness) over 20mm thick PCC 1:2:4, Type B-0 laid over RCC Slab.

12.11.3 White Marble border with white marble 18 to 20 mm thick Abu white "Makrana", 15cm wide shall be provided as specified in Schedule of Finishes.

12.11.4 Marble topping on shelve wherever shown on drawing shall be 18 to 20mm thick ABU white "Makrana" laid over 10mm thick cement mortar (1:3) including grinding and Bee-Wax polishing all as specified in SSR Part-I, 1991 Specifications.

12.11.5 **CURING, POLISHING & FINISHING: -** Refer clause 13.47.4 of MES Schedule Part-I.

12.11.6 Thickness of Kota stone in skirting and dado and risers of steps shall be 15mm. It shall be laid over a layer of 10mm thick screed in cement mortar (1:3). Curing, polishing and finishing shall be as for floors mentioned above. Unlessotherwise specified in drawing height of skirting shall be 10cm. In case of steps (treads & risers), Kota green stone shall be in a single piece to full length & width of riser & tread. The nosing of tread shall be provided with two parallel grooves of 3mm × 3mm as shown on drawings to be provided.

12.12 **GLASS MOSAIC TILES FOR SWIMMING POOL FLOOR AND WALLS**: Irrespective of what is shown on drawings (Schedule of finishes or any other drawing) the glass mosaic tiles shall be of size 20mm X 20mm and of thickness 4mm of model Vitreo of shade 122-V_I and 130-V_{II} (combination of light and Dark blue colour) in make "**Palladio**" or equivalent model & shade in make "**Italica/ Pino / Accura**" as approved by GE. Tiles shall be fixed using Tile adhesive and tile grout as per manufacturer's instructions. Note: Make of Wall tiles of swimming pool: PINO/PALLADIO/ACCURA/ITALICA. The samples for the same are to be provided by GE to the user.

12.12.1 **FIXING TILES INTERNALLY (SWIMMING POOL /DIVING POOL)**: Provide 10mm thick plaster on wall and 20mm screed on base slab in flooring in CM (1:3) with microsilica PP fibre at 2% by weight of cement alongwith detachment DM as per manufacturerer's instructions. Mosaic tiles of approved makes for floors shall be of size 200mm x 200 x 6-7mm thick shall be provided to floor of swimming pool/diving pool. The tiles shall be fixed in tile adhesive (Zentrival PL 3mm thick layer) and grout the joints with file grout (Zentrival PM) of M/s MC-Douchemic or equivalent as per manufacturer's instructions and all as per IS-6494-1988 and IS:3370. Whether shown on drawings or not, water proofing treatment as described above shall be provided at site and contractor's quoted rate shall be deemed to include for the above provision.

12.12.2 **Non-skid (Finger Grip Tiles):** Provide Non-skid (Finger grip tiles) at locations shown in the schedule of finishes drawing and all as specified in schedule of finishes drawing. The thickness of tile 20mm and shall be as indicated in schedule of finishes. The tiles shall be plain, first quality, Grade B II A, and shall conform to relevant IS. The shade shall be as indicated in the schedule of finishes drawing/as approved by GE. The screed for laying the tiles shall be 15 mm thick in cement mortar [1:4]. The tiles shall be laid as per pattern described by GE, set, jointed in cement slurry. Joints shall be pointed flush in white cement mixed with pigment to match the colour of tile wherever applicable. The workmanship shall be all as specified in clause No.13.40.2 of MES Schedule Part I.

12.12.3 DESIGNER POLISHED CHEQUERED CEMENT CONCRETE TILES: Pre-cast Designer Chequered PCC tiles in floors with 100% grey cement and pigments shall be provided wherever indicated in drawings. The tiles shall be of size 300 X 300 X 20-25mm thick and the tiles shall comply the requirement of clause 13.17 of MES Schedule Part – I. Workmanship shall be all as specified in Clause 13.25 & 13.39 of MES Schedule Part – I. Tiles shall be laid over screed bed in cement sand mortar as specified in Schedule of finishes. Tiles shall be set, jointed and pointed in neat cement slurry of colour to match the tiles. The tiles shall confirm to IS – 13801, Specification for Chequered Cement Concrete Tiles except for the wear quality and when tested in the manner specified in clause 11.6 of the same IS. The wear for tiles shall not exceed the following values: [a] Average wear: 2mm, [b] Wear on individual specimen: 2.5mm

12.13. **INTERLOCKING TYPE PAVER BLOCK.**

12.13.1 The paver block shall be as mentioned in as shown on drawing, reflective and inter locking type and shall be factory made. The paver block shall be brought from the manufacturer mentioned hereinafter and as approved by the GE. Paver blocks shall be conforming to IS 15658-2006. Shade of coloured tiles wherever specified shall be as directed by the GE.

12.13.2 Material used for preparation of paver block shall be as per clause 4 of IS: 15658-2006

12.13.3 The grade and strength of paver blocks shall be as follows:

Sl No	Grade of Paver blocks	Specified Compressive strength at 28days N/mm²	Traffic Category	Recommended Minimum Paver Block Thickness	Traffic Examples of Application
(a)	M-30	30	Non-traffic	50	Building premises, monument premises, landscapes, public gardens/ parks, domestic drives, paths and patios, embankment slopes, sand stabilization area etc
(b)	M-35	35	Light-traffic	60	Pedestrian plazas, shopping complexes ramps, car parks, office driveways, housing colonies, office complexes, rural roads with low volume traffic, farm houses, beach sites, tourist resorts local authority footways, residential roads etc.
(c)	M-40	40	Medium-traffic	80	City streets, small and medium market roads, low volume roads, utility cuts on arterial road etc
(d)	M-50	50	Heavy-traffic	100	Bus terminals, industrial complexes, mandi houses, roads on expansive soils, factory floor, service stations, industrial pavements etc
(e)	M-55	55	Very heavy-traffic	120	Container terminals, ports, docks yards, mine access roads, bulk cargo handling areas, airport pavements etc.

Notes:

(i) Non-traffic areas are defining as areas where no vehicular traffic occurs.

(ii) Light-traffic is defined as a daily traffic upto 150 commercial vehicles exceeding 30kN laden weight, or an equivalent upto 0.5 million standard axles (MSA) for a design life of 20years (A standard axles is defined as a single axle load of 81.6kN).

(iii) Medium traffic is defined as a daily traffic of 150-450 commercial vehicles exceeding 30kN laden weight or an equivalent of 0.5 to 2.0 MSA for a design life of 20 years.

(iv) Heavy traffic is defined as a daily traffic of 450 to 1500 commercial vehicles exceeding 30kN laden weight, or an equivalent of 2.0 to 5.0 MSA for a design life of 20years.

(v) Very heavy-traffic is defined as a daily traffic of more than 1 500 commercial vehicles exceeding 30kN laden weight, or an equivalent of more than 5.0 MSA for a design life of 20years.

12.13.4 Water absorption - The average water absorption shall not more than 6% and for individual samples not more than 7% when tested as per IS 15658.

12.13.5 Markings - The tiles shall be purchased from an approved manufacturer and shall have the markings as per clause 10 of IS 15658 embossed either on the sides or bottom.

12.13.6 Testing - The tiles shall be tested for the following under laid requirements as per testing procedure specified in IS 15658. The cost of samples and cost of testing shall be borne by the Contractor.

(a) Dimensions and tolerance -Table 2 of IS 15658: 2006 shall be referred

(b) Thickness of the wearing layer-Table 2 of IS 15658: 2006 shall be referred

(c) Water absorption-Clause 6.2.4 of IS 15658: 2006 shall be referred

(d) Compressive strength -Clause 6.2.5 of IS 15658: 2006 shall be referred

(e) Abrasion resistance - Clause 6.2.6 IS 15658: 2006 shall be referred

(f) Tensile splitting strength-Clause 6.3.1 of IS 15658: 2006 shall be referred

(e) Flexural strength / Breaking load-Clause 6.3.2 IS 15658: 2006 shall be referred

12.13.7 Sampling - The sampling of the blocks for testing shall be done as per clause 8 of IS 15658 : 2006 & sampling requirements given in Table 4 of IS 15658-2006. The numbers given there in shall be sampled out of each consignment of blocks supplied at a time, not exceeding 25000 blocks or part thereof.

12.13.8 However one set of samples as per Table 4 shall be obtained from the manufacturer from where the blocks are intended to be procured and submitted to the GE for testing and approval. The cost of samples and cost of testing shall be borne by the Contractor.

12.14. **SKIRTING:**

12.14.1. **CEMENT PLASTER SKIRTING:** Provide cement plaster skirting at locations shown in Schedule of finishes drawing. Skirting shall be of 5mm thick in cement mortar [1:3] over 10 mm thick rendering in cement mortar [1:6], unless otherwise specified on drawings the height of skirting shall be 100mm. Surface shall be finished even and smooth with steel trowel using extra cement.

12.14.2. **NON SKID CERAMIC TILE SKIRTING:** Provide coloured glazed ceramic tile skirting at locations shown in Schedule of finishes drawing over 10 mm thick screed in cement mortar [1:3]. Tiles shall be all as specified here-in-before for non-skid ceramic tile flooring. Tiles shall be set and jointed in cement slurry. Joints shall be pointed flush with white cement mixed with pigment to match the color of tile, unless otherwise specified on drawings the height of skirting shall be 100mm.

12.14.3. **KOTA STONE SKIRTING:** Provide kota stone skirting at locations shown in Schedule of finishes drawing over 10mm thick screed in cement mortar [1:3]. Stone shall be all as specified here-in-before for kota stone flooring, unless otherwise specified on drawings the height of skirting shall be 100mm.

12.14.4. **GLAZED CERAMIC TILE DADO / SKIRTING:**

12.14.4.1 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 7-8mm 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 all round, irrespective of what is shown in the drawing. Where not indicated in the drawing the height of dado shall be 1.50M for W/C, and shall be 2.1M for bathrooms and unless otherwise specified on drawings the height of skirting shall be 100mm

12.14.14.2. 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.

12.14.5 **STAIR CASES**

12.14.5.1 Provide RCC staircases 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 1.5 mm and of size as shown on drawings.

12.14.5.2 Stair case shall be provided with 18-20mm thick Green Marble slabs laid over 20mm thick screed bed in CM 1:6 over 25mm thick PCC 1:2:4, Type B-0 laid over sub base/over well rammed earth. Treads of steps & landing of stair case shall be provided with Green Marble 18 to 20mm thick machine cut in one piece set over 20mm thick CM (1:6). Risers shall be provided with Green Marbles 18 to 20mm thick machine cut in one piece set over 10 mm thick CM (1:3). Soffit of RCC stair case shall be treated with 3 coats of white wash all as specified hereinbefore. Treads shall be bull Nosed.

12.15 GRANITE STONE CLADDING: Provide 18 to 20mm thick polished granite stone slabs cladding at locations as shown in drawings. Granite stone slabs shall be laid over 10mm thick plaster of cement and sand mortar 1:3. The colour and size of the stone shall be as approved by GE.

12.16 DECORATIVE CERAMIC WALL TILE CLADDING: Provide 6-8mm thick decorative ceramic wall tiles cladding at locations as shown in drawings. Decorative wall tiles shall be laid over 10mm thick plaster of cement and sand mortar 1:4. The colour and size of the tiles shall be as approved by GE.

12.17. **ANTI SKID TILE FLOORING**: Provide Anti skid ceramic tile flooring at locations all as shown on drawings and as specified in schedule of finishes drawing. Irrespective of what is mentioned in schedule of finishes, the size of the tiles shall be 240mm x 115mm (Standard)/ 244mm X 119mm [Anti slip/Finger Grip with safety marking/Grooved Anti-Slip tile with safety Marking] as indicated on drawing. The tiles shall be Hugely versatile porcelain, low water absorption rate, no colour fading, Anti-slip surfaces that comply with the international norms, highly resistant to scratch, crack, marks, wear, chemical agents and shall conform to relevant IS. The shade shall be as approved by GE as per the location wise. The screed for laying the tiles shall be 15mm thick in cement mortar [1:4]. The tiles shall be laid as per pattern described by GE, set, jointed in cement slurry. Joints shall be pointed flush in white cement mixed with pigment to match the colour of tile wherever applicable. The workmanship shall be all as specified in clause No.13.40.2 of MES Schedule Part I.

12.18 **ACID PROOF TILE FACING:** Where indicated provide Acid Proof tiles in flooring. Tiles shall be 15mm thick and size not exceeding 200mm × 200mm. Tiles shall be set, jointed and pointed in chemical resistant mortar as per manufacturer's instructions over primed bituminous primer conforming to IS-3824 @ 1.70 Kg/Square metre of the area over 40mm thick PCC (1:2:4) type B-1 laid over 75mm thick PCC (1:4:8) type D-2 over well rammed earth/compacted earth. Material and workmanship shall conform to Clause 13.22 and 13.46 of SSR Part-I. Tiles shall be ceramic, unglazed, vitreous tiles conforming to IS-4457. Tiles shall withstand 98% concentrated Sulfuric Acid. Tiles shall be square in size except those provided at ends where rectangular tiles of suitable size may be used. The compressive strength shall be 700 Kg. per Sq Cm. The loss in weight when tested for acid resistance shall not exceed 1.50 percent.

12.18.1 Where indicated provide acid proof tiles in skirting/dado. The tiles shall be 12mm thick set, jointed and pointed with chemical resistant mortar as recommended by the manufacturer.

PARTICULAR SPECIFICATIONS [Contd...]

12.19 **STONE SETT FLOORING:** Where indicated and shown on drawings, stone sett flooring shall be provided. Stones for setts shall be of the best quality, granite/trap stones shall be obtained from the approved quarries as indicated. Use of sedimentary stone shall not be permitted. Provide 150mm deep stone sett flooring with stone setts of size 200mm to 250mm long, 150mm to 200mm wide and sides dressed bedded in 20mm thick cement mortar (1:3), joints grouted in cement mortar (1:2) with an admixture of metallic floor hardner 5% by weight of cement or as recommended by the manufacturer of the hardner and struck flush as the work proceeds laid over rammed 100mm thick PCC M-20 laid over 225mm thick stone soling (Consolidated thickness) stones broken to sizes ranging from 100mm to 50mm) laid over rammed earth. Stone sett flooring shall be provided as specified in Clause 13.28 and 13.29 of SSR (1991) Part-I. Metallic hardeners in the topping of floors and paving for increasing abrasion resistance shall be Ironite, Hardonate, Ferronite or other equal and approved metallic floor hardeners.

12.20 **WOODEN FLOORING**: Laminate wooden floors shall be provided as detailed in the drawings. Only selected quality of boards of uniform width shall be used. Floor boards shall be 40mm in thickness as indicated and shall not be less than 10 cm nor more than 15 cm, in width. The same width of boarding shall be maintained throughout the floor except where the width of the room is not an exact multiple of the boards; in which case the difference shall be equally adjusted between the two end boards adjacent to walls. The maximum length of the boards shall be restricted to 3 meters. The minimum length of board shall be such that the boards rest at least on three supports but in no case it shall be less than 2 metres. Wooden flooring shall be provided as specified in Clause 7.25 of SSR (1991) Part-I.

12.21 **IRONITE FLOORING**: Provide Ironite flooring at locations all as shown on drawings and as specified in schedule of finishes drawing. Irrespective of what is mentioned in schedule of finishes, the flooring shall consist of 20mm floor finish with hardonite / ironite treated with sodium silicate over 30mm thick granolithic layer as per cluse No. 13.34 & 13.35 of MES Schedule Part I over 200mm thick PCC M20 base course over 100mm thick PCC 1:4:8 type D2 laid over 250mm thick granular sub base over 150mm thik sand layer mixed with 3% of cement over well rammed earth.

12.22 **MAPLE FLOORING FOR GYMNASIUM HALL**

12.22.1 SURFACE BOARD: - 1st class canadian maple wood sports flooring labo sports test certified & EN 14904 certified finished with 21mm thick, 57 to 83mm wide and in random length in tongue and groove shape. The edges of the boards will have a finger lock groove and the bottom side with air pass groove and treated with special anti-termite and water-resistant lacquer.

12.22.2 UNDER FRAME: - made of spruce pine fir (spf) quality canadian pine wood runners of 70 mm x 45 mm, treated with anti-termite solution and fixed on the bottom side with 19 mm thick EPDM air cushioned pads, stappled through the two wings at 350 mm x 350 mm.

12.22.3 INSTALLATION: - IPS subfloor (Indian patent stone: 100mm thick PCC: 1:4:8 type D2) treated with a vapour barrier to be placed on the levelled IPS sub-floor before laying the under frame. The runners having air cushion pads to be placed on the vapour barrier in perfect level at 350 mm spacing in one direction. The surface board to be screwed to the runner through the tongue only and will lock the screwed tongue by the groove of adjoining board. Ends of the boards will be locked by inserting the wooden fingers through the edge grooves and fixed with suitable adhesives. An expansion gap of 8 to 10 mm will be left open between the wooden flooring and the surrounding tiled area / walls.

12.22.4 FINISHING: After installation the floor will be machine sanded in uniform level and finished with chimiver panseri spa made in italy din & fiba approved eco primer 2k sports & eco star 2 k sports water based polyurethane lacquer water based polyurethane polish. Laying of flooring will be done through authorised applicant of company. Make: Apex sport surface, Aeroflex, Saint Gobain as approved by GE.

12.23 **CEMENT CONCRETE TILES:** Cement concrete tiles be all as mentioned in Drawings. Unless otherwise shown on drawings the size of cement concrete tiles shall be 300mm x 300mm x 7-8mm thick. The colour and pattern of the tile shall be all as approve by GE. The tiles shall be bedded, jointed and pointed with coloured cement to match the colour of tiles, laid over 15mm thick screed in CM [1:4] over 20mm thick PCC 1:2:4, Type B-0 over 75mm thick PCC [1:4:8], Type D–2 sub base over rammed earth in Ground Floor and laid over 15mm thick screed in CM [1:4] over 20mm thick PCC 1:2:4, Type B-0 laid over RCC Slab.

12.24 **RUBBER FLOORING:** Provide Rubber flooring at locations all as shown on drawings and as specified in schedule of finishes drawing. Irrespective of what is mentioned in schedule of finishes, the flooring shall consist of 20mm thick Rubber sheet or tiles for flooring laid over 50mm thick PCC 1:2:4 type B1 over well rammed surface, shall conform to IS 809-1992. The rubber flooring shall be with fabric backing or fabric insert with topping type 'B' ribbed or fluted, and of colour as directed as per cluse No. 13.20 of MES Schedule Part I. The flooring shall be fixed with adhesive as recommended by the manufacturer, the manufacturer shall also indicate the precautions to be taken while using the adhesive. The work shall be executed by the rep of manufacturer.

12.25 **SYNTHIC FLOORING:** Provide Synthic flooring at locations all as shown on drawings and as specified in schedule of finishes drawing. Irrespective of what is mentioned in schedule of finishes, the flooring shall consist of 4mm thick synthic sheet fixed with adhesive as recommended by the manufacturer, the manufacturer shall also indicate the precautions to be taken while using the adhesive. The work shall be executed by the rep of manufacturer. The synthic flooring shall be laid over concrete surface as specified in in schedule of finishes drawings.

12.25 **ELECTRO STATIC DISCHARGE FLOORING (ESD):** Electro static discharge flooring treatment for concrete surfaces shall be done as per instructions of Engineer-in-Charge. The concrete thus laid shall be vibrated with poker vibrator. During poker vibration, proper compaction of coarse aggregate fine aggregate, and cement shall be obtained. The surface will then be finished in level with the help of surface vibrator to give a dense level surface of concrete. The top surface after removal of mat shall be floated with a mechanical skim floater with trowelling blade to enable the top surface to grind and give a uniform water resistance surface on top. Under no circumstances neat cement be sprinkled directly on concrete surface to absorb bleed water as surface scaling may occur later. Similarly, water should not be applied between trowelling operations as it may cause surface weakness. Minimum two passes shall be carried out. The surface shall then be watered and cured as per clause 13.32.10 of MES Schedule Part I.

12.26 **ACRONYM EPDM:** Acronym EPDM rubber sheet shall be laid over concrete surface with adhesive as recommended by the manufacturer, the manufacturer shall also indicate the precautions to be taken while using the adhesive. The work shall be executed by the rep of manufacturer. The flooring shall be laid over concrete surface as specified in in schedule of finishes drawings.

PARTICULAR SPECIFICATIONS [Contd…]

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 salts, 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.

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 3mm 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]:**

13.16.1 All the internal surfaces of walls/concrete [as specified] hereinbefore in buildings/ structures of Schedule "A" Part I shall be rendered 15mm thick in CM [1:6] surface finished even and smooth without using extra cement.

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 with minimum @2.0% of weight of cement. The surface shall be finished fair and even. External plastering shall be started from 15cm below ground level/plinth protection wherever applicable.

13.16.3 All the soffits / ceilings of walls/concrete [as specified] hereinbefore in buildings/ structures of Schedule "A" Part I shall be rendered 5mm thick in CM [1:3] surface finished even and smooth without using extra cement.

13.7 The junction between column/beam/slab and wall shall be provided with chicken wire mesh before executing the plastering work. Groves shall be provided wherever required as directed by Engineer-in-Charge.

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-712-1984. Three 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 is to be treated with 3 coats of white wash all as specified herein above.

14.2. **ACRYLIC EMULSION DISTEMPER:** Wherever indicated in Schedule of finishes drawings provide ACRYLIC emulsion /distemper two coats over a coat of alkali resistant primer and over two coats of 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 mentioned hereinafter. Wherever oil bound distemper is shown in schedule of finishes drawing, acrylic emulsion distemper shall be provided with specification stated above.

14.3 **EXTERNAL WEATHER PROOF PAINT:**

14.3.1 **GENERAL:**

14.3.1.1 Unless samples of all materials are approved, the contractor will not be allowed to commence the work. Painting shall be carried out by heavy duty air less spray painting machine by experienced painter.

14.3.2 **MATERIALS:**

14.3.2.1 Paint shall be weather proof Acrylic emulsion, exterior grade [100%acrylic] premium quality having VOC less than 50grms/Ltr. Paint shall be procured from any of the makes listed hereinafter

14.3.2.2 Shade(s) 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 The painting shall be carried out with spray painting machine as specified here-in-before. 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 sand papered 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 automatic spray painting machine 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 automatic spray painting machine. 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 400ml 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 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 locations complained of, notwithstanding that the same may have been inadvertently passed / certified and paid for, under take to carry out such treatment as may be necessary forthwith to rectify the defects to the full satisfaction of GE. In the event of his failure to do so, within the specified period to be specified by the GE in his demand aforesaid, the GE may undertake such defective work at the risk and expense of the contractor. The liability of the contractor under this condition shall not extend beyond the period of five years from the certified date of completion, unless the GE had previously given notice to the contractor to rectify the defects.

14.3.7.3 **3% of the cost of the weather proof painting as decided by the GE** shall be retained from the final bill amount towards Guarantee for Acrylic Emulsion paint which will be released after satisfactory expiry of 05 [five] years Guarantee period. If contractor fails to rectify the defects noticed in the treatment or found in the material the aforesaid amount so retained shall be utilized for rectification of defects and contractor shall have no claim whatsoever on this account. The contractor may submit Bank guarantee Bond or Fixed Deposit Receipt from any Nationalised Bank pledged in favour of GARRISON ENGINEER for the said sum valid for the period of 05 [five] years from the date of completion of work in which event no further amount will be recovered from the final bill on this account. Defect liability period under condition 46 under General Conditions of Contracts IAFW-2249 shall be deemed to be amended to the extent mentioned above for Acrylic emulsion paint.

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:

[i] Extent of area to be painted.
[ii] Sample of painting work [Area to be decided by GE]
[iii] After preparation of surface and before applying priming coat.
[iv] After applying priming coat.
[v] After applying first coat of Acrylic emulsion paint.
[vi] After applying second coat of Acrylic emulsion paint.

14.4. **PLASTIC EMULSION PAINT:** Wherever indicated in Schedule of finishes drawings provide Plastic emulsion paint two coats over a coat of primer. The plastic emulsion paint shall confirm to IS 5411 (Part-1) 1974 (Interior) or IS 5411 (Part 2) 1972 (Exterior) as indicated.

14.4.1 Preparation of surfaces: The surface shall be thoroughly cleaned of dust. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give smooth and even surface. Any unevenness shall be made good by applying putty made of Plaster of Paris with water on the entire surface including filing up of undulation and then sand papering the same again when surface is dry.

14.4.2 The paint shall then be applied either by brush or by roller. Each coat of paint shall be allowed to dry before the next coat is applied. The thinning of emulsion shall be done with water and not Turpentine Oil. The quantity of water to be added shall be as per manufacturer's instruction. No washing shall be done within 3 to 4 week of application.

14.4.3 The brush shall be completely dried of Turpentine oil paint by washing with warm soap water before use. The brushes shall be washed in water after use. No oil based putty shall be used for filling cracks. Splashes in floor shall be cleaned immediately. Paint shall be in accordance with clauses specified in MES schedule part I.

14.5 **CEMENT BASE PAINT**: Wherever indicated in Schedule of finishes drawings provide cement base paint as specified here in below.

14.5.1 Preparation of Cement Paint Cement paint shall be made by adding equal volume of paint powder to water and the mix stirred to obtain a thick paste, which shall then be diluted to a brushable consistency. If the proportion recommended by the manufacturer differs, the recommendation of the manufacturer shall invariably be followed.

14.5.2 The water mixed paint shall be kept well stirred during use and shall be applied within one hour of preparation. To prevent algae and moss growth and efflorescence, silicon base water repellant compound may be added to mixture, at the rate as recommended by the manufacturer. The lids of cement paint drums shall be kept tightly closed when not in use, as the cement paint rapidly becomes air set. Preparation of Surfaces The surfaces shall be prepared as specified under white washing and colourwashing.

14.5.3 Wetting of Surface Before applying cement paint, the surface shall be thoroughly wetted to control surface suction. The surface shall be moist but not dripping wet when the paint is applied. Surfaces which readily absorb moisture shall be wetted in one operation not more than one hour before painting. Surfaces which absorb moisture slowly shall be wetted in at least two operations not less than 30 minutes apart.

14.5.4 Application of Paint No painting shall be done when the paint is likely to be exposed to a temperature below 7° C within 48 hours after application.

14.5.5 When weather conditions are such as to cause the paint to dry rapidly, work shall be carried out 'in the shadow' as far as possible, for proper hardening of the paint film.

14.5.6 To maintain a uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket. White Washing, Colour Washing and Distempering. Unless otherwise indicated, new surfaces shall be treated with minimum of two coats of cement paint of the same colour. Not less than 24 hours shall be allowed between two coats and the second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather the preceding coat shall be slightly moistened before applying the subsequent coat. For old surfaces the treatment will be with one coat, unless two coats are indicated.

14.5.7 Cement paint shall be applied with a brush with relatively short stiff hog or fiber bristles. The paint shall be brushed in uniform thickness and shall be free from excessive brush marks. The laps shall be well brushed out. On external plastered and concrete surfaces, cement paint shall be vigorously scrubbed on in such a manner as to work the paint into the voids and provide a continuous paint film free from pin holes or other openings. Spray applications may be adopted only for dense concrete or interior surfaces where the paint is not required for waterproofing purposes. The finished surface shall be even and uniform in shade, without patches, paints drops etc. Curing Painted surfaces shall be sprinkled with water using a fog spray two or three times a day. Curing shall be done between coats and for atleast two days following the final coat. The curing shall be started as soon as the paint has hardened so as not be to damaged by the spray, about 12 hours after the application.

PARTICULAR SPECIFICATIONS [Contd…]

15. **FALSE CEILING:**

15.1 GYPSUM BOARD CEILING**:** Gypsum tile Ceiling shall be provided at the location as shown in drawings. Ceiling with gypsum board of 12.5mm thick of each panel size 600x600mm fixed with aluminium snap grid, fixing gypsum board with screws 230mm centre to centre, including jointing compound joint paper tape and drywall top coat, complete with two coats of acrylic distemper over a coat of putty and primer as per manufacturers instructions.

15.2 ACCOUSTIC TILE CEILING: Accoustic borads / tiles ceiling shall be provided at the location as shown in drawings with sound proofing / acoustic treatment by providing heat insulation panels / sheets as per manufracturers instructions. The Ceiling shall be with Mineral Fibre Acoustic ceiling tiles with open cell type of minimum 12mm thick of each panel size 600x600mm fixed with aluminium sanp grid, fixing with screws 230mm centre to centre, including jointing compound joint paper tape and drywall top coat, complete as per manufacturers instructions.

15.3 PARTICLE BOARD: - Unless otherwise shown on drawings or specified elsewhere, particle board shall be exterior grade 18/19 mm thick veneered one side decorative and other side commercial type finish conforming to IS-1697:1980 of make mentioned here in after.

15.4 PRELAMINATED PARTICLE BOARD: - Unless otherwise mentioned on drawings or specified elsewhere pre-laminated particle board shall be exterior grade 18/19 mm thick phenol formaldehyde bonded, flat pressed, 3 layered, melamine faced, BWP type pre-laminated particle board of make mentioned here in after. Pre-laminated particle board having choice lamination on one side and balancing white lamination on other side. Shade of pre-laminated particle board shall be approved by the GE.

15.5 PLYWOOD: Unless otherwise mentioned/shown elsewhere the Plywood shall be commercial facing veneer on both sides and BWR type BB; 6 mm thick of make mentioned here in after.

15.6 LAMINATED SHEET: - Where provision of laminated sheet shown in the drawings/ specified it shall be Plastic laminated not less than 1.5 mm thick natural teak finish of make mentioned here in after.

15.7 WOODEN BEADING: In case size of beading not mentioned/shown elsewhere it shall be 6 mm thick teak wood as per IS:1687

15.8 PVC PLY: Where provision of PVC Ply shown in the drawings/ specified it shall be of thickness indicated in drawings and of make mentioned here in after. In case thickness of PVC ply not shown/specified it shall be considered as 6 mm.

15.9 ALUMINIUM SNAP GIRD: Aluminium sections incorporated in frame work shall conform to IS 733, IS 737 and IS 1285. The snap grid consists of anodized aluminium main/cross tee of size as indicated in drawings. Snap grid frame work shall be fixed to ceiling with supporting hanger consisting of 6mm dia mild steel rod, J bolts with necessary bolts, nuts and washers all as manufacturer's instruction. The main and cross tees shall be jointed at junction/crossings with anodized aluminium angle bracket of size as indicated, if not indicated it shall be 15mmxl5mmx1.5mm, weighing 0.12 Kg per running metre, fixed with sutiable mild steel, bolts nut and washers, all as per manufacturer's instructions. The snap grid (main/cross tee section) shall be supported at ends all along the wall with anodized aluminium angle of size as indicated, if not indicated it shall be 40mmx25mmx2mm, weighing 0.36 Kg per running metre. The size of the snap grid shall be 605x605mm if not indicated. PVC protected sheeting shall be used to avoid scratches, damage to the framework while fixing to ceiling."

PARTICULAR SPECIFICATIONS [Contd...]

15.10 **WALL PANELLING:**

15.10.1 GRIPPER FABRIC ACOUSTICAL WALL PANELING: Gripper fabric wall paneling wherever indicated/shown on drawings shall be provided. GI channel frame @ 600 mm c/c as per manufacturer specification shall be fixed as directed. Provide chemically hardened 50 mm thick glass wood of density 48 kg/cum on GI channel frame work. 12 mm thick BWR grade commercial plywood bearing IS-303 mark (all as specified in SSR Part I – 2009) shall be provided over glass wood wool building slabs, light weight type 1 and GI channel frame wrok. Cut out as per architectural and acoustical design, instructions shall be made all as shown in drawings/as directed. Acoustically transparent fabric of approved colour shall be fixed over plywood as per fixing arrangement enumerated in manufacturer instruction/specification. Square edges shall typically be used where panel edges or seams to be invisible.

15.10.2 PERFORATED WOODEN SLATS WALL PANELLING: Perforated wooden slats wall paneling wherever indicated/shown on drawings shall be provided. GI channel frame @ 600 mm c/c as per manufacturer specification shall be fixed as directed. Provide chemically hardened 50 mm thick glass wood of density 48 kg/cum on GI channel frame work. Provide wood perforated panels of width 128mm, thickness 15mm of length 2440 mm (or cut to size as per site requirement) made out of medium density fibre board substrate with laminated facing (shade and finish as approved by GE) with a melamine balancing layer on other side/face. Board shall have special perforation pattern and where the visible surface shall have "Helmholtz" fluted perforation of 2 mm width. The panel shall provide a minimum sag resistance of RH 90. The edges of panel shall be "tongue and grooved" to receive special clips for installation. The back of above perforated panel shall be provided with sound absorbing non-woven acoustical fleece. The panels shall be mounted on special aluminium splines fixed over GI channel frame using special clips supplied by manufacturer of frame work/panels.

15.11 **GI FRAME WORK**: GI frame work, GI perimeter channel size 20 x 30 x 27 x 0.55mm (having one flange of 20mm and another flange of 30mm and web 27mm) along perimeter of ceiling, screwed fixed to wall with help of nylon sleeves and screws at 600mm centre to centre, suspending GI channels of size 15 x 45 x 0.55mm thick (two flanges of 15mm each and web 45mm) from the soffit at 1200mm centre to centre both ways with ceiling angle soffit cleat of size 25 x 25 x 0.55mm thick fixed to soffit with rawl plug, ceiling section of 65 x 65 x 8mm fixed to the inter mediate channels with the help of connecting clip 2.64mm dia and in direction perpendicular to the intermediate channel at 365 mm centre as per manufacturers instructions.

15.12 **METAL SHEET CEILING:** Metal Sheet Tile Ceiling shall be provided at the location as shown in drawings. The size of metal sheet tile shall be 595mm x 595mm of thicjness as shown in drawings. The tile shall be fixed with GI frame snap grid of size 600mm x 600mm, fixing with metal screws 230mm centre to centre, including jointing compound joint paper tape and drywall top coat, complete with two coats of acrylic distemper over a coat of putty and primer as per manufacturers instructions.

15A. **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 **5.5mm** 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.

PARTICULAR SPECIFICATIONS [Contd...]

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 SSR 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 contact 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 Paras 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/SWR [ring] soil pipes from water closets taken up to first manhole.
[b] UPVC waste pipes from UPVC Nahani traps shall be taken up to gully trap.
[c] UPVC waste pipe up to UPVC Nahani trap and UPVC waste pipe from Nahani trap to Nahani trap.
[d] UPVC Nahani traps
[e] SWG gully traps
[f] Specials in UPVC lines and those in vertical stack with oval access doors.
[g] The working pressure of UPVC pipes and fittings shall not be less than 4 Kg per Sq.cm.

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 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.

17.2.4 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.

17.2.5 Cast iron brackets shall be fixed on walls with wooden plugs [built in walls] or plugged to walls, Size of PCC blocks shall be 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 SSR Part-I.

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 and 18.67.7A of SSR 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 of 1980.

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.

17.10 **RAIN WATER PIPE**

17.10.1 Where shown on drawing rain water pipe and fittings shall be of UPVC grade "A" to withstand continuous internal hydraulic pressure of 4kg/sqcm conforming to IS-4985, and of size 160mm dia. Pipes and fittings shall be secured to wall just below all joint with MS flat clamps embedded in cement concrete blocks 100x100x100mm in mix M-15, type BI. MS clamps shall be made from 1.6mm thick sheeting of 300mm width. Pipes and fittings shall be jointed with epoxy resin or compound as recommended in manufacturers" instruction. The grating shall be of CI, round type, weighing not less than 0.5kg each, provided and fixed at the inlet of rain water pipe.

18. **SANITARY APPLIANCES:**

18.1 Sanitary appliances shall be of vitreous China first 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.

18.1.1 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.

18.2 URINAL: Provide white glazed fire clay stall urinal and its screens. Stall urinal shall be half stall urinal and shall conform to IS 2526 [Part- 6]1995 and all as specified in clause 18.32.7.2 of MES Schedule Part I. Screens shall be white glazed fine clay 1200 mm high and 15 mm thick [overall] and projecting 500 mm after suitable embedment in the wall shall be provided as directed by the Engineer-in-Charge. The end screen shall be suitably fixed as directed by the Engineer-in-Charge. The range shall have 15 cm deep standard pattern tread plates of fire clay. The inside surface of the stall and its screens shall be regular and smooth throughout to ensure efficient flushing. Provide galvanized iron flush pipe with CP stop valve, 32 mm dia chromium plated waste coupling with chromium plated bottle trap 32 mm size with 190 mm long wall connection pipe, concealed GI waste pipe from bottle trap to nahani trap with necessary specials and fittings as directed by Engineer – in – Charge. Necessary slope in PCC platform shall be provided as directed. GI flush pipe and stop valve shall be measured and paid for separately under relevant items of Internal water supply Schedule.

18.3 **FLUSHING CISTERN**:

18.3.1. Provide PVC flushing cistern low level 10 liters capacity for water closets. The PVC cistern shall be conforming IS 7231. 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. The flushing cistern shall be of model waste bird of commander brand or equivalent of other approved make.

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 polyphone 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 [floor mounting type] wherever shown on drawing shall comprise as under:

[i] Water closet European type [floor mounting type] fixed to wall with suitable 'P' trap. 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 [Pt II] white 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 flushing cistern 10 litres capacity all as described here- in - before.

[iv] Flush pipe.

18.5 WATER CLOSET (ORISSA PATTERN) SQUAT PATTERN

18.5.1 Squat pattern water closet shall be Orissa pattern WC and shall consist the following: -

(i) Vitreous China white WC, Orissa pattern of size 580mm x 440mm with integral footrests and P or S trap with inspection vent.

(ii) The WC pan/trap shall be set in lime concrete below level of rim of pan to receive the floor finish.

(iii) 10 litres discharge capacity low level flushing cistern made of hard durable plastic (HDPE/PP) finger touch operated bearing IS-7231 diaphragm bearing IS 13049 and delrin valve float bearing IS 9762 model water bird of commander brand fixed with standard cast iron brackets, 32mm dia polythene flushing pipe of required length with suitable plastic coupling, nuts and other accessories all as specified in Paras 18.32.2, 18.35 and 18.36 of MES Sch Part I. Fixing shall be done as specified in Para 18.87 of MES Sch Part I.

18.6 WASH HAND BASIN:

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

18.6.2 Wash hand basin shall include the following:

[a] Vitreous china wash hand basin of size 550mm x 450mm complete with brass chromium plated waste out let screwed with necessary coupling connection.

[b] one brass chromium plated quarter turn pillar cock 15mm dia

[c] A pair of painted cast iron brackets fixed on and including teak wood plugs embedded in walls.

[d] Brass chromium plated chain and rubber plug

[e] Ready made low density polythene pipe for cold water services conforming to IS – 3076 comprising 16mm dia [outer dia] and 450mm long polythene pipe having brass union at both ends, one end to be screwed to inlet of pillar cock and the other end to the GI pipe / stop cock. The polythene shall not weigh less than 47 grams [the weight worked out from the density and dimension given in IS – 3076 for low density polythene pipes for cold water services]. The weight of pair of brass unions shall not be less than 40 grams.

[f] Bottle trap shall be provided to WHB

PARTICULAR SPECIFICATIONS [Contd...]

18.7. MIRROR: Provide mirror at locations and to the size shown on drawing. Mirror shall be of selected quality glass of 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 mentioned hereinafter. Mirror shall have 6 mm thick plywood backing of BWR grade with commercial face veneers. Mirror shall be fixed to wooden plugs embedded in wall. If size of mirror is not mentioned, then the same shall be of full size.

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

18.8.1 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.

18.8.2 Provide mirror of full width of counter all as shown on drawing. Mirror shall be of selected quality glass of 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 mentioned hereinafter. Mirror shall have 6 mm thick plywood backing of BWR grade with commercial face veneers. Mirror shall be fixed to wooden plugs embedded in wall.

18.9 SOAP TRAY & CORNER GLASS SELF: Provide Polished marble corner of 20mm thick soap tray at locations shown on the drawings and corner glass shelf as shown on drawings

18.10 HEALTH FAUCET: Provide 15mm dia 2 in 1 Bib cock, fancy type, twin elbow valve faucet wall mounted type, with and including SS health faucet & jet spray with SS flexible tube & hook of Make: Cat No. F-330004 for Bib cock and F-160023 for Health Faucet of Hindware or equivalent in makes given here-in-after. Provide Health faucet with two ways shall be provided at location as shown on drawings. The ABS body with 1.2m long flexible type steel tube and wall hook.

18.11 PEG SETS: Provide standard machine made pegs of aluminium of size shown on drawing and at locations shown on drawing. The wooden plank shall be of second class hard wood and shall be screwed to second class hard wood plug out of 50 x 50 x 80mm embedded in wall. Exposed surface of teak wood plank shall be treated with french polish. The pegs shall be fixed to plank by means of cadmium plated screws.

18.12 ARRANGEMENTS FOR DRYING CLOTHES: Arrangement for drying cloths shall be provided at balcony of all buildings/ at locations as shown on drawings. String wire shall be not less than 4mm dia GI with galvanizing of Class-V with PVC coating. MS hooks with 8mm dia MS Rod 200mm long shall be made to shape as shown on drawing/as directed by Engineer-in-Charge. MS Hooks shall be embedded in PCC (1:2:4) type B-1 using graded stone aggregate blocks of size 230mm x 230mm x 150mm.

19 CRUMPLE JOINTS: Crumple joints wherever shown on drawing shall be provided as per TD Drawing. The top surface of RCC over crumple joint shall be provided with water proofing treatment as specified for RCC roof and joint filler shall be bituminious filler board and joints shall be made continuous in floor.

PARTICULAR SPECIFICATIONS [Contd…]

20. **MISCELLANEOUS ITEMS:**

20.1. 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.

20.2 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.

20.3 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.

20.4 DAMP PROOF COURSE:

20.4.1 Damp proof course shall consist 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 instructions and laid as specified in Para 5.42.1 and 5.42.2 of MES Schedule Part I. Water proofing compound for damp proof course shall be as per IS-2645 [1975].

20.4.2 Damp proof course shall also be provided under door / openings [below floor by giving a vertical drop]. Floor finish shall be extended in door openings.

20.5 **CILL:** Provide cills at locations shown on drawing. Cill shall have 75 mm bearing on either side of opening. Cill shall have slope to external side for easy drain out of water. Green Marble stone 18 to 20mm thick cill shall be provided over all window and ventilators.

20.6 STAINLESS STEEL RAILING

20.6.1 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 1.2mm 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.

20.7 Built in Furniture of steel & Wood shall be of make Godrej/Durian / Methodex / Juari.

20.8 RCC SHELVING WITH GRANITE STONE: Provide 18 to 20mm thick black polished granite stone slab over RCC slab at locations shown in the drawing. Granite stone slab shall be in one piece and shall be set over 15 mm thick screed in cement mortar 1:4 over RCC slab.

20.10 COOKING PLARTFORM/WORKING PLATFORM/PREPARATION PLATFORM/ PLATFORM: Provide 18 to 20 mm thick black polished black Granite stone slab over RCC slab at locations shown in the drawing. Granite stone slab shall be in one piece and edges shall be moulded and shall be set over 15 mm thick screed in cement mortar 1:4 over RCC slab. 20 mm dia hole shall be provided in the RCC slab while casting as well as in the Granite stone slab cooking platform only.

PARTICULAR SPECIFICATIONS [Contd…]

20.11 STAINLESS STEEL SINK WITH DRAINING BOARD (DOUBLE SINK & DOUBLE DRAINING BOARD): Provide stainless steel sink with draining board in kitchen at location shown on drawing. Sink with draining board (combined) shall be of overall size 2210mm x 505 mm (87" x 20") or nearest size. The size of bowl shall be 510x405mm and 200mm depth. Sink with draining board shall be manufactured from Salem stainless steel sheets grade A1 SI-305. The thickness of the sheet shall be 1 mm. The sink with draining board shall be of any one of the makes mentioned in list of makes. The surface of the sink and draining board shall be plastic coated to make it safe and scratch free installation. The sink with draining board shall be first got approved by GE before placing bulk order. The sink shall be provided with brass chromium plated connecting union and plug. The waste pipe shall be of HDPE pipe and shall be extended upto top of nahani trap. Sink and draining board shall be supported on 25 x 25 x 6 mm angle iron brackets 500mm long with split end embedded in PCC block of size 250x250x150mm in 1:3:6 type C2.

20.12 WORDROBE/CUP BOARDS: Provide wardrobe/cup boards as per location and all as shown on drawings. In-case of details not shown on main drawing, it shall be followed as per TD drawing No. DGNP/TD/217. Chowkats and frame of shutters of wooden doors shall be made of first class Hard wood. The panel insert for panelled door shutters shall be 18 to 19mm thick pre laminiated particle-board on bothsides and shall conform to IS-3097. Shelves shall be made of cuddapah stone as shown on drawing. Provide stainless steel builders hardware as shown in the drawing. Shutter shall be fixed with the help of stainless steel butt hinges. All woodwork shall be treated with fench polish. The internal plastered surfaces of cupboard/wardrobe shall be treated with the room finishes as specified in schedule of finishes. Aluminium anodized haspe and staple, tower bolts 100mm long, 250mm long Aldrop bolt and handles 125mm long shall be provided as per details shown in drawing. All internal surfaces of cup boards shall be finished with two coats of ACRYLIC emulsion over a coat of alkali resistant primer and over two coats of wall care putty.

20.13 RCC SHELVING: Provide RCC shelves at locations and as per details shown on drawing. The surfaces of RCC shelves, shall be finished with 5 mm thick plaster in CM (1:3) finished fair and even without using extra cement and treated with finish given for walls of respective rooms. Platform below shelves shall be with PCC (1:2:4) type B1, finished to match the flooring of the room.

20.14 MIRROR WITH SHELF: Provide mirror at locations and to the size shown on drawing. Mirror shall be of selected quality glass of 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 mentioned in Appendix 'A'. 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. If size of mirror is not mentioned, then the same shall be of full size. The selves made from 12mm thick pre-laminated particle board with one side decorative finish and other side white. 6mm thick ply wood shall be used for desks. Total frame shall be of TW duly polished.

20.15 DRYING CLOTHES WIRES: Drying clothes wind of MS angles and wires shall be all as shown in TD Drawings. The fixing arrangements all as shown in the drawings. Wires shall be of PVC coated and anti rusted coating for MS wing supports.

20.16 PLATE RACKS IN KITCHEN: Stainless steel side rack / plate rack shall be provided in kitchen at places as shown in drawings. SS for side rack and plate rack shall be of the grade SS304 and shall be made out of 1mm thick SS sheet. Plate rack shall be manufactured by any one of the manufacturers having license from BIS for the manufacturing/as directed by GE. Fixing of Plate rack shall be done by means of Rawl plugs and as directed by the Engineer in Charge.

20.17 GLASS LOOKING MIRROR: Provide mirror at locations and to the size shown on drawing. Mirror shall be of selected quality glass of 5.5mm thick with edges bevelled. It shall be free from all flaws, specks or bubbles. The glass shall be uniformly silver plated on the back, free from silvering defects. The silver shall have a uniform protective coating of red lead paint. Mirror shall be any one of the makes mentioned in Appendix 'A'. 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. If size of mirror is not mentioned, then the same shall be of full size.

20.18 GROUND SINK: It shall be finished with glazed ceramic tiles white in colour 7-10mm thick and of size 200mm X 100mm all as specified. Glazed tiles in dado shall also of the same specification as above fixed over 10mm thick rendering in Cement Mortar 1:3.

20.19 3 TIER RCC SHELVES: 50mm thick three tier RCC shelving shall be provided as per details shown on Drawings. Whatever constructional details are shown on this drawing, these shall be adopted.

20.20 SAUCER DRAIN: Irrespective of shown or not in drawings, PCC 1:2:4 type B1 Saucer drain shall be provided allround the main buildings. Dimensions of Saucer Drain shall be as shown on main plan of respective building / TD drawing.

20.21 RAILING FOR BALCONY AND STAIR HALL/STAIR CASE: Railing in any situation such as railing/parapet for balcony stair hall/stair case shall be provided all as per details shown on drawings. Where MS pipe is shown, it shall be light grade un-galvanized pipe of dia shown on drawings and welded to flat iron/square bars. Mortice hole left in concrete for fixing balusters of railing shall be grouted in cement mortar (1:2) and finished to match the adjoining surface of concrete. Welding of MS pipe with flat iron frames of railing where shown on drawings shall be with running welding.

20.22 KITCHEN CABINET ABOVE & BELOW COOKING PLATFORM: The specifications for Kitchen Cabinet shall be as under if not given in drawings: - (a) Kitchen Cabinet (i) Top, bottom sheet & shelves: 18 to 19mm thick marine plywood conforming to IS-710 (ii) Shutter: 18mm thick marine plywood (as per IS-710) with 1.5mm thick lamination (shade and colour as approved by GE) (iii) Internal surfaces of plywood finished with French polish (iv) 100mm stainless steel handles for every shutter. All internal surfaces of cup boards shall be finished with two coats of ACRYLIC emulsion over a coat of alkali resistant primer and over two coats of wall care putty.

21 SWIMMING POOL ITEMS

21.1 PCC SURFACE DRAIN/ DRAIN AND WET DECK: PCC surface drain shall be constructed with the following specification and at locations as shown in drgs:- (a) PCC Block masonry - cement and sand mortar 1:4 (b) Copings - PCC 1:2:4 type B1 using 20mm graded stone aggregate irrespective of whatever is specified in drawing. (c) Rendering - Internal surfaces of drain shall be rendered 15mm thick in CM 1:4 and finished even smooth with using extra cement. (d) Cover - 40mm thick ABS UPVC as shown on drg. (e) Finishing - All the internal surfaces finished with finsishes of swimming pool.

21.2 STAINLESS STEEL RAILING: Wherever shown on drawing provide stainless steel framed railing with stainless steel pipe of 304 grade and fixed as per the details of manufacturer's instruction and as directed by Engr-in-Charge.

21.3 SKIMMERS: - Skimmer shall be provided at equvidistant distance on the length of swimming pool of 16 Nos on each side (total 32 Nos) and 07 Nos on width of swimming pool on each side (total 14 Nos) of size 600 x 100mm. The dia of skimmer if not shown on drawing shall be of 25mm dia of 304 grade stainless steel pipe and fixing shall be as per manufacturer's instructions.

21.4 NOZZLES Nozzles shall be provided all as shown on drawings. It shall be of stainless steel of UV RICH devices or equivalent. The Lumpsum quoted by the contractor is deemed to be included the cost of above provisions.

21.5 DIVING SPRING BOARD: This will consist of a laminated diving board supported on a rigid mechanical function which will be grouted on suitable concrete platform on the deck, all as shown on drawing. The design & size to confirm with FINA standards (a) Size - 0.5 Metre width x 5 Metre Length (b) Material - FRP laminated with wooden core.

PARTICULAR SPECIFICATIONS [Contd…]

21.6 SWIMMING POOL LANES ROPES: Swimming Pool racing lanes are made up of plastic pool floats (ball or anti wave floats) of red, blue, white in color of 52 mtr length alongwith 14 Nos of floats per running meter. Dia of floats may be from 50mm to 150mm and are stung on stainless steel cable, tensioned to limit movement of lane alongwith complete fixing arrangement and storage reel for storage of ropes, made of SS AISI 304 complete all as per FINA standard. Make : Austin, Potent, Halbert or as per FINA standards as approved by GE.

21.7 LANE MARKING TRACKS: This consist of a nylon rope on which plastic floats are fitted in different colors complete with stainless steel of grade 304 hooks at both ends that are permanently grouted in concrete. The cost on account of this item shall be deemed to include the cost of Lumpsum quoted for Swimming pool.

21.8 STARTING BLOCK FOR SWIMMING POOL: Base made out of SS AISI 316 polished finish with non slip fibre glass top of size 500x 500 x 4000mm blue color top angle deflection 100, depth of platform 1 mtr complete with fixing arrangements alongwith anchors etc duly numbered complete as per FINA standards. Make: Austin, Franco, Halbert or any other make as per as per FINA standards approved by GE

21.9 PVC PARTITION: Where shown on drawing PVC partition shall be made with MS hallow stud frame and panelled with 20mm thick PVC board all as shown on drawing. The PVC partition shall be fixed in floor and wall by means MS base plate and PCC blocks respectively and all as shown on drawing.

21.10 SWIMMING POOL EQUIPMENTS: The tenderer shall have to guarantee to the quality of the water being maintained in the swimming pool as per provisions given in IS-3328-1965, with the provision of equipments catered in the Sch 'A' and any extra provisions required to maintain the swimming pool in conformity with the provisions given in IS-3328-1965 shall be provided by the contractor at no extra cost.

21.11 CASCADE: Cascade shall be provided all as shown on drawings. CI pipe and standard gratings shall be fixed before concreting. The lumpsum quoted for sminning pool shall deemed to be included the cost of cascade, the cost of pipe from the outer face of the foundation and upto the top of cascade. Finishes shall be all as shown on drawing. In case not shown, all the exposed surfaces shall be finished with 5mm thick plaster cement mortar 1:3 using water proofing compound finished even and smooth with using extra cement and shall be finished with two coats of exterior emulsion paint over a coat of primer all as per manufacturer's instruction and as directed by the GE.

PARTICULAR SPECIFICATIONS [Contd...]

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

22.1 Site clearance/Earthwork excavation shall be carried out all as detailed in Schedule "A".

22.2 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 unserviceable materials obtained from site clearance shall be disposed to a distance not exceeding 50m.

22.3 Moorum shall be of good quality hard decayed rock free from roots, vegetable mould and other deleterious substance and shall not contain any admixture of ordinary earth. Materials shall vary from dust to 40mm gauge. Anything over in size shall be rejected or shall be broken down to bring within 40mm size. It shall conform to be superior to the samples kept in Garrison Engineer office. No price adjustment shall be made on this account.

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 CONCRETE PIPE NP3: The pipe and fittings shall be provided all as specified in para 18.29 of MES Schedule Part-I.

23.4 SALT GLAZED STONE WARE PIPES AND FITTINGS

23.4.1 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.

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 Sch Part I.

PARTICULAR SPECIFICATIONS [Contd...]

23.9 CI RUNGS/STEPS

23.9.1 The rungs shall conform to IS: 5455-1969. The step shall be clean, well cast and they shall be free from air and sand holes, cold shuts and warpings which are likely to impair the utility of castings.

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 s 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.

23A. **RCC OVER HEAD TANK:** Refer relevant items of Schedule 'A' in conjunction with the specifications of relevant trade sections given here-in-before and in MES Schedule Part-I. The work under this schedule shall be carried out all as specified here in before and in MES schedule, shown on drawings and as directed by Engineer-in-Charge.

24. **COMPOUND WALL /GATE / FENCING:**

24.1 The work under this schedule shall be carried out all as specified here in before and in MES schedule, shown on drawings and as directed by Engineer-in-Charge.

24.2 **FLY ASH BRICK MASONRY**

24.2.1 Fly ash brick shall be locally available best quality brick, as approved by GE.

24.2.2 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 without 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.

24.2.3 200 / 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.

24.2.4 The entire workman ship 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.

24.2.5 Provide horizontal RCC lintel band at 2.10 Metres height / lintel level over 115 mm thick brick wall / half brick walls and hidden beam as specified in DGNP/TD/234 Sheet No. 1/1 dated 14-08-12.

24.2.6 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].

24.2.7 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.

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

24.2.9 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 @ 3% by weight of cement. The make shall be as specified hereinafter.

24.3 Materials such as coarse aggregate, fine aggregate, plstering, concrete and other connected works shall be all as specified hereinbefore.

24.4 SECURITY FENCING & GATE**:** Specification of materials shall be all as specified for concrete works for building works hereinbefore. Work shall be got done as directed in respective items of Sch 'A', Respective Part and all as specified in relevant section of SSR Part-I.

25. **ROADS:**

25.1 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.

25.2 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 measurement of stacks are not subject to any deductions.

25.3. **BITUMEN:** Bitumen shall be paving bitumen of Grade VG-10 for tack coat and VG–30 for other as per IS – 73, Specification of Paving Bitumen and shall be Contractor's supply and shall be procured by the contractor directly from **HPCL / IOCL / BPCL.** Contractor shall make his own arrangements to store the same. The contractor shall produce paid vouchers and test certificates for bitumen used in the work immediately on receipt of materials. Contractor shall make his own arrangements to store the bitumen. After the bitumen has been brought to site, independent tests shall also be carried out by the GE, to ascertain the quality of the bitumen. Testing of bitumen shall be in accordance with IS – 73. For sampling the numbers of containers to be selected from the lot of bitumen depend upon size of the lot and shall be in accordance with Table – III of IS – 73. Number of tests and types of tests to be carried out shall be as per relevant IS. In case the bitumen is not of requisite standard as verified by the GE through independent testing as mentioned herein before, the Contractor shall remove the total consignment from the site at his own cost after written rejection order of the consignment by the GE despite manufacturer's test certificate. The cost of test shall be borne by the Contractor irrespective of the results of tests.

25.4 **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.

25.5 **BLOCK LEVELS:** 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.

25.5.2 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.

25.5.3 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 work passing register in addition to the entries made in the measurement book.

25.5.4 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.

25.6 **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.

25.7 **WATER BOUND MACADAM:** (WBM)

25.7.1 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.

25.7.2 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 SSR 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.

25.7A **WET MIX MACADAM (WMM):** Wet mix macadam shall be as specified in SSR clause 20.B.2.5. The surface of WMM shall be inspected before laying carpet by GE and representative of contractor for rectifying the defective construction if any. WMM shall be laid as specified in SSR clause 20.B.5, without extra cost to the Government. Bituminous carpet work shall not be carried out unless the 'stage passing' is given by GE.

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

25.8.1. **MATERIALS:**

25.8.1.1. 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:

Is Sieve [mm]	Cumulative % by weight of total aggregate passing
19	100
13.2	90 – 100
9.5	70 – 90
4.75	35051
2.36	24 – 39
1.18	15 – 30
0.6	15 – 30
0.3	–
0.15	09 – 19
0.075	3 – 8

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

25.8.1.2. 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.

25.8.1.3. The aggregates shall satisfy the following physical requirements:

Property	Test	Specification
Cleanliness [Dust]	Grain Size Analysis [IS – 2386 Part – I]	Max 5% Passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index [Combined] [IS – 2386 Part – I]	Max 30%
Strength	*Los Angeles Abrasion Value [IS – 2386 Part – IV]	Max 30%
	*Aggregate Impact Value [IS – 2386 Part – IV]	Max 24%
Polishing	Polished Stone Value [BS:812 Part – 114]	Max 24%
Durability	Soundness [IS:2386 Part – V] Sodium Sulphate Magnesium Sulphate	 Max 12% Max 18%
Water Absorption	Water absorption [IS – 2386 Part – III]	Max 2%
Water Sensitivity	Retained Tensile Strength [AASHTO T 283]	Min 80%
Stripping	Coating & Stripping of Bitumen Aggregate [Mixtures] [IS – 6241]	Minimum retained coating 95%

Note:

1. *Aggregate may satisfy requirements of either of these two tests.
2. Water sensitivity test is only required for the minimum retained coating in the 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.

25.8.1.4. 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.

25.8.1.5. 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.

IS Sieve [mm]	Cumulative per cent passing by weight of total aggregate
0.6	100
0.3	95 – 100
0.075	85 – 100

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.

25.8.2. **DESIGN CRITERIA FOR SDAC:**

25.8.2.1. 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:

Criteria		Specified Value
		Semi Dense Asphaltic Concrete
[a]	Number of compaction blow each end of Marshall specimen	75
[b]	Marshall stability in KGs	1200 [Min]
[c]	Flow value [mm]	2 – 4
[d]	Percentage air void mix [to prevent bleeding]	3 – 5
[e]	Percentage air voids filled with Bitumen [VFB]	65 – 78
[f]	Loss of stability on immersion in wear at 60 degree C [ASTMD 1075]	–
[g]	Binder content % by weight of total mix.	**
[h]	Percentage voids in mineral aggregates [VMA]	See table below

** 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".

25.8.2.2. **MINIMUM PERCENT OF VOIDS IN MINERAL AGGREGATES:**

Nominal maximum particle size*	Minimum VMA, Percent related to mix Design air voids, percent**		
	3.0	4.0	5.0
9.5	14.0	15.0	16.0
12.5	13.0	14.0	15.0
19.0	12.0	13.0	14.0
25.0	11.0	12.0	13.0
37.5	10.0	11.0	12.0

* The nominal maximum particle size is one size large than the first sieve to retain more than the 10.

** Interpolate maximum voids in the mineral aggregate [VMA] for design air voids values between those listed.

25.8.3. **JOB-MIX FORMULA FOR SDAC:**

25.8.3.1. 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.

25.8.3.2 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 hereinbefore.

25.8.3.3. The contractor shall submit their job mix formula to the Garrison Engineer for approval. 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.

25.8.3.4. 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.

25.8.3.5. Preparation of mix, laying, spreading, compaction and control for semi dense asphaltic concrete shall be done all as specified in clause 20.B.4 of MES Schedule Part – I.

25.8.3.6. 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.

25.8.4. Plant Trails – Permissible variation in Job mix formula.

25.8.4.1. 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.

Description	Permissible variation
	SDAC
Aggregate passing 19mm sieve or larger	+8%
Aggregate passing 13.2mm, 9.5 mm	+ 7%
Aggregate passing 4.75 mm	+ 6%
Aggregate passing 2.36mm, 1.18 mm, 0.6 mm	+ 5%
Aggregate passing 0.3mm, 0.15 mm	+ 4%
Aggregate Passing 0.075mm	+ 2%
Mixing temperature	+10°C

25.8.4.2. 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.

25.8.4.3 **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 on 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 it 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, not 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.

PARTICULAR SPECIFICATIONS [Contd...]

25.8.5. **MIXING AND TRANSPORTATION OF MIX:**

25.8.5.1. 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.

25.8.5.2. 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.

25.8.5.3. 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 cleaned and be covered using suitable covers in transit to ensure that the temperature of mix does not fall below 120 degrees Celsius at the time of laying.

25.8.6. **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.

25.8.7. **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 tone Tandem Vibratory Roller use on static mode. Intermediate rolling shall be with a smooth sheet pneumatic roller of 15 to 30 ton capacity having tyre pressure of 7 Kg/Sq.cm. There after the compaction will be carried with the help of Tandem roller with vibratory mode till compaction levels are achieved. Final compaction and surface finish shall be achieved with the help of pneumatic tyred roller.

25.8.8. **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.

25.8.9. **QUALITY CONTROL PLAN:**

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

PART – I:

<table>
<tr><td>1</td><td colspan="7">Contract Agreement Reference No</td><td></td></tr>
<tr><td>2</td><td colspan="7">CPM Net work prepared and approved by GE</td><td></td></tr>
<tr><td>3</td><td colspan="7">Resource scheduling done base on CPM</td><td></td></tr>
<tr><td>4</td><td colspan="7">Mix design submitted and approved</td><td></td></tr>
<tr><td>5</td><td colspan="7">Preliminary works completed to standard engineering practice</td><td></td></tr>
<tr><td>6</td><td colspan="7">Arrangements for water made</td><td></td></tr>
<tr><td>7</td><td colspan="7">Arrangement for electric supply made</td><td></td></tr>
<tr><td rowspan="2">8</td><td colspan="7">Materials brought to the site to be maintained as per following format:</td><td></td></tr>
<tr><td>Ser No.</td><td>Item</td><td>Source as per CA</td><td>Contractors plan of sourcing</td><td>Refer to testing clause</td><td>Agency for testing</td><td>Responsibility for testing</td><td></td></tr>
<tr><td>9</td><td colspan="7">List of all T & P, make and numbers that the contractor would deploy at site of work</td><td></td></tr>
<tr><td>10</td><td colspan="7">Name of person nominated by contractor for exercising quality control</td><td></td></tr>
<tr><td>11</td><td colspan="7">Qualifications / Experience of person at Serial No.11 above.</td><td></td></tr>
<tr><td>12</td><td colspan="7">Name of supervisors with their qualifications experience employed by contractor</td><td></td></tr>
<tr><td>13</td><td colspan="7">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><td></td></tr>
</table>

<table>
<tr><td>14</td><td colspan="8">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><td></td></tr>
<tr><td>15</td><td colspan="8">Method to be adopted for maintaining records of test result</td><td></td></tr>
<tr><td rowspan="3">16</td><td colspan="8">Certificate that contractor shall maintain log of all materials received at site as per the following format:</td><td></td></tr>
<tr><td>Ser No.</td><td>Date</td><td>Material</td><td>Quality received</td><td>Source</td><td>Whether as per approved sample or not</td><td>Test carried out by supplier</td><td>Tests to be carried out before incorporation</td><td></td></tr>
<tr><td colspan="8"></td><td></td></tr>
<tr><td>17</td><td colspan="8">General Remarks by contractor of his plan of actions to ensure that quality standards.</td><td></td></tr>
</table>

25.8.10. **PLANTS / MACHINERY TO BE USED:**

25.8.10.1. **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 unborn 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.

25.8.10.2. **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.

25.8.10.3. **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.

25.8.10.4. **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.

25.8.10.5. **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.

25.8.10.6. **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 martial 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.

25.8.11 **QUALITY CONTROL TESTS:**

25.8.11.1. **CONTROL TESTS ON FLEXIBLE PAVEMENT:**

Sl	Type of Construction	Test	Frequency [Minimum]
1	Semi Dense Bituminous Concrete / Bituminous Concrete	[i] Quality of binder	Number of samples per lot and test as per IS – 73, IS – 217 and IS – 8887 as applicable.
		[ii] Aggregates impact value/Loss Angles Abrasion Value [iii] Flakiness Index & Elongation Index	One test per 200 Cu.m of aggregate One test per 50 Cu.m of aggregate
		[iv] Striping Value	Initially one set of three representative specimens for each source of supply. Subsequently when the warranted by changes in the quality of aggregate.
		[v] Water Absorption of Aggregates [vi] Soundness [Magnesium and Sodium Sulphate]	– do – Initially one determination by each method for each of supply, ten as warranted by change in the quality of aggregates.
		[vii] Sand equivalent test	As required
		[viii] Plasticity Index	As required
		[ix] Polished Stone Value	As required, for Semi Dense Bituminous Concrete / Bituminous Concrete
		[x] Percentage of fractured faces	When Gravel is used, one test per 50 Cu.m of aggregates

		[xi] Mix grading	One set of tests on individual constituents and mixed aggregates from the dryer for each 400 tones of mix subject to a minimum of two tests per plant per day.
		[xii] Stability of mix	For each 400 tones of mix produced, a set of 3 Marshall specimen to be prepared and tested for suitability, flow value, density and void content subject to minimum of two sets being tested per plant per day
		[xiii] Water sensitivity mix [Retained tensile Strength]	Initially one set of three representative specimens for each source of supply. Subsequently when the warranted by changes in the quality of aggregate [if required]
		[xiv] Swell test on the mix	As required for the Bituminous Concrete
		[xv] Control of temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling	At regular close intervals
		[xvi] Control of binder content and grading of mix	One test for each 400 tonnes of mix subject to a minimum two tests per day pert plant.
		[xvii] Rate of spread of mixed materials	Regular control through checks on weight of mixed materials and layer thickness
		[xviii] Density of compacted layer	One test per 250 Sq.m area
	Binder	[i] Softening Point	Initially on submission there after daily if site blended, weekly if pre – blended
		[ii] Penetration at 25°C and 4°C	– do –
		[iii] Elastic recovery	– do –
		[iv] Ductility	– do –
		[v] Flash Point	– do –
		[vi] Frass Breaking	Initially on submission
		[vii] Viscosity at 150°C	– do –
		[viii] Thin film oven test, penetration, softening pint, elastic recovery of residue, loss on heating.	– do –

25.8.12. **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%

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

25.8.13. **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.

PARTICULAR SPECIFICATIONS [Contd…]

25.9. **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.

25.10. **MEASUREMENTS:** Refer preamble 20.A.1 on Page 465 of MES Schedule Part – II :2020.

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

25.12. **USE OF ROAD:** During the progress of work on road the contractor has to provide suitable temporary screen barricades preferably of galvanization sheets duly painted on back side of intersections of road to avoid any untoward accident.

25.13. **COMMUNICATION FACILITIES:** Efficient communication facility for executives and contractor's representative shall made available by the contractor regarding site control, safety precautions, quality control to ensure smooth execution of work.

25.14. **MATERIALS AND TESTING:**

25.14.1. 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.

25.14.2. 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.

25.14.3. 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.

26 **AREA DRAINAGE / RCC CABLE DUCT:** Refer relevant items of Schedule 'A' in conjunction with the specifications of relevant trade sections given here-in-before and in MES Schedule Part-I. The work shall be carried out all as directed at site by the Engineer-in-Charge and as described in Schedule `A` and as specified in these particular specifications.

27 **RECREATION GROUNDS:** Refer relevant items of Schedule 'A' in conjunction with the specifications of relevant trade sections given here-in-before and in MES Schedule Part-I. The work shall be carried out all as directed at site by the Engineer-in-Charge and as described in Schedule `A` and as specified in these particular specifications.

27.1 **PREPARATION OF GROUND**:

27.1.1 SUB GRADE (Formation): Preparation of sub grade includes site clearance, surface excavation, grading (cutting/filling, if any) and compaction. It is most essential to compact the sub grade adequately before placing the other layers. The sub-grade should be compacted at optimum moisture content as determined from laboratory tests. Field check for achieving 95 % of standard proctor density should be done by Sand Replacement Method.

27.1.2 All excavation, earth filling and embankments shall be executed as ordered in accordance with Section 3, Earthwork of SSR Part I.

27.1.3 Rolling of formation shall be done with 8-10 T power roller under optimum moisture conditions, so as to obtain at least 95 percent of standard proctor density. Laboratory determination of optimum moisture content and dry density shall be done in accordance with IS:2720 (Pt-VII)-1980. Field check for achieving the required compaction shall be done by sand replacement method as specified in IS:2720 (Pt XXVIII)-1980.

27.1.4 GRANULAR SUB BASE: This work shall consist of laying and compacting well-graded material on prepared subgrade in accordance with the requirements of these Specifications. The material shall be laid in one or more layers as sub-base or lower sub-base and upper sub-base (termed as sub-base hereinafter) as necessary according to lines, grades and cross-sections or as directed by the Engineer-in-Charge and manufracturers instructions.

27.1.5 PREPARATION OF THE BASE: The surface shall be thoroughly swept clean by a mechanical broom, and the dust removed by compressed air. In locations where mechanical broom cannot get access, other approved methods shall be used.

27.1.6 BASE FOR LAYING OF FLOORING: The base for all the sports ground shall be **Pavement quality concrete as specified** in Schedule 'A' laid over PCC 1:3:6 type D2 using 40mm graded granite stone aggregate over well prepared ground as per manufacturer's instructions. The Payment quality cement concrete mix will be designed as per the design and the flexural strength shall not be less than specified value at 28 days in the field and shall be designed and mix tested as per design mix specified here in before. The Mix design shall be approved by GE.

27.1.7 Before laying of synthetic flooring, the surface area should be flooded with water, to ensure there is no stagnation. The layout of the ground surface is to be approved by the PMG and GE. However, contractor shall be responsible for all the dimensions and slopes.

27.2 **FOOTBALL**: The quoted rate for football synthetic turf shall be inclusive of the following provisions.

27.2.1 Provind and laying of synthetic turf flooring for football ground over the well prepared surface as per manufacturer's instructions. The FIFA approved synthetic turf flooring shall be procured from FIFA approved manufracturers. The work shall be carried out by the rep of FIFA approved orginal manufacturer and a certificate to this effect shall be taken by contractor from manufacturer and shall be submitted to GE before completion of work. The quoted rate for football synthetic turf shall be inclusive of all connected items such as necessary drainage system, field markings, flag posts, goal posts with connected items as per FIFA requirement.

27.2.2 **Field certification:** The contractor shall submit the following certificates.

(a) Laboratory testing certificate by FIFA that the Licensee's Product has met the requirements of the FQC Laboratory Test Procedure and the Licensee can progress with the installation of fields for potential certification.

(b) Initial field assessment by FIFA Field Test Institute and will issue a unique Field Test Report.

(c) Final field certification: If the field satisfies all aspects of the FIFA Quality Concept FIFA will grant the appropriate FQC star rating to the Licensee with a copy to the Department. The quoted rates by the contractor shall be inclusive of the visits of FIFA accredited agency rep on site.

27.2.3 MAINTENANCE DURING DEFECTS LIABILITY PERIOD: Contractor shall maintain entire ground during defects liability period by deploying the facility operator. The facility operator shall ensure that all the equipments are available to maintain the field in accordance with the manufacturer's instructions. Maintenance equipment on site must at least include a tractor unit, either a drag brush or drag mat, additional infill to top up the field and a ball roll ramp. The facility operator shall ensure all required maintenance equipment is available for inspection by GE.

27.2.4 **PENALTY:** If the ground is found without facility operator / without equipments, a penalty of **Rs. 1,000.00/day [Rupees one thousand]** or double the prevailing minimum wage as notified by the Central / State Authorities / Local Bodies whichever is more per day, for the period of absence, shall be recovered from the amount due to the contractor. No claim whatsoever arising on this account is admissible. The decision of GE in this regard shall be final conclusive and binding.

27.3 **VOLLEYBALL**: The quoted rate for volleyball polypropylene flooring shall be inclusive of the following provisions.

27.3.1 Provind and laying of polypropylene flooring for volleyball ground over the well prepared surface as per manufacturer's instructions. The flooring shall be procured from ITF/FIVB approved manufracturers. The work shall be carried out by the rep of ITF/FIVB approved orginal manufacturer and a certificate to this effect shall be taken by contractor from manufacturer and shall be submitted to GE before completion of work. The quoted rate for polypropylene flooring shall be inclusive of all connected items such as necessary drainage system, lines of court, net, posts, antenna and connected items as per ITF/FIVB requirement.

27.3.2 **Field certification:** The contractor shall submit the following certificates.

(a) Laboratory testing certificate by ITF/FIVB that the Licensee's Product has met the requirements of the Laboratory Test Procedure and the Licensee can progress with the installation of fields for potential certification.

(b) Initial field assessment by ITF Field Test Institute and will issue a unique Field Test Report.

(c) Final field certification: If the field satisfies all aspects of the ITF/FIVB Quality Concept, ITF/FIVB will grant the appropriate Licensee with a copy to the Department. The quoted rates by the contractor shall be inclusive of the visits of ITF/FIVB accredited agency rep on site.

27.3.3 MAINTENANCE DURING DEFECTS LIABILITY PERIOD: Contractor shall maintain entire ground during defects liability period by deploying the facility operator. The facility operator shall ensure that all the equipments are available to maintain the field in accordance with the manufacturer's instructions. Maintenance equipment on site must at least include a tractor unit, either a drag brush or drag mat, additional infill to top up the field and a ball roll ramp. The facility operator shall ensure all required maintenance equipment is available for inspection by GE.

27.3.4 **PENALTY:** If the ground is found without facility operator / without equipments, a penalty of **Rs. 1,000.00/day [Rupees one thousand]** or double the prevailing minimum wage as notified by the Central / State Authorities / Local Bodies whichever is more per day, for the period of absence, shall be recovered from the amount due to the contractor. No claim whatsoever arising on this account is admissible. The decision of GE in this regard shall be final conclusive and binding.

27.4 **BASKETBALL/BADMINTON COURT:** The quoted rate for basketball/badminton court flooring shall be inclusive of the following provisions.

27.4.1 Provind and laying of polyurethane flooring (PU floor) for basketball/badminton court over the well prepared surface as per manufacturer's instructions. The flooring shall be procured from FIBA approved manufracturers. The work shall be carried out by the rep of FIBA approved orginal manufacturer and a certificate to this effect shall be taken by contractor from manufacturer and shall be submitted to GE before completion of work. The quoted rate for PU flooring shall be inclusive of all connected items such as necessary drainage system, lines of court, net, posts, basket ring, backboards and connected items as per FIBA requirement.

PARTICULAR SPECIFICATIONS [Contd...]

27.4.2 **Field certification:** The contractor shall submit the following certificates.

(a) Laboratory testing certificate by FIBA that the Licensee's Product has met the requirements of the Laboratory Test Procedure and the Licensee can progress with the installation of fields for potential certification.

(b) Initial field assessment by FIBA Field Test Institute and will issue a unique Field Test Report.

(c) Final field certification: If the field satisfies all aspects of the FIBA Quality Concept, FIBA will grant the appropriate Licensee with a copy to the Department. The quoted rates by the contractor shall be inclusive of the visits of FIBA accredited agency rep on site.

27.4.3 MAINTENANCE DURING DEFECTS LIABILITY PERIOD: Contractor shall maintain entire ground during defects liability period by deploying the facility operator. The facility operator shall ensure that all the equipments are available to maintain the field in accordance with the manufacturer's instructions. Maintenance equipment on site must at least include a tractor unit, either a drag brush or drag mat, additional infill to top up the field and a ball roll ramp. The facility operator shall ensure all required maintenance equipment is available for inspection by GE.

27.4.4 **PENALTY:** If the ground is found without facility operator / without equipments, a penalty of **Rs. 1,000.00/day [Rupees one thousand]** or double the prevailing minimum wage as notified by the Central / State Authorities / Local Bodies whichever is more per day, for the period of absence, shall be recovered from the amount due to the contractor. No claim whatsoever arising on this account is admissible. The decision of GE in this regard shall be final conclusive and binding.

27.5 **HOCKEY GROUND:** The quoted rate for hockey ground flooring shall be inclusive of the following provisions.

27.5.1 Provind and laying of Synthetic Sand dressed hockey surface with shockpads for hockey ground over the well prepared surface as per manufacturer's instructions. The flooring shall be procured from FIH approved manufracturers. The work shall be carried out by the rep of FIH approved orginal manufacturer and a certificate to this effect shall be taken by contractor from manufacturer and shall be submitted to GE before completion of work. The quoted rate for Synthetic Sand dressed hockey surface flooring shall be inclusive of all connected items such as necessary sprinkler & drainage system, lines of ground and connected items as per FIH requirement.

27.5.2 **Field certification:** The contractor shall submit the following certificates.

(a) Laboratory testing certificate by FIH that the Licensee's Product has met the requirements of the Laboratory Test Procedure and the Licensee can progress with the installation of fields for potential certification.

(b) Initial field assessment by FIH Field Test Institute and will issue a unique Field Test Report.

(c) Final field certification: If the field satisfies all aspects of the FIH Quality Concept, FIH will grant the appropriate Licensee with a copy to the Department. The quoted rates by the contractor shall be inclusive of the visits of FIBA accredited agency rep on site.

27.5.3 MAINTENANCE DURING DEFECTS LIABILITY PERIOD: Contractor shall maintain entire ground during defects liability period by deploying the facility operator. The facility operator shall ensure that all the equipments are available to maintain the field in accordance with the manufacturer's instructions. Maintenance equipment on site must at least include a tractor unit, either a drag brush or drag mat, additional infill to top up the field and a ball roll ramp. The facility operator shall ensure all required maintenance equipment is available for inspection by GE.

27.5.4 **PENALTY:** If the ground is found without facility operator / without equipments, a penalty of **Rs. 1,000.00/day [Rupees one thousand]** or double the prevailing minimum wage as notified by the Central / State Authorities / Local Bodies whichever is more per day, for the period of absence, shall be recovered from the amount due to the contractor. No claim whatsoever arising on this account is admissible. The decision of GE in this regard shall be final conclusive and binding.

27.6 **ATHLETIC GROUND:** The quoted rate for athletic track flooring shall be inclusive of the following provisions.

27.5.1 Provind and laying of Sandwich Type Synthetic Athletic Turf for athletic ground over the well prepared surface as per manufacturer's instructions. The flooring shall be procured from IAAF approved manufracturers. The work shall be carried out by the rep of IAAF approved orginal manufacturer and a certificate to this effect shall be taken by contractor from manufacturer and shall be submitted to GE before completion of work. The quoted rate for Synthetic Athletic Turf flooring shall be inclusive of all connected items such as necessary sprinkler & drainage system, lines of ground and connected items as per FIH requirement.

27.5.2 **Field certification:** The contractor shall submit the following certificates.

(a) Laboratory testing certificate by IAAF that the Licensee's Product has met the requirements of the Laboratory Test Procedure and the Licensee can progress with the installation of fields for potential certification.

(b) Initial field assessment by IAAF Field Test Institute and will issue a unique Field Test Report.

(c) Final field certification: If the field satisfies all aspects of the IAAF Quality Concept, IAAF will grant the appropriate Licensee with a copy to the Department. The quoted rates by the contractor shall be inclusive of the visits of IAAF accredited agency rep on site.

27.5.3 MAINTENANCE DURING DEFECTS LIABILITY PERIOD: Contractor shall maintain entire ground during defects liability period by deploying the facility operator. The facility operator shall ensure that all the equipments are available to maintain the field in accordance with the manufacturer's instructions. Maintenance equipment on site must at least include a tractor unit, either a drag brush or drag mat, additional infill to top up the field and a ball roll ramp. The facility operator shall ensure all required maintenance equipment is available for inspection by GE.

27.5.4 **PENALTY:** If the ground is found without facility operator / without equipments, a penalty of **Rs. 1,000.00/day [Rupees one thousand]** or double the prevailing minimum wage as notified by the Central / State Authorities / Local Bodies whichever is more per day, for the period of absence, shall be recovered from the amount due to the contractor. No claim whatsoever arising on this account is admissible. The decision of GE in this regard shall be final conclusive and binding.

27.6 **COMPLETION DRAWINGS**: The quoted rate shall also include for preparation and supply of 05 sets of coloured completion drawings of all the above mentioned recreation grounds as directed by GE.

PARTICULAR SPECIFICATIONS [Contd…]

28. **INTERNAL WATER SUPPLY:**

28.1. **GENERAL:**

28.1.1. 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.

28.1.2. Layout shown in the drawing is tentative.

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

28.1.4. 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.

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

28.1.6. IS – 2065, Code of practice for water supply in buildings.

28.2. **SAMPLES AND MATERIALS:**

28.2.1. All fittings, accessories and other items to be incorporated in the work shall strictly be as per current/latest IS [even if not mentioned hereinafter] and shall invariably bear the ISI certification mark. In case ISI marked items are not available in the country, these shall be arranged to the best quality as approved by GE.

28.2.2. The test certificates for items to be incorporated shall be procured by the contractor from a standard laboratory as approved by GE. In addition, samples [as per IS provision] shall be tested in any approved laboratory by GE. However, the cost shall be borne by the contractor.

28.2.3. All manufactured articles required for incorporation in the work shall be brought to site in the manufacturer's original packing with the seal intact. Incorporation shall be done only when approved by the Engineer-in-Charge.

28.2.4. The samples of all items shall be supplied by the contractor to GE for approval within one month from the date of issue of work order. The contractor shall proceed with the work only after the samples are approved by the GE. Approved samples shall be labeled as such are signed both by GE and contractor. One set of approved samples shall be kept in custody of GE till the work is completed and the other at the site of work. The contractor and the executive will ensure that the materials used in the work are identical with the approved samples.

28.2.5. Concealed pipe work shall be embedded into chases formed/cut into walls/floors. After fixing of pipes gaps/voids in chases shall be filled with cement concrete [1:3:6] type C-1 or in cement sand mortar [1:3] as specified hereinbefore and neatly finished as per surrounding surfaces. Cost of cutting chasing in walls shall be included in Lumpsum cost of building.

28.3. **WATER SUPPLY PIPES:** GI Water tubing and fitting shall be of meadium grade and shall be ISI marked conforming to IS-1239 (Part I)-2004. Pipes and fittings shall be provided by the contractor. The workmanship and specification of GI pipes shall confirm to para 18.4 on SSR Part I 2009. 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 day work.

28.3A **UPVC WATER PIPE:** Provide UPVC 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 Manufacturers name or trade mark and Nominal outside dia of pipe at internals not more than 3 metres. 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.

28.4. **BIB TAPS AND STOP VALVES:** Bib taps and stop valves shall be of size and specification 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].

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

28.6. **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.

28.7. **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.

28.8. **WORKMANSHIP:**

28.8.1. Skilled artisans and qualified supervisors shall be employed by the contractor.

28.8.2. 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.

28.8.3. 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.,

28.8.4. 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.

28.8.5. 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.

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

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

28.8.8. 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 invariably be provided for the intake and supply pipes of overhead tanks.

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

28.8.10. 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.

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

PARTICULAR SPECIFICATIONS [Contd...]

29. **INTERNAL ELECTRIC SUPPLY:**

29.1.1. **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 – III and as specified and shown on drawings.

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

29.1.3. 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.

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

29.1.5. 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.

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

29.1.7. Point wiring circuit. The arrangement of circuit shall be as per schematic drawing.

29.2. **CLASS OF WORK:**

29.2.1. The work shall be carried out in strict compliance with the provisions contained the latest edition of the Indian Electricity Rules IEE Regulations and IS-732 [Code of practice for electrical wiring and fittings in buildings] as applicable to these works except where such regulations and rules are modified by the specifications. It shall be of high standard and approved constructions used in modern electrical work and shall be suitable in every respect for the type of voltage specified and shall be to the satisfaction of the Engineer-in-Charge.

29.2.2. All electrical works shall be executed properly by skilled licensed electricians under the supervision of suitably qualified electrical supervisor. The contractor on demand by Engineer-in -charge shall produce such evidence of qualifications of his workmen, supervisors either at the commencement or thereafter during contract period.

29.2.3. The 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.

29.2.4. 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.

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

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

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

29.2.8. 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.

PARTICULAR SPECIFICATIONS [Contd...]

29.2.9. 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.

29.2.10. 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.

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

29.3. **MATERIALS AND SAMPLES:** Approved samples shall be labeled as such and signed both by the contractor and the GE. These shall be in the custody of Engineer-in-Charge till final completion of the work. The materials shall be brought to site by the contractor in the makers wrapper and shall not be installed unless approved by the Engineer-in-Charge. The contractor shall ensure that the materials used in the work are identical with approved samples and are uniform throughout.

29.4. **SCREWS, NAILS, ETC:** All screws used in the work shall be brass nettle fold or sun brand. Cover of MS boxes be fixed with brass screws.

29.5. **TYPE OF WIRING:** Type of wiring shall be all as described in Schedule and shown on drawings and directed by Engineer-in-Charge.

29.6. **SUB MAIN WIRING:** Sub main wiring shall be as described in Schedule "A" and at locations directed by Engineer-in-Charge.

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

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

29.7.2. All 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.

29.8. **CABLES:** All cables except flexible cable to be used in the work shall conform to IS-694-1977. All cables used in the work shall have ISI marking. The cables shall be approved by the GE.

29.9. **MS BOX FABRICATED STEEL BOX:** MS box for housing, switches etc. shall be fabricated out of 1.6 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.

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

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

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

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

PARTICULAR SPECIFICATIONS [Contd...]

29.11. **CONDUIT:**

29.11.1. Conduits of rigid non-metallic PVC heavy grade shall conform to IS – 9537 and accessories conform to IS – 3419. Conduits where specified shall be concealed in walls/slabs and fixed as specified in clause 19.132 of MES Schedule Part – I. Conduits shall be approved by GE.

29.11.2. Metallic Conduits shall be ERW steel galvanised conduit conforming to IS – 3601. Conduits shall be approved by GE. Conduits where specified shall be fixed as specified in clause 19.125 to 19.131 of MES Schedule Part I. Conduits shall be approved by GE.

29.12. **PLUGS:** In ceiling/columns/stonewalls provide patent "Rawl plug" [such as "MELTREK" rawl plug or "Phil plug"]. These shall be of adequate size. Wooden plug shall be provided in other places as approved by Engineer-in-Charge.

29.13. **GENERAL:** All the fittings and accessories shall be uniform throughout suitable in every way for the supply to which they are connected. Details of materials and workmanship unless otherwise specified shall be as per MES Schedule and relevant IS specifications.

29.16 **MCCBs, MCBs AND MCB DB:**

29.16.1 MCCBs, MCBs shall be approved by GE:

29.16.2 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.

29.16.3. 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-19725A -—[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.

29.16.4. 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.

29.16.5. All the item provided in the works shall be ISI marked. If ISI mark is not available in India the same shall be procured from the best available in market with prior approval of GE. No substandard item shall be allowed.

29.17. **EARTHING:**

29.17.1. Earthing shall be strictly in conformity with MES Schedule Part – I and as per Electrical Plate No. 2 / Plate No. 3 for pipe earthing / plate earthing respectively of MES Schedule Part-I and work shall be executed in the presence of MES representative.

29.17.2. Excavation for earth pit shall be in any type of strata. Excavation shall be passed by the Engineer-in-Charge before refilling. The surplus material if any shall be removed to a distance not exceeding 50 Mtrs and the site kept clean and tidy.

29.17.3. 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".

29.18. **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.

29.19. **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.

29.20. **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.

29.21. **ELECTRICAL TESTS**

29.21.1. [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

[iv] Wiring test Sheet

[v] Inventory of electric fittings and fixtures.

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

29.22. **EXCAVATION AND EARTH WORK FOR CABLE:** The trenches for cable shall be upto a depth of 75cms for LT cable and 90cm for HT cables and width as per IS – 1255 with allowances for horizontal inter axial more than required excess spacing as specified in succeeding clauses and bottom of trenches shall be formed to level and gradients all as specified in MES Schedule. In case excavation is done more than those required, the excess shall be made good by cement concrete [1:7:12] with 20mm graded stone aggregate. All surplus spoil shall be disposed off to a distance not exceeding 50metres as directed by the Engineer-in-Charge.

30 **EXTERNAL ELECTRIFICATION**

30.1 Contractor has to submit 3 sets of following drawings: -

(i) Layout of cable
(ii) Site test record of cable
(iii) Inventory and test record of equipments'
(iv) LT Panel drawings
(v) Hydraulic pressure test of drawing
(vi) Record drawing of water supply pipe line
(vii) Inventory of equipment's"

30.1.1 The work under this schedule comprises of Supply, installation, testing and commissioning of VCB, SF6 Panels, LT/HT Panels, DG Sets, Transformers, APFC Panels and other connected works.

30.1.2 The entire equipment shall be from standard manufacturers with high class workmanship and finishes as mentioned hereinafter.

30.1.3 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.

30.1.4 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.

30.2 **APPLICABILITY OF RULES, REGULATIONS AND CODE OF PRACTICE**

30.2.1 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.

30.2.2 Generally power is supplied to MES by Andhra Pradesh State Electricity Board and therefore all plants, equipment and electrical work shall comply with relevant rules of that authority also. It will be the responsibility of the contractor to ascertain from Andhra Pradesh State Electricity Board rules and regulations applicable for these 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.

30.3 **CIVIL ENGINEERING WORKS:** Cost of all civil Engineering works required for installation of various electrical equipments shall be included by the tenderer in the Lumpsum quoted.

30.4 **PAINTING AND PROTECTION**

30.4.1 Each item of equipment shall be painted or protected as detailed hereinafter. Entire surface of structural steel work shall be thoroughly scrapped to remove rust, dust etc and wire brushed. One coat of zinc chrome primer shall be applied before erection. After erection at site the structural steel work shall be painted with a under coat followed by finishing coat. Damage to paint in respect of factory painted equipment shall be made good by applying same tint and type of paint at no extra cost. The cost of painting shall deemed to be included in the unit rate of respective items of Schedule 'A'.

30.4.2 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, 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.**

30.4.3 If owning 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.

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

30.4.5 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.

30.5 **OPERATION OF EQUIPMENT OF CONTRACTOR:** The contractor shall be responsible for all operations necessary for the adjustment, testing and final trials of the equipments and system until it has been taken over by the department. During the complete period of erection and testing, the contractor shall be fully responsible for the preservation, care and maintenance of the equipment and he shall provide all materials and stores etc. necessary for these operations until the work is taken over.

30.5.1 **EXCAVATION AND EARTH WORK FOR CABLE:** The trenches for cable shall be upto a depth of 75cms for LT cable and 90cm for HT cables and width as per IS – 1255 with allowances for horizontal inter axial more than required excess spacing as specified in succeeding clauses and bottom of trenches shall be formed to level and gradients all as specified in MES Schedule. In case excavation is done more than those required, the excess shall be made good by cement concrete [1:7:12] with 20mm graded stone aggregate. All surplus spoil shall be disposed off to a distance not exceeding 50metres as directed by the Engineer-in-Charge.

30.5.2 **HT/LT CABLES:** HT/LT underground cables shall conform to relevant IS Specifications suitable for 33000/11000/1100 volt grade electric supply with aluminium conductors. The cable shall be laid and jointed as specified in clauses 19.74 to 19.91 & 19.93 to 19.96 of MES Schedule Part – I [Specifications]. While laying underground cables under paths, roads etc, exact depth at which the cable is to be laid shall be as 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.

30.5.3 **TESTING OF CABLES:** Testing of cables shall be carried out as detailed in clauses No 19.93 and 19.94 of MES Schedule Part – I [Specifications]. The cable record shall be maintained all as per clause 19.95 of MES Schedule Part – I [Specifications].

30.5.4 **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".

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

30.5.6 **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 6mm thick supported by 25x6 mm flat iron piece.

30.5.7 **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.

PARTICULAR SPECIFICATIONS [Contd…]

30.5.8 **GI PIPE:** GI tubing shall be all as specified in Schedule "A" and confirmed to IS-1239 and shall be ISI marked and all as specified in clause 125A.4 of MES schedule part I. The fittings provided by the contractor shall bear ISI mark. GI pipes shall be any one of the makes mentioned hereinafter.

30.6 **POLES**

30.6.1 **STEEL TUBULAR POLES:-** Refer clauses 19.5 of MES Sch, Part-I.

30.6.2 **WORKMANSHIP: -** Refer clauses 19.50, 19.51, 19.51.1. 19.51.2, 19.51.4, 19.52 of MES Schedule Part-I. The numbering of the poles shall be carried out as per the direction of the Engineer-in-Charge and unit rate quoted against the relevant item shall be deemed to include for the same. Planting depth of poles unless otherwise shown on drawing shall be equal to 1/6 of the total length of each pole.

30.6.3 Painting of Poles, Cross Arms etc. External surfaces of poles shall be painted with two coats of tar or bitumen composition in the portion buried in ground and upto concrete collar where collars are to be provided before erection. Steel tubular poles shall in addition be coated with bitumen composition on the inner surface throughout. After erection the external surface of metal poles above ground or collar level and all pole fittings shall be painted with two coafs of aluminum paint and unit rate quoted against the relevant item shall be deemed to include for the same.

30.7 **CABLE ROUTE INDICATOR:** These shall be fixed along the route of cable at 30meter interval & on every turning & cable joint.

30.8 **STREET LIGHT FITTINGS:** Refer clause 19.42 of MES Schedule Part-I. This shall be of cast housing and shall comply to IS: 2149 of 1970 for street light all as detailed in Schedule 'A' and shown on drawings.

30.9 **DANGER NOTICE BOARD:** Refer clause 19.18 of MES Schedule Part-I and all as specified in the relevant item. The plate for danger notice board shall be mild steel 1.6mm thick in case not specified in the relevant item schedule 'A'.

30.10 **CABLE TERMINATION & JOINT BOXES:** Refer clause 19.22 of MES SSR-1991, Part I.

30.11 **TRANSFORMER:** Supply, install, testing and commissioning of various capacities of transformers as specified in relevant items of BOQ.

30.11.1 **GENERAL:** The two winding Power transformer shall be Natural Ester oil immersed transformers shall be conforming to **IS 1180** and IEC 62770 standard for Natural Ester Oil filled transformer. This specification covers design, engineering, manufacture; shop testing, inspection, painting, packing, and supply of Distribution Transformers complete with all accessories for efficient and trouble-free operation of the proposed Substation. The design, manufacture and performance of equipment shall comply with all currently applicable statues, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the VENDOR of this responsibility. The Quality of Raw material, Manufacturing process & design parameters should meet the requirement so as to ensure quality of transformers

30.11.2 The equipment shall conform to the latest edition of applicable standards as follows. In case of conflict between applicable standards and this specification, this specification shall govern.

(a) IS 1180, for Tests & tolerance on Guaranteed Particulars

(b) IS: 3639 for Fittings and Accessories

(c) IS:2099 for Bushings > 1000 V

(d) IS:7421 for Bushings < 1000 V

(e) IS:1271 for Electrical Insulation classified by Thermal stability

PARTICULAR SPECIFICATIONS [Contd…]

30.11.3 **GENERAL CONSTRUCTION :** All material used shall be of best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions, overloads, over excitation, short-circuits as per specified standards, without distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform

30.11.4 **TANK:** The exterior of tank and other steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied. The second coat shall be of an oil and weather-resistant nature, preferably of distinct colour from the prime and finish coats. The final coat shall be of a flossy, oil and weather resisting non-fading paint of specified shade. The interior of the tank shall be cleaned by shot blasting and painting with two coats of heat resistant and oil insoluble paint. Steel bolts and nuts exposed to the atmosphere shall be galvanized. Unless otherwise stated, the tank together with radiators, conservator, bushings and other fittings shall be designed to withstand without permanent distortion the following conditions: Full vacuum of 760 mm of Hg, for filling with oil by vacuum. Internal gas pressure of 0.35 Kg/cm2 (5 lbs/sq.in) with oil at operating level. The tank cover shall be suitably sloped so that it does not retain rain water. The material used for gaskets shall be cork neoprene or approved equivalent.

30.11.5 CORE: Transformer shall be double wound, core type with low loss, non ageing, high permeability PRIME GRADE, CRGO with M4 Grade or Better, perfectly insulated and clamped to minimize noise and vibrations

30.11.5.1 Transformer shall be of BOLTLESS core design. Core shall be purchased Directly from Manufacturer or from their accredited Marketing organization of Repute & not through any agent. Bidder has to submit manufacturer's name during bidding having sufficient credential & Core has to be purchased from the approved manufacturer. Stage inspection of the core shall be done at manufacturer's premises & inspection call shall be given with following Documents like Invoice of the supplier, Mill's test certificate Packing list, Bill of landing & Bill of Entry certificate by customs.

30.11.5.2 Transformer manufacturer should have in-house core cutting facilities for proper control & monitoring of quality & to avoid mixing of Prime core with Second grade /defective core materials. Transformer Manufacturer should have inhouse slitting Machine so as core is cut to width & stacked with minimum air gap thus ensuring Burr level less than 10Microns. Core shall be procured from one of these reputed Manufacturers – Posco / Nippon/ Novex/ Ak Steels or else the transformer manufracturer shall produce invoice and test certificate from Posco / Nippon/ Novex/ Ak Steels. The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 2000V for one minute.

30.11.6 Following stage inspections will be carried out by purchaser or by third party engineers appointed by purchaser

a) Verification & inspection of the mother coil at port & putting Stamp & seal.

b) Reconciliation of mother coil by checking stamp & Seal at factory before slitting. CRGO Sample to be test at ERDA/CPRI by purchaser with Manufactures Report

c) Bidder should have in house core cutting facility for proper monitoring & control on quality and also to avoid any possibility of mixing of prime material with defective/second grade material In case it is done outside cutting should be done in presence of purchaser.

d) Inspection call notice for the purpose should be accompanied with the following documents. As applicable as a proof toward use of Prime core materials: -

i) Invoice of supplier.

ii) Mills test certificates.

iii) Packing list.

iv) Bill of lading.

v) Bill of entry certificates by customs.

vi) Core material shall be directly procured either from the manufacturer or through their accredited marketing organization of repute and not through any agent.

e) Core should be boltless step lap design

f) Bidder should have hydraulic core lifting facility to avoid any jerk at the time of core building.

g) Pre-core loss measurement test should be conducted on 1 no. unit each lot

30.11.7 WINDING

30.11.7.1 The Winding shall be made with 99.9% pure electrolytic grade copper, insulated with thermally upgraded paper (Insulation Class A / Conductor Turn Insulation-Class E). The HV & LV winding should be able withstand thermal and mechanical stress in the event of short circuit. The Winding shall be carried in dust free area. The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.

(a) The Purchaser shall witness built up winding for its quality, weight of copper, insulation and over all weight of coil assembly. The size of conductor used for different windings shall be also be checked during stage inspection to check the current density viz-a-viz guaranteed values.

(b) Calculation of weight of copper by following two methods and comparison with respect to the value furnished during Bid stage.

(c) Weight measurement of per unit length of copper sample taken from windings. Verification of no. Of turns and inner/ outer diameter of windings. Calculation of bare copper weight by using these parameters.

(d) Cross section area of conductor is already measured. Verification of no. of turns and inner/ outer diameter of windings. Calculation of bare copper weight by using these parameters.

(e) Verification of continuously transposed conductor (CTC) in LV/HV winding, if indicated during offer stage.

30.11.8 TEMPERATURE RISE

30.11.8.1 With the given climatic conditions, the transformers shall be capable of operating continuously on any tap at their normal rating without exceeding following temperature rises:

(a) 40 to 45° C (kraft paper).

(b) 50 to 55° C (thermally updraded paper).

30.11.8.2 The temperature of a hot spot in winding shall not exceed 120°C when calculated over max. annual weighted average temperature of 50° C.

30.11.9 **TEMPERATURE INDICATOR:** One set of winding temperature indicators with necessary current transformer, heating coil and a detector element and one set of oil temperature indicator with maximum reading pointer shall be mounted locally so as to be readable at a standing height from ground level. Each of the above indicators shall be provided with necessary contacts for alarm and trip.

30.11.10 **CONSERVATOR TANK:** Oil preservation shall be done by means of conservator tank arranged above at the highest point of the oil circulating system. Connections into the main tank shall be at the highest point to prevent trapping of air or gas under the main tank cover.

30.11.11 **TRANSFORMER OIL:** Transformer oil shall be as per IEC 62770 - Natural Ester vegetable oil. Oil should be Environment friendly, Green & Biodegradable. It should also exhibit safety against fire hazards. Loose oil drum should be epoxy painted from inside to avoid any contamination in oil. In Transformer Oil filling should be done under vaccum at 0.5 millibar.

30.11.12 **BUCHHOLZ RELAYS**. The relay shall have facility for testing by injection of air by hand pump and with cock for draining and venting of air. The location of the relay shall be such that all rising gas will readily reach it

30.11.13 **BUSHING:** All bushings shall be homogenous, solid porcelain oil communicating type, uniformly glazed and free from blisters, burns and other defects and shall be furnished complete with suitable terminal connectors of adequate capacity. The bushings shall be located so as to provide necessary electrical clearances between phases and also between phase and ground as specified in relevant standards. Bushings rated for 400A and above shall have non-ferrous flanges and hardware. All bushings shall have puncture strength greater than the dry flashover value.

30.11.14 **TERMINAL ARRANGEMENT:** Low voltage terminals of Power transformer shall be brought out to bushing inside Cable Box. High voltage terminals of Power transformer shall be Cable Box. The cable box shall be suitable for cable termination kits and shall be self-supporting, weather proof, air filled type, complete with all hardware such as gland plate, brass glands, tinned copper lugs, armour clamps etc.

30.11.15 **TAP CHANGER:** Off circuit tap changing gear shall be provided on the HV winding for a variation of voltage. They can be suitably designed to vary in steps of 2 ½ % to get constant LV voltage of 410 and 380 volts. T-50 changing will be done with external handles which will be avoided with tap position indicator and arrangement for locking the handle in each tap position.

30.11.16 **MARSHALLING BOX:**

30.11.16.1 Sheet steel weather proof marshaling box of IP 55 construction, shall be mounted on the tank of transformer and shall accommodate all auxiliary devices except those which must be located directly on the transformer. All terminal blocks for external cable connections shall be located in this box. The terminal blocks shall be ELMEX 10 sqmm or approved equal. The marshalling box shall have the following as a minimum

(a) Load disconnect switch for incoming power supply for auxiliaries.
(b) All outgoing connections from transformer viz. buchholz relay, temperature indicators, fault contacts for annunciation system etc.
(c) Wiring and termination points individually of the following trip contacts for remote alarm and trip.

(i) Winding temperature high / very high
(ii) Oil temperature high / very high
(iii) Buchholz relay Alarm / Trip
(iv) Oil level low

30.11.16.2 Cubicle illumination lamp with door switch and space heater with thermostat and ON/OFF switch shall be provided. Marshalling box shall be designed to facilitate external cable entry from bottom. Removable gland plates shall be furnished with double compression type brass cable glands. Sufficient space shall be provided to avoid sharp bending and for easy connection of cables. A minimum space of 200 mm from the gland plate to the nearest terminal block shall be provided. Wiring shall be done with HR PVC 650 V grade wires. The wire size for CT circuits shall be 4 mm2 copper and for other circuits shall be a minimum of 2.5 mm2 copper. Not more than two (2) wires shall be connected to a terminal. 10% spare terminals shall be provided. All devices and terminal blocks within the marshalling box shall be identified by symbols corresponding to those used in applicable schematic or wiring diagrams.

30.11.17 **VALVES**: Valves shall be of forged carbon steel above 50 mm and of gun metal for sizes upto 50mm. They shall be of full way type with screwed ends. They shall be opened by turning counter clock-wise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position. Every valve shall be provided with open/close position indicators. The valves shall be suitable for pad locking in open/close positions. All screwed valves shall be furnished with pipe plugs for protection. All valves shall be provided with flanges having machined faces drilled to suit the applicable requirements. Oil tight blank flanges shall be provided for the following.

(a) valves opening to atmosphere.
(b) for each connection for use when any radiator is detached.

30.11.17.1 Any special radiator valves tools required shall be supplied by the contractor. The Transformer shall be provided with Nitrogen Fire Protection system so as to envisage complete safety from Fire Hazards of quality of oil exceeds 2000 litres as per CEA guidelines.

30.11.18 **GROUNDING:** Two grounding pads, located on the opposite sides of the tank, shall be provided for connection of Switchyard ground mat for each transformer. Grounding pads shall have clean buffed surface with tapped holes. M10 G.I. bolts, nuts and spring washer shall be provided. 2 Nos. Ground terminals each shall also be provided on marshalling box, cable box & OLTC panel to ensure effective earthing. The Neutrals of the windings shall be brought out through neutral bushings at suitable location. The neutrals shall be suitable for connecting 75x10 mm Copper flat. For conductivity of earth connection, all gasket joints shall be provided with minimum two nos. of copper strip of adequate size.

30.11.19 **Testing:**

30.11.19.1 ROUTINE TESTS – The manufacturer should have NABL accredited test lab to conduct below tests.

(a) Measurement of winding resistance
(b) Measurement of voltage ratio and check of voltage vector relationship
(c) Measurement of impedance of voltage (principal tapping), short circuit impedance and load loss.
(d) Measurement of no load loss and current
(e) Separate source voltage withstand test
(f) Induced overvoltage withstand test (2 times the rated voltage)
(g) 2kV withstand test for all wiring

30.11.19.2 TYPE TESTS

(a) Lightning impulse test - Test certificate of similar design shall be furnished

(b) Temperature rise test - To be done on the transformer at third party or NABL accredited lab

(c) Zero phase sequence impedance test - Test certificate of similar design shall be furnished

(d) Respective Current density & Flux Density shall be so as to suit the required No load & loss levels

(e) All the measurement of losses shall be carried out by digital meters of class 0.5or better accuracy and should be certified by the manufacturer. If the losses measured are found to be out of tolerance band as stated in Standard and guaranteed losses declared by manufacturer , the same shall be attributed to the manufacturer as per capitalization formula till the end of warranty period . In extreme conditions the customer has got holds absolute rights to reject the lot and terminate the contract of vendor. One transformer of each rating, selected randomly from the lot shall to sent For measurement of losses, declared by vendor (on data sheet) at third party / any NABL accredited lab.. In case loss figures deviates more than tolerances specified in IS 2026, purchaser reserves rights of terminating the contract of vendor.

(f) Also Manufacturer should have Short circuit test report for similar or Higher rating transformer (Any rating). If SC test report is not available, then bidder has to conduct the same without any extra cost to the purchaser.

30.11.19.3 ACEEPTANCE TEST

(a) In case loss figures deviates more than tolerances specified in IS, purchaser reserves rights of terminating the contract of vendor
(b) Oil Leakage test for acceptance shall be conducted at pressure of 0.35kg/sq.cm for one hour.
(c) Checking of weights, Dimensions, fitting and accessories, tank sheet thickness, oil quantity, material, finish and workmanship, Physical verification of core coil assembly and or calculations of flux density on one unit of each rating of the offered lot with reference to the GTP and contract drawings.

PARTICULAR SPECIFICATIONS [Contd…]

30.11.19.4 REJECTION: Department may reject any transformer if during tests or service any of the following conditions arise:

(a) No load loss exceeds the guaranteed value greater than tolerance limit mentioned in IS2026
(b) Load loss exceeds the guaranteed value greater than tolerance limit mentioned in IS2026
(c) Impedance value differs the guaranteed value by + 10% or more
(d) Winding temperature rise exceeds the specified value by 5°C
(e) Transformer fails on impulse test
(f) Transformer fails on power frequency voltage withstand test
(g) Transformer is proved to have been manufactured not in accordance with the agreed specification.
(h) The PURCHASER reserves the right to retain the rejected transformer and take it into service until the SELLER replaces, at no extra cost to PURCHASE, the defective transformer by a new acceptable transformer.

30.11.19.5 INSPECTION & TESTING: -

(a) The transformer shall be tested / inspected by the Rep of Accepting Officer in OEMs manufractures unit. Purchaser may appoint recognized testing authority like CPRI/ERDA with their instruments & engineer's team and measure no load loss, load loss and percentage impedance of the transformer at supplier's works. The contractor shall give intimation in advance to GE. The contractor shall give them full co-operation during their stay & testing at shop floor. The losses & impedance values so obtained will be considered as final.

(b) The bidder shall agree to the results. At his discretion, purchaser may also decide to take any transformer to third party labs like CPRI or ERDA for measurement of no load loss, load loss and percentage impedance of the transformer. The losses & impedance values so obtained will be considered as final. The bidder shall agree to the results.

(c) Pre-core loss measurement test should be conducted on 1 no. unit each lot.

(d) Tan delta measurement value should be less than 0.5.

(e) Detail Loss calculation shall be submit during Tendering and Execution of the project Minimum stray loss should be 15% of I2R loss at 75Degree

(f) Bidder should have in-house NABL accredited testing facility.

30.11.19.6 STAGE INSPECTION; Stage inspection of built up core (in horizontal/vertical position), windings, tank and radiators shall be carried-out as detailed below :-

a) Core :
   i) Measurement of flux Density.
   ii) Tests of CRGO sample taken from the core shall be carried-out for Carlite test (Resistance Measurement), Watt Loss Test, Lamination Thickness & Aging Tests.
   iii) Physical inspection for quality of workmanship.
   iv) Slitting/Cutting of core at manufactures works or in customer representative presence
b) Windings:
   i) Measurement of Cross-sectional area for current density.
   ii) The measurement of weight of bare copper/cover copper by Resistance Method, ID/OD method, Per unit length methods.
   iii) Tests maybe carried out on sample of copper for assessing its quality.
c) Tank:
   i) Vacuum Test.
   ii) Pressure Test.
   iii) DP Test
   iv) Peel-off Test.
   v) Test on welded joints such as X-Ray testing shall be carried out on minimum one unit.

   Note: For permissible deflection as per CBIP ultrasonic for pressure and vacuum test, Horizontal width shall be taken between nearest stiffeners.

d) Radiators: Radiator shall be routine/type tests at sub-supplier works as per relevant standards.
e) Core-coil assembly – Weighing of core-coil assembly will be done as stage inspection & weight should not be less than approved drawings
f) Drying process: Drying process of Active part of transformer (Core-coil assembly) should be done under vacuum heating.
g) Shipping & Logistics: If shipping weight of the transformer goes beyond 32 Ton, Hydraulic trailor must be used as per government rules.
h) Bar coding or QR coding: Bar coding should be done for main unit & all loose accessories for easily tracking .and to avoid any miss-handling/ transportation theft.

30.11.20 Recommended painting: Painting shall be as per manufractures instructions with paint Scheme of PS 4 – Epoxy –PU coated on surface of oil contact and external surfaces as per manufracturers instructions.

30.11.21 Apart from above said specification each transformer will have following accessories. Cost of these accessories are deemed to be included in the cost quoted by the contractor.

[a] Cable box of HT side for XLPE Cables.
[b] Cable box on LT side to be accommodate bus duct/Cable Box 410 volts.
[c] Conservator with drainpipe.
[d] Silica gel dehydrating breather.
[e] Bottom channel
[f] Thermometer pocket.
[g] Oil drain valve at bottom. [h] Oil level gauge.
[j] Air release plug.
[k] Oil filter pipe with flange and dummy cover, precaution, conservator for filling the oil. [l] Lifting lugs – 2 Nos.
[m] Earthing terminals – 2 Nos.
[n] Rating and terminal marking plate. [o] Polar unit directional – 4 Nos.
[p] PRD (Pressure relief Device)
[q] Top filter valve
[r] Top oil temperature indicator
[s] Double float buchholz relay with alarm and grip contact. [t] Magnetic oil level gauge with low oil level alarm.
[u] Winding temperature indicator with current transformer and heater coil.
[v] Transformer will be supplied complete with all first filling of oil conforming to IEC 62770. Subsequent filtering of oil shall be carried out as required till issue of completion certificate by GE without extra cost to Government.

30.11.22 LOSS CAPITALISATION: The design of transformer shall be such that annual cost of losses is minimum. For the purpose of comparing the losses will be capitalized by adding to the total cost of other item. A sum shall be worked out at the following rates.

(a) Copper losses - Rs. 90, 000/ KW
(b) Iron losses - Rs. 2, 20, 000/ KW

30.11.22.1 While suppliers in transformer to the department tenderer should note that copper losses and Iron losses and not exceeded the limit stated in schedule 'A' or of more than 1% [one percent]. A compensation shall be deducted from unit price in accordance with the cost as given above.

30.12 VACUUM CIRCUIT BREAKER AND IN CUBICLE

30.12.1 NOMENCLATURE:

30.12.1.1 VCB shall be as specified in BOQ along with Buscoupler Panel and complete accessories.

30.12.1.2 The VCB panel shall be tested / inspected by the Rep of Accepting Officer in OEMs manufractures unit. The contractor shall give intimation in advance to GE. The contractor shall give them full co-operation to the rep of Accepting Officer for required inspection / testing of VCB.

PARTICULAR SPECIFICATIONS [Contd…]

31.0 **TYPE TESTED LOW VOLTAGE POWER CONTROL CENTRE:**

31.1 This section covers the detailed requirements of medium voltage switchboard for 415 volts, 3 phase, 50 Hz, 4 wire system.

31.2 **STANDARDS AND CODES:** Updated and current Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract.

Low Voltage Switchgear Assemblies	IEC 61439-1/2
Low Voltage Switchgear & control gear	IEC 60947 – 1/2/4
Low Voltage Power Factor Control Panels	IEC 61921
Degree of Protection of Enclosures	IEC 60529 IS 2147: 1962
Internal Arc – IEC 61641	

31.3 **SWITCHBOARDS**

31.3.1 **General:** The LV switchboards shall be as per the standards IEC 61439-1 and 2. The switchboards and the associated equipment including switchgear, control gear, Busbar supports, Busbar orientation, Busbar links etc shall be similar in construction to the assembly which has undergone the type test. The drawings of the type-tested assemblies shall be made available for inspection.

31.3.2 The designs of the switchboards should be with switchgear manufacturer, and all the mechanical drawings must be available in the factory beforehand.

31.3.3 Switchboards shall have a short circuit level withstand as per Schedule of Quantities and drawings.

31.3.4 The enclosures shall be designed to take care of normal stress as well as abnormal electro-mechanical stress due to short circuit conditions. All covers and doors provided shall offer adequate safety to operating persons and provide ingress protection of IP 42 unless otherwise stated. Ventilating openings and vent outlets, if provided, shall be arranged such that same ingress protection of IP 42 is retained. Suitable pressure relief devices shall be provided to minimize danger to operator during internal fault conditions.

31.3.5 The switchboard along with ACBs and connections should have been type tested design at **CPRI** /Independent international test house for short circuit, temperature rise, protective earth short circuit test and dielectric tests of the ratings required.

31.3.6 For operator safety IP2 X (touch proof) protection to be available even after opening the feeder compartment door. The compartmentalization to be achieved by using metal separators or screens, use of PVC / Hylam / FRP / GRP sheets shall not be allowed.

31.3.7 As specified in the BOM the switchboard shall be Form 4b as per IEC

31.4 Switchboard Configuration

31.4.1 The Switchboard shall be configured with Air Circuit Breakers, MCCB's, MCB's and other equipment as called for in the schedule of quantities.

31.4.2 The MCCBs shall be arranged in multi-tier formation whereas the Air Circuit Breakers shall be arranged in Single or Double tier formation only to facilitate operation and maintenance.

31.4.3 The Switchboards shall be of adequate size with a provision of spare space to accommodate possible future additional switch gear.

31.4.4 If supplied by assembler, only OEM name shall be mentioned on top of each of the columns of switchboard.

31.5 Constructional Features

31.5.1 The Switchboards shall be metal clad totally enclosed, floor mounted free standing type of modular extensible design suitable for indoor mounting.

31.5.2 Switchboards construction shall employ the principle of compartmentalized and segregation for each circuit.

31.5.3 Incomer and bus section panels or sections shall be separate and independent and shall not be wired with sections required for feeder. The incomer panel shall be suitable for receiving bus trunking or LV cable of size specified. Switchboards shall be made up of requisite vertical sections, which when coupled together, shall form continuous dead front switchboards.

31.5.3.1 Switchboard shall be readily extensible on both sides by addition of vertical sections after removal of the end covers.

31.5.3.2 The switchboards shall be designed for providing the stated performance at an ambient temperature of 40C and humidity (RH=85%) typical of tropical conditions as specified. Ease of inspections, cleaning and repairs while maintaining continuity of operation shall be provided.

31.5.3.3 Metal based Poly urethane foam gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust and vermin proof to provide a degree of protection of IP 54 as stipulated in schedule of quantities. The unused openings within the switchboards shall be closed using suitable grommets. Degree of Protection shall be (IP42 Upto 1600A) and IP54 above 1600A

31.5.3.4 Special care to be taken to ensure effective earthing of the frame and doors of the switchboards

31.5.3.5 Each vertical section shall be provided with a rear or side cable chamber housing the cable end connections and power/control cable terminations. There should be generous availability of space for ease of installation and maintenance with adequate safety for working in one section without coming into contract with any live parts. The design of the switchboard shall allow standard extension chambers if required to accommodate cables.

31.5.3.6 Some switchboards may be required to be installed against the wall, for such application-documented designs shall be available.

31.5.3.7 Switchboard panels and cubicles shall be fabricated with CRCA Sheet Steel of thickness not less than 2.0 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be fabricated from CRCA sheet steel of thickness not less than 2 mm. Joints of any kind in sheet metal shall be seam welded and all welding slag ground off and welding pits wiped smooth with plumber metal. All main load bearing members preferable 9 fold structures shall be GI with 275 GSM.

31.5.3.8 All panels and covers shall be properly fitted and square with the frame. The holes in the panel shall be correctly positioned.

31.5.3.9 Switchboard shall be provided with "Danger" notice plate in Telugu, English conforming to relevant Indian Standards.

31.5.3.10 Main PCC shall be certified for Internal arc withstand of 65kA for 0.4sec as per IEC 61641. The panel shall be tested and certified for internal arc withstand in all three chambers: Horizontal Bus Bar Chamber, Vertical Bus Bar Chamber / Cable Alley, Functional Unit Chamber.

31.5.4 Switchboard Dimensional Limitations

31.5.4.1 The overall height of the switchboard shall be limited to 2400 mm for all the Bus bar ratings and type of switchboards. Panel should have integral base frame of 75mm, hence total panel height should not be more than 2475mm.

31.5.4.2 The height of operating handle push buttons etc shall be restricted between 300 mm and 2000 mm from finished floor level.

31.5.4.3 Other dimensional limits if any are specified separately.

31.5.5 Switchboard Compartmentalization

31.5.5.1 For compartmentalized switchboards, separate totally enclosed compartments shall be provided for horizontal busbars, vertical busbars, ACBs, MCCBs, and cable alloys.

31.5.5.2 The main board shall be with Form 4b Construction with metallic shrouding only, FRP is not acceptable.

31.5.2.3 Earthed metal or insulated shutters shall be provided between draw out and fixed portion of the switchgear such that no lives parts are accessible with equipment drawn out. Degree of protection within compartments shall **be at least IP 2X.**

31.5.2.4 Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker in "ON" and "OFF" position.

31.5.2.5 For all Circuit Breakers separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contactors and control MCB etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.

31.5.2.6 For Some MCCB feeders for critical loads like UPS, it may be required to have operation only after opening the door, all other facilities like pad lockable rotary handle to be provided for such feeder. It shall be possible to do this change during execution of order

31.5.2.7 Each switchgear cubicles shall be fitted with label in front and back identifying the circuit, switchgear type, rating and duty. All operating device shall be in front of switchgear only.

31.5.2.8 A horizontal wire way with screwed cover shall be provided at the top to take interconnecting control wiring between vertical sections.

31.5.2.9 Separate cable compartments running the height of the switchboard in the case of front access boards shall be provided for incoming and outgoing cables.

31.5.2.10 Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top. The construction shall include necessary and adequate and proper support shall be provided in cable compartments to support and clamping the cable in the cable alley / cable chamber.

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31.6 Switchboard Bus Bars

31.6.1 Busbars shall be made of high conductivity, and high strength Aluminum E91 grade Busbars shall be of rectangular cross sections, not more than 6mm thickness better suitable for full load current for phase bus bars and half/ full rated current for neutral bus bar or as stipulated in schedule of quantities. Busbar shall be suitable to withstand the stresses of fault level as specified in schedule of quantities**.**

31.6.2 Main Horizontal bus bar and Neutral bus bar must be enclosed in the same bus compartment.

31.6.3 The bus bar system may comprise of a system of main horizontal bus bars and auxiliary vertical bus bars run in bus bar alloy on either side in which the circuit could be arranged with front access for cable entrances

31.6.4 The bus bars shall be supported on non-breakable, non-hygroscopic epoxy resin or glass fiber reinforced polymer insulated supports able to withstand operating temperature of 110^{O} C at regular intervals, to withstand the forces arising from a fault level as stipulated in schedule of quantities. The material and the spacing of the Busbar supports should be same as per the type tested assembly

31.6.5 Auxiliary buses for control power supply, space heater power supply or any other specified service shall be provided. These buses shall be insulated, adequately supported and sized to suit specific requirement. The material for auxiliary supply bus will be insulated electrolytic copper. Wires.

31.6.6 Clearances between phases should be in line with IEC.

31.7 Switchboard Interconnection

31.7.1 All connection and tap offs shall be through adequately sized connectors appropriate for fault level at location. This shall include tap off to feeders and instrument/control transformers.

31.7.2 For unit ratings up to 250 amps, PVC insulated 105 dg withstand, copper conductor wires of adequate size to carry full load current shall be used. The terminations of such interconnections shall be crimped. Solid connections shall be used for all rating of above 250 amps.

31.7.3 All connections, tapping, clamping, shall be made in an approved manner to ensure minimum contact resistance. All connections shall be firmly bolted and clamp with even tension. Before assembly joint surfaces shall be filed or finished to remove burrs, dents and oxides and silvered to maintain good continuity at all joints. All screws, bolts, washers shall be zinc plated. Only 8.8 grade nuts and bolts shall be used for bus bar connections.

31.8 **Draw out Features of Circuit Breakers:** Air Circuit Breakers shall be provided in fully draw out, unless otherwise stated. These cubicles shall be such that draw out is possible without disconnection of the wires and cables. The power and control circuits shall have self-aligning and self-isolating contacts. Mechanical latches shall be integrated in ACB at service, test and isolated position to ensure that Breaker is firmly latched in respective position. It shall not be possible to move the breaker from the position unless latch is manually operated.

31.8 Instrument Accommodation

31.9.1 All voltmeter and ammeter and other instruments shall be flushed mounted type of size 96 sq.mm conforming to class 1.5 to IS 1248 for accuracy. Meters shall be protected with MCBs.

31.9.2 Instruments and indicating lamps shall not be mounted on the Circuit Breaker Compartment door for which a separate and adequate compartment shall be provided and the instrumentation shall be accessible for testing and maintenance without danger of accidental contact with live parts of the Switchboard.

31.9.3 For MCCBs, instruments and indicating lamps can be provided on the compartment doors.

31.9.4 The current transformers for metering and for protection shall be mounted on the solid copper / aluminium bus bars with proper supports.

31.9.5 On all the incomers of switch boards ON/OFF indicators lamps shall be provided suitable for operation on AC 230 volts supply. All lamps shall be protected by MCBs.

31.10 Metering (Specifications for Main PCC and DG Sync. Panel)

31.10.1 Incomers and outgoing feeder shall be provided with comprehensive power meters capable of four quadrant operation an equipped with graphical display for A , V, Pf , Hz ,KW , KVA, KVAr, KWh, KVarh, demand values , THD on current and Voltages

31.10.2 Meters shall be capable of reading magnitudes of individual harmonics (odd) up to the 31st order. Measurements that reflect the power quality such as Total harmonic distortion and Total demand distortion shall be available. There shall also be provision for waveform capture for the purpose of analysis of event.

31.10.3 There shall be provision within the meter for set point driven alarms and at least 2 digital alarms with 1s time stamping. It should be possible for alarms to be programmed and combined to trigger digital outputs and mechanical relays. Further, there shall be a historical data log of alarms with date and time stampings.

31.10.4 There shall be provision of at least one Ethernet port on the meters provided on Incomers of Sync Panel, Main PCC and LT Kiosks for communication on Modbus TCP

31.10.5 The meter shall be preferable of standard front dimensions of 96 mm x 96 mm with graphical anti-glare display and backlighting for superior viewing even in extreme lighting conditions and viewing angles. For Incomers, it shall be possible to detach the display and secure it to a convenient location on the panel for ergonomic viewership.

31.10.6 The performance of meters with Ethernet port shall comply with IEC 61557-12. Accuracy shall be as follows:

Active Energy (as per IEC62053-22): Class 0.5S

Reactive Energy (as per IEC62053-24): Class 2

31.10.7 The multi-function meter installed to monitor the mains incomer(s) of the installation shall comply to Power Quality measurement standard IEC 61000-4-30. Further, for the incomers the meters shall have disturbance direction detection to clearly identify the source of any power quality disturbance as emanating from within the facility or from external sources on the grid.

31.11 Wiring: All wiring for relays and meters shall be with PVC insulated copper conductor wires. The wiring shall be coded and labeled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 2.5 sq. mm. Runs of wires shall be neatly bunched and suitably supported and clamped. Means shall be provided for easy identification of wires. Identification ferrules shall use at both end of wires. All control wires meant for external connections are to be brought out on a terminal board**.** The cables and control wires shall be suitable for withstanding 105 deg C.

31.12 Communication: Communication architecture shall be published as part of tested validated and documented architecture (TVDA) solution from the manufacturer. Part numbers and configuration for power up and operation of the modules comprising the architecture shall be clearly detailed in the design documentation of the OEM. Assembler shall produce declaration of conformity to TVDA counter signed by the OEM. A single Ethernet port shall be provided for every panel for integration to installation LAN. Refer to typical schematic in Appendix A. Low Voltage 24V DC power source may be needed for providing power to the gateways / switches and other smart components. The same shall be provided from a ripple free SMPS source as approved by the OEM. Alternatively, a DC bus internal to the panels may supplied from external redundant UPS.

31. 13 Space Heaters: Anti- condensation heaters shall be fitted in each cubicle together with an ON/OFF isolating switch suitable for electrical operation at 230 volts A.C 50 Hz single phase of sufficient capacity to raise the internal ambient temperature by 5^{O} C. The electrical apparatus so protected shall be designed so that the maximum permitted rise in temperature is not exceeded if the heaters are energized while the switchboard is in operation. As a rule, the heaters shall be placed at the bottom of the cubicle.

31. 14 Ventilation Fans: The Switchboard shall be provided with panel mounting type ventilation fans in each panel with switchgear rated for 4500 A and above. The fan shall be interlocked with switchgear operation. The degree pf enclosure protection to be maintained even with fans.

31.15 Earthing: Continuous earth bus sized for prospective fault current to be provided with arrangement for connecting to station earth at two points. Hinged doors / frames to be connected to earth through adequately sized flexible braids.

31.16 Sheet Steel Treatment and Painting: Sheet steel used in the fabrication of switchboards shall undergo a rigorous cleaning and surface treatment seven tank process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognized phosphating process after which a coat of primer paint compactly with the final paint shall be applied over the treated surface. Final paint coat of oven baked powder coating, of minimum 50-micron thickness, of sheet approved by Engineer-in-Charge shall then be provided.

31.17 Name Plates and Labels: Suitable engraved white on black name plates and identification labels of metal for all Switchboards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

31.18 Type test reports: Switchboard configurations offered shall be CPRI /Independent international test house tested for all the tests as per IEC61439-1 and 2 and internal arc tests as per IEC 61641 for all three functional compartments. Copies of the test certificates shall be submitted with the tender.

31.19 Testing at Works: Copies of type test carried out at ACB/ MCCB manufacturers works and routine tests carried out at the switchboard fabricators shop shall be furnished along with the delivery of the switchboards. Engineer-in-Charge reserves the right to get the switchboard inspected by their representative at fabricators works prior to dispatch to site to witness the followings.

a) Physical variation and dimensional check
b) Verification of bill of material
c) Functional check
d) HV test
e) IR test

31.20 LOW VOLTAGE SWITCHGEAR

31.20.1 LT AIR CIRCUIT BREAKERS

31.20.2 The circuit breakers shall be of the air break type, robust and compact design suitable for indoor mounting and shall comply with the requirement IEC 60947-1 and 2. Short Circuit capacity shall be Icu=Ics=Icw (for 1 sec.) = 65kA or for the value specified in the BOQ. The same is stipulated in schedule of quantities. Heat loss per pole shall be low.

31.20.3 The breaker shall comply with the isolation function requirement of IEC 60 947-2 section 7.12 to be marked as suitable for isolation / disconnection to facilitate safety of operating personal while the breaker is in use. Rated Insulation voltage shall be 1000V and Impulse withstand voltage shall be 12 kV.

31.20.4 The breaker shall provide class II insulation between the front panel and internal power circuits to avoid any accidental contact with the live main current carrying path with the front fascia open.

31.20.4.1 The ACB shall have front face with Insulation Class II for safety as per IEC 60947-2 allowing class II installations with breaker control from outside

31.20.4.2 Protective devices, metering, CTs, PTs, push buttons and indicating lamps shall be provided as per schedule of quantities.

31.20.4.3 ACB must be suitable for operation in pollution degree 4 as per IEC 60664-1 and also conform to stringent environmental directives as in ROHS and WEEE norms

31.20.5 **Constructional Features:** The Air Circuit Breaker shall be moulded case design and with single frame up to 4000A for uniformity in the switchboard and take care of replacement of any lower rated ACB with the higher rated ACB in the event of breakdown.

31.20.5.1 The Circuit Breaker cradle shall be designed and constructed to permit smooth withdrawal and insertion. The movement shall be free of jerks, easy to operate. Mechanical Latch to be provided to identify the Isolated, test & service position of breaker to prevent over racking.

31.20.5.2 Arc chutes shall be provided for each pole, and these shall be suitable for being lifted out for the inspection of the main and the arcing contacts. Arc Chute Cover shall be fitted with integral stainless steel filters to absorb gases which are released in the event of short circuit interruption to ensure safety of the installation.

31.20.5.3 The circuit breaker shall have indication of mechanical wear of contacts enabling visible indication of contact life.

31.20.5.4 Vertical self-aligning cluster type isolating contacts shall be provided for the Circuit Breaker, with automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle. Sliding connections including those for the auxiliary contacts and control wiring shall also be of the self-aligning type. The fixed portion of the sliding connections shall have easy access for maintenance purposes.

31.20.5.5 All ACB irrespective of rating, shall be equipped with rear vertical type of terminals for both top and bottom bus bar (VR-VR) orientation only. All adapters/extender links supplied by the manufacturer for terminating load or line (bus bars / cable lugs) shall be silver/tin plated. Bare copper / aluminium extenders or adapters for the same purpose shall not be permitted.

31.20.5.6 The cubicle for housing the breaker shall be free standing dead front pattern, fabricated from the best quality sheet steel.

31.20.6 Operating Mechanism

31.20.6.1 The Circuit Breaker shall be trip free with independent manual spring operated or motor wound spring operated mechanism as specified and with mechanical ON/OFF indication. The operating mechanism shall be such that the circuit breaker is always free to open immediately once the trip coil is energized.

31.20.6.2 The draw out mechanism shall be part of the fixed frame to reduce the weight of with drawable part. Further, each position (service, test and isolated) shall be acknowledged by the operator before racking in / moving to the next position.

31.20.6.3 The closing time shall be less than or equal to 70 ms to ensure faster closing of the breaker. Break time shall be less than 30 ms at full short circuit fault capacity to reduce the let through energy in the event of severe fault.

31.20.6.4 The operating handle and mechanical trip push button shall be at the front of and integral with the Circuit Breaker.

31.20.6.5 ACB shall be provided with "Ready to Close" Contact as standard feature to check in the event of closing under the following conditions:

a. ACB is in OFF position

b. Spring Mechanism is Charged

c. Opening order is not present

d. Device completely racked in

31.20.6.6 The Circuit Breaker shall have the following three distinct and separate positions which shall be indicated on the face of the panel. The breaker shall get latched in each of three position namely Service, Test and Isolated, operator to de latch before racking in/out to other position

"Service" -- Both main and secondary isolating contacts closed

"Test" -- Main isolating contacts open and secondary isolating contacts closed

"Isolated" -- Both main and secondary isolating contacts open

Hence there shall be 3 distinct locking positions on the ACB for all 3 conditions as above

31.20.6.7 There must be provision for storing the racking handle (when not in use) within the ACB

31.20.7 Circuit Breaker Interlocking

31.20.7.1 Sequence type strain free interlocks shall be provided to ensure the following:

31.20.7.2 It shall not be possible for the Breaker to be withdrawn from the cubicle when in the "ON" position. To achieve this, suitable mechanism shall be provided to lock the Breaker in the tripped position before the Breaker is isolated.

31.20.7.3 It shall not be possible for the Breaker to be switched "ON" until it is either in the fully inserted position or, for testing purposes, it is in the fully isolated position.

31.20.7.4 It shall not be possible for the Circuit Breaker to be racked in unless it is in the OFF position.

31.20.7.5 A safety latch shall be provided to ensure that the movement of the Breaker, as it is withdrawn, is checked before it is completely out of the cubicle, thus preventing its accidental fall due to its weight.

31.20.7.6 Mechanical anti-pumping feature shall be incorporated in the ACB.

31.20.8 Circuit Breaker Auxiliaries

31.20.8.1 The Circuit Breaker shall have suitable free / minimum 4 NO/NC auxiliary contacts rated at 10 amps 415 volts 50 Hz. These contacts shall be approachable from the front for connecting all external wiring from the front. They shall close before the main contacts when the Circuit Breaker is racked in and vice versa when the Circuit Breaker is Drawn Out of the cubicle.

31.20.8.2 All electrical auxiliaries, including the spring charging gear motor shall be installable on site without requiring adjustment or any tools other than a screw driver

31.20.8.3 The closing release, shunt trip release and under voltage release shall be fixed in the front and secured on a metal plate with continuity to external earth in all circumstances.

31.20.8.4 The shunt trip coil shall be continuous rated with low holding VA. Momentary rated coils and/or mechanical latching type coils shall not be permitted for shunt trip and under voltage releases.

31.20.8.5 It shall be possible to connect all control and auxiliary wiring from the front of the circuit breaker.

31.20.8.6 There must be provision of Making Current Release operable in half a cycle (10 ms or less) for incomer breakers if rated for short circuit capacity of 65kA or higher.

31.20.9 Circuit breaker Releases (For ACB in Main PCC and Sync. Panel)

31.20.9.4 The Air Circuit Breakers shall have microprocessor release with composite Rogowski based current sensors for very high linearity in measurement and protection functions.

31.20.9.5 The circuit breaker shall be equipped with a safety interlock which keeps the breaker open if the protection release is not fitted / installed.

31.20.9.6 The microprocessor based release shall have adjustable over load (70% to 100% of breaker rating), short circuit protection (1.5 times to 10 times over load setting), and adjustable earth fault protection (10% to 70% of rated current) with adjustable time delay.

31.20.9.7 Zone selective interlocking feature shall be provided to enable interconnection with protection releases of upstream and downstream devices to optimize trip times and associated stresses on the system during short circuits or earth faults. It should be possible to store tripping history of last ten faults.

31.20.9.8 The protection release shall have adjustable neutral protection from 50% to 100% of rated current or long time setting of the protection release.

31.20.9.9 The ACB shall have display of all the metered data such as phase currents, phase and line voltages, demand values, on a handheld HMI visualized on a smart phone for user convenience. The energy readings shall conform to Class 1.0 as certified by third party agency. Bar graphs to show percentage loading of the breaker shall be available on the HMI to enable viewership from beyond the limited arc flash protection boundary. There shall be separate LED indications on the protection release for trip on overload, short circuit current and earth fault. In pursuance of the above, it is preferable to have the said HMI readily available in the form of an app configured for Android OS / iPhone.

31.20.9.10 The overload setting shall have a thermal memory feature lasting for not less than 20 minutes before and after tripping.

31.20.9.11 The protection settings of the release should be possible from hand held smart phone after pairing the devices over Bluetooth. Alternatively, settings of protection release through navigation buttons presented on the fascia of the release is acceptable. However, toggle type DIP switches for setting shall not be permitted. In the event of a total blackout, it shall be possible to retrieve event data from release through Near Field Communication.

31.20.9.12 The protection releases shall be capable of communication through a published interface hardware architecture over the Ethernet using Modbus TCP protocol. The parameters that shall be communicated are: ON/OFF/Trip status, Alarms, metering data, trip history and contact wear indications.

31.20.9.13 It shall be possible to remotely control the ON / OFF ACB through low power digital signaling enabled over the Ethernet. For mains incomers, it shall also be possible to communicate the position of breaker in its chassis (Connected/Disconnected)

31.20.10 Circuit breaker Releases (For ACB in Sub Mains and Peripheral Distribution)

31.20.10.4 The Air Circuit Breakers shall have microprocessor release with composite Rogowski based current sensors for very high linearity in measurement and protection functions.

31.20.10.5 The circuit breaker shall be equipped with a safety interlock which keeps the breaker open if the protection release is not fitted / installed.

31.20.10.6 The microprocessor based release shall have adjustable over load (70% to 100% of breaker rating), short circuit protection (1.5 times to 10 times over load setting), and adjustable earth fault protection (10% to 70% of rated current) with adjustable time delay.

31.20.10.7 Zone selective interlocking feature shall be provided to enable interconnection with protection releases of upstream and downstream devices to optimize trip times and associated stresses on the system during short circuits or earth faults. It should be possible to store tripping history of last ten faults.

31.20.10.8 The protection release shall have adjustable neutral protection from 50% to 100% of rated current or long time setting of the protection release.

31.20.10.9 The ACB shall have LCD Display of phase currents, phase and line voltages, current demand values. The error in readings shall not exceed +/- 1.5% from the true values. Prominent LED bar graph to show percentage loading of the breaker from 40% to 100% shall be available on the release to enable viewership from beyond the limited arc flash protection boundary. There shall be separate LED indications on the protection release for trip on overload, short circuit current and earth fault.

31.20.10.10 The overload setting shall have a thermal memory feature lasting for not less than 20 minutes before and after tripping.

31.20.10.11 The setting of the ACB should be possible with dial settings with a screwdriver. Settings of protection release through toggle type DIP switches shall not be permitted.

31.20.10.12 The protection release of the incomer ACB shall be capable of communication through a published interface hardware architecture over the Ethernet using Modbus TCP protocol. The parameters that shall be communicated are: ON/OFF/Trip status, Alarms, metering data, trip history and contact wear indications.

31.20.10.13 It shall be possible to remotely control the ON / OFF ACB through low power digital signaling enabled over the Ethernet. For mains incomers, it shall also be possible to communicate the position of breaker in its chassis (Connected/Disconnected)

31.21 Circuit Breaker Communication : The circuit breaker shall be able to report the ON/OFF/TRIP status to a remote location by communicating over the Ethernet through Modbus TCP protocol. To this extent, all accessories that form part of the breaker communication hardware and architecture shall be pre-wired and compatible for communication over the Ethernet. A sample configuration of the proposed communication architecture is published in the Annexure herewith. Each Air Circuit Breaker shall be addressable over the Ethernet through a unique IP address to access data related to status of the operation (On/Off/Trip), metered data and fault diagnostics. The Ethernet wiring may be done using daisy chain topology. It should be possible to generate e-mail messages on alarms and status from the ACB. It is recommended that the ACB be equipped with native Ethernet Ports (dual for looping) to reduce wiring complexity and improve.

31.23 Earthing : The frame of the Circuit Breaker shall be positively earthed when the Circuit Breaker is racked into the cubicle. There shall be provision for connection of panel earth at clearly marked locations on the metal frame of the cubicle.

31.24 MOULDED CASE CIRCUIT BREAKERS

31.24.1 General

31.24.1.1 The circuit breakers shall comply with the requirement of IEC 60947 -2. MCCBs shall be suitable for nominal voltage of 3 phase 690 Volts AC 50 HZ supply.

31.24.1.2 The circuit breaker shall comply with the isolation function requirement of IEC 60947-2 section 7.1.2 to be marked as suitable for isolation / disconnection to facilitate safety of operating personnel while the breaker is in use.

31.24.1.2.1 The circuit breaker shall provide class II insulation between the front cover and internal power circuits to avoid any accidental contact with the live main current carrying path with the front cover open.

31.24.1.3 The MCCBs shall be of double break contact system only to ensure very low let through energy during severe faults. Legacy designs of single break contact mechanisms shall not be acceptable. Double break design shall have two arc chambers per phase to effectively quench the arcs and lower the severity of fault impact.

31.24.2 **Constructional features**

31.24.2.1 The MCCBs shall be made of halogen free high strength heat resisting and flame retardant thermo setting insulating material.

31.24.2.2 Three phase MCCBs shall have a common handle for simultaneous operation and tripping of all the three phases.

31.24.2.3 The contact tips shall be made of suitable arc resistant sintered alloy. Terminals shall be of liberal design with adequate clearances

31.24.2.4 Suitable arc extinguishing devices shall be provided for each contact.

31.24.3 **Operating mechanism**

31.24.3.1 The operating handle of the MCCBs shall be quick make / break, trip free type.

31.24.3.2 The operating handle of the MCCBs shall have suitable, ON, OFF and TRIPPED indicators.

31.24.3.3 The operating handle and mechanical trip push button shall be at the front of and integral with the circuit breaker

31.24.4 **Operating Characteristics:** MCCBs shall limit the fault currents. The maximum thermal I^2 t shall be indicated by the manufacturer. These characteristics shall allow high cascading performance with MCCBs / MCBs downstream.

31.24.4.1 MCCBs shall comprise of the very fast acting mechanism designed to trip the circuit breaker in the event of high value short circuit currents.

31.24.4.2 The minimum electrical life of MCCB while switching rated current at rated operational voltage shall be as follows and tested for the same in accordance with IEC 60947-2

For Ir < = 250A: 10,000 Operations

For 250A < Ir < = 400A: 5,000 Operations

For Ir > 400A: 4,000 Operations

31.24.4.3 Earth fault protection, if specified should be an integral part of the breaker, direct operating type & with adjustable set points. Earth leakage protection, where required shall be provided with direct actuating means with no requirement of wiring to trip coils.

31.24.4.4 MCCBs range shall have established and documented discrimination charts readily available. For main power control center, only plug-in type or motorized MCCBs to be used.

31.24.5 Circuit Breaker Interlocking

MCCBs shall be provided with following interlocking devices.

- Handle interlock to prevent unnecessary manipulations of the breaker.
- Door interlock to prevent door being opened when the breaker is in ON position
- Door interlocking device to open the door even if the breaker is in ON position.

31.24.6 MCCB Protection Releases

31.24.6.1 The MCCB shall be equipped with Thermo-Magnetic protection release up to and including a nominal current rating of 320A. The MCCB be shall have electronic microprocessor based protection release for ratings of 400A and above.

31.24.6.2 Regardless of whether the MCCB is of TM release or Microprocessor release type, there must be separate provision of potential free contact for indication of trip on electrical faults to distinguish from other modes of tripping the MCCB. This contact shall be exclusively actuated when trip occurs because electrical fault only.

31.24.6.2 The thermo magnetic release, where specified shall have adjustable overload setting from 70% to 100% of rated current and magnetic setting of at least 8 times rated current.

31.24.6.3 The microprocessor based release shall have adjustable over load (70% to 100% of rated current of the breaker), short circuit protection (2 to 10 times overload setting and fixed time delay not exceeding 60 msec), and instantaneous setting of greater than 10 times rated current. It should be possible to store tripping history of last ten faults.

31.24.6.4 The protection release shall have adjustable neutral protection from 50% to 100% of rated current or long time setting of the protection release.

31.24.6.5 The overload setting of microprocessor release shall have a thermal memory feature lasting for not less than 20 minutes before and after tripping.

31.24.6.6 The setting of the MCCB should be possible with dial settings with the help of screwdriver. Toggle type dip switches for settings of protection release shall not be permitted.

31.24.6.7 The manufacturer shall submit charts to ensure full and effective discrimination for the MCCB in upstream and downstream combinations up to the short circuit capacity envisaged in the project. Data on discrimination of MCCB with even downstream MCB shall also be furnished. Cascading charts shall also be furnished for the MCCBs.

31.24.6.8 Communication from MCCB, where required, shall be through Modbus TCP over Ethernet. In case of MCCB having Modbus RS485 port, strictly no more than 8 devices may be looped to a common gateway for Ethernet connectivity.

31.24.7 Circuit breaker auxiliaries

The circuit breaker shall be provided with following accessories.

- Under voltage trip (Where specified)
- Shunt trip. (Shunt trip coil must be rated for continuous operation.)
- Alarm switch
- Auxiliary switch

31.24.8 Type test certificate: The contractor shall submit type test certificate from an international recognized test house for the circuit breakers offered.

PARTICULAR SPECIFICATIONS [Contd…]

31.25 **3 PHASE MOTOR STARTER AND CONTACTORS**

31.25.1 The 3phase motor starter shall be of DOL type up to motor rating of 7.5 kW and with a combination of MPCB and Contactor strictly as per type 2 coordination of the manufacturer.

31.25.2 The 3phase motor starter shall be of Soft starter type for motor ratings higher than 7.5 kW, unless otherwise stated. The starter shall be configured to provide type 2 coordination for open transition scheme comprising MPCB, All Contactors, complete with required timer, control circuit wiring, digital Ammeter and Voltmeter.

31.25.3 The MPCB used in starters as above shall be equipped with inbuilt overload and short circuit fault protection, with minimum 50 kA fault capacity and further provided with extended rotary operating handle, 1 NO/NC contact and suitable for termination of cables.

31.25.4 The Contactors shall be of 3 Pole and suitable for operation at 415V. The utilization category shall be AC3. Consideration for selection of contactor in type 2 coordination charts shall be IE2/IE3 efficiency class motors only and shall be indicated in the technical submissions.

31.25.5 The Contactor shall have a universal coil suitable for energizing from ac/dc control power source and have a wide band of at least 2 times the lower voltage limit

31.25. The control voltage limits for contactor coils shall be as follows:

Operation: 85V to 275V for ac control and 85V to 418V for dc control
Drop Out: <60V for ac control and <45V for dc control

31.25.1 Further to the above, the contactor shall have a coil with low power consumption, achieving sealing of power contacts whilst consuming less than 2 W for contactor ratings up to 60 A

31.26 **INTELLIGENT MOTOR PROTECTION RELAY (FOR PROCESS CONTROL FEEDERS)**

31.26.1 Intelligent Motor Protection Relay (IMPR) shall provide protection, metering, control, monitoring, and historical logging for 1ϕ and 3ϕ AC induction motors up to 100 A using integral current transformers (CTs) or up to 810 A using in-puts from external CTs. The current measuring shall be from the integral unit of the controller.

31.26.2 Certification: UL, CE, IEC/EN 60947-4-1

31.26.3 Operating Temperature: 0°C to 60°C

31.26.4 Conformal Coating: since IMPR is used in harsh environments the conformal coating on IMPR shall be as per IEC 60721-3-3 class 3C4

31.26.5 Degree of Protection: IP 20, (IP 54 for HMI)

31.26.6 Control Voltage: 24VDC or 100-240V AC 50 / 60 Hz

31.26.7 Communication: device should have integrated communication port for the direct link to the higher-level system communicating through Modbus TCP / Ethernet IP, Modbus, Profibus DP, Device NET, CAN open.
Measurement accuracy:
Line currents @ 1% upto 27 amps and 2 % for higher currents
Line to line voltage: operable upto 690V AC @1% accuracy
Ground Current @5% (internal)

31.26.8 Protections: IMPR module shall provide all current based protections mentioned below:

a) Thermal overload
Trip curve shall be selectable between inverse (I^2t) and definite time (Ixt)
Trip Class 5 to 30 site selectable
b) Current phase imbalance

c) Current phase loss
d) Current phase reversal
e) Long start
f) Jam (locked rotor during run)
g) Undercurrent
h) Overcurrent
i) Ground Fault protection (internal)
j) Motor temperature sensor
k) Rapid cycle lockout
m) With Voltage module:
i. Voltage phase imbalance
ii. Voltage phase loss
iii. Voltage phase reversal
iv. Under / Over voltage
v. Voltage load shedding
vi. Under / Over power
vii. Under / Over power factor
viii. Voltage Dip Detection Automatic Restart

31.26.10 Monitoring & Protection:

i) Shall provide monitoring of all 3ph currents, ground current, avg current, voltages, power, pf, active and reactive and energy, it shall have fault recording with all the current, voltage values for the last 5 faults.
a. Ground fault protection shall be possible by IMPR (internally), it shall also have the provision to connect the (external) CBCT to IMPR and no expansion module shall be required
b. IMPR shall be capable to monitor, display and communicate the ground fault current values (for both internal & external measurements)
c. IMPR shall be directly connected to the temperature sensor, without expansion module, PTC binary, PTC analog, NTC analog and PT100 sensors must be supported.
d. IMPR shall monitor, display and communicate the temperature value (when connected with PT100 sensor)

31.26.11 Control Functions:
a. The basic IMPR shall have integral 6 Digital inputs, 3 Programmable relay output, 1NO+1NC fault output, 1 temperature sensor input, 1 CBCT input terminal.
b. The voltage expansion module shall have 4 Digital inputs and provide all the voltage based protections and monitoring.
c. IMPR shall have a test/reset button to reset faults and to test the functionality.
d. IMPR shall have the provision for grouping protection faults in 3 groups and based on the criticality each group shall have time to reset, no of permissible fault resets and enabling / disabling auto reset for the fault groups.

31.26.12 Electrical Wiring:
a. The expansion module shall be internally powered by IMPR, and the connections between the module shall be with standard cables with RJ45 connectors
b. The IMPR shall have LEDS to indicate HMI Communication Status, Power, Alarm, Communication statuses.
c. IMR shall have dedicated port for HMI / Expansion module
e. HMI shall also be internally powered by IMPR
f. For current greater than 100 Amps IMPR shall be suitable for use with an external 5P10 / 5P15 CT up to 810 Amps

31.26.13 Configuration / Programming:
a. IMPR shall be programmable from HMI / PC / DCS
b. IMPR shall have prebuild configuration modes for motor starters (DOL / RDOL / star-delta / 2 speed)
c. IMPR shall be configurable to operate as an overload relay
d. Custom logic for programming DI/DO shall be possible and the software shall have the provision for programming on Structured text / Function block.

e. Digital outputs shall be potential free and independent, each output shall be connectable to different field voltages
g. Performance Parameters:
h. The MTTF (Mean Time to Failure) for the product to be declared.
MTTF ≥ 7,00,000 Hours

31.26.14 User Interface:

a. HMI shall have the capability upload / download parameters to IMPR
b. The address & other communication parameters shall be configurable from HMI, no additional module shall be required
c. HMI shall be internally powered by IMPR no additional power supply shall be required, simple cables with RJ45 connectors shall be sufficient for connection to IMPR
d. HMI shall have the simple text display in English with options to download other languages
e. HMI shall have the operate / reset buttons
f. HMI shall display the operating data, status, faults, counters & warning information.

31.27 **MINIATURE CIRCUIT BREAKERS:** The MCB shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system. The MCB's shall have a rupturing capacity of 10 KA at 0.5 p.f. conforming to arc limiting category 3. There shall be no de-rating of the MCB when multiple units are stacked vertically together inside the distribution board. There shall be no de rating of MCB at 50C operation. The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. All types of RCD (RCCB/RCBO) shall be specifically immunized to prevent nuisance tripping in the presence of harmonics in the load currents. The MCB unit shall have "bi-connect" type terminals suitable for connection to cable or strip conductors. It shall be possible to terminate on the MCB without load or line bias. The MCB shall have ISI marking and certified to IEC 60898.

31.28 MANUFACTURING FACILITY

31.28.1 Sheet steel manufacturing for the LV panels shall be done as per the drawings on in house CNC cutting and bending machines at the assembler/OEM premises.

31.28.2 In house facility to be available for fourteen tank pre-treatment process and powder coating facilities The Pretreatment and painting process shall be regularly checked for the stability of the process the final paint thickness should be 60 to 80 microns.

31.28.3 The manufacturer must have established stores with proper procedures for checking incoming material, stocking, rejection etc so that inferior quality material does not enter the shop.

31.28.4 In house facility for routine testing of the switchboards. The complete facility should have ISO 9001 certification.

31.28.5 If supplied by the assembler, the OEM shall provide references of projects executed by the assembler with the OEM certified designs for at least 4 years preceding the date of issue of this tender. Further, evidence shall be furnished of orders of OEM designed TTA conforming to IEC over the 4 year period as mentioned above.

31.28.6 The LT panels shall be accommodated with fully automatic change over switch (auto transfer switch) with RJ 45 ethernet switch along with cable for integration and synchronization of DG sets/panels with SAS architecture.

31.29 Rep of accepting officer shall send to witness the testing/inspection of the all the LT Panels at factory/manufacturer before dispatch and the overall cost to be borne by the contractor"

31.30 Third party inspection by TUV/LRS/IRS and submission of record drawings in soft copy and 5 sets colour coded hard copy"

Note: **Totally type tested panel shall be design and manufactured by OEM only.**

32 EXTERNAL WATER SUPPLY

32.1 GENERAL

32.1.1 The work under this Schedule comprises of taking branch connection by cutting, the existing cast iron pipe line, laying DI / GI / cast iron pipes and specials including fittings.

32.1.2 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.

32.1.3 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.

32.1.4 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.

32.2 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.

32.3 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 day work.

32.4 DI PIPES AND PIPE FITTINGS / SPECIALS: Centrifugally Cast [spun] Ductile Iron Pressure Pipes shall be IS – 8329 marked of class K-7 / K-9 as mentioned in Schedule "A" and suitable for Spigot and Socketed CI / Ductile Iron Fittings with Push on Joints. The pipes shall be in standard lengths of 4m, 5m, 5.5m & 6m. The pipes and fittings shall withstand the hydrostatic test pressure after installation, without showing leakage, sweating or defects of any kind as laid down in IS. Internal surface of Pipes and Fittings such as bends [any type, radius and angle], tapers any type [straight, bent, increasing / decreasing or double socket, etc.], tee pieces [single branch "Y" junction, double branch, etc.], cross [all flanged], collars, duck foot bends, caps and plugs etc shall be cement mortar lining with epoxy seal coat and external surface shall be zinc coating [minimum 130 Grams per square metre] with bituminous finish layer [minimum thickness 70 micron]. Ductile iron Pipes shall be laid, jointed and tested all as per IS –12288, Code of practice for use and laying of DI pipes and as specified in MES Schedule Part – I. All DI pipe fittings / special shall be IS – 9523 marked.

32.5 DUCTILE IRON FLANGED PIPES AND FITTINGS: DI flanged pipe shall confirm to IS-8329. he pipers shall be free from defects, other than unavoidable surface imperfections which results from the method of manufacture and which do not affect the use of pipes. The flanges shall be at right angles to the axis of the pipe.

32.6 DI FITINGS: All DI fittings shall confirm to IS-9523. In Sch 'A' unit of measurement of each fitting is given in kilogram. For measurement and payment purposes weight given in IS shall be considered and not the actual weight of the fitting. However, weight of each fitting shall be within the tolerances given in IS and underweight fittings shall not be used in the work.

PARTICULAR SPECIFICATIONS [Contd...]

32.7 LAYING & JOINTINGS OF PIPES

32.7.1 All pipes laying and jointing shall be conforming to various provisions of IS. The minimum depth shall be 1000mm. However, where standard depth is not possible it can be reduced to a minimum of 600mm. No sand bedding is required. Jointing of ductile iron pipe can be done similar to CI pipes. Back filling can start immediately after jointing is completed. To avoid pipe floatation back fill should start immediately after installation. The pipe can be cut with engine cutter/metal saw/bite cutter. Oxyacetylene torches should not be used for cutting. If cement mortar lining is damaged at the cutting point, it should be repaired by the contractor at his own cost.

32.7.2 The trench shall be so dug that the pipe may be laid to the required alignment and at the required depth when pipeline is crossing a road, a minimum cover 1.0m is required. Width of trench shall be kept to a minimum consistence with the working space required. At the bottom between the faces, it shall be such as to provide not less than 200 mm clearance on either side of the pipe.

32.7.3 JOINTING OF PIPE: For jointing of flanged pipe, rubber insertion sheet of min 3 mm thick conforming to IS shall be used. Alternatively, flanged joints shall be made with jointing ring of good quality, smooth, hard compressed fiber board (not less than 1.5 mm thick) and of such width as to fit inside the circle of bolts. The rings shall be smeared thinly with graphite paste. The nuts shall be carefully tightened in opposite pairs, until the joint ring is only just sufficiently compressed between the flanges to ensure water tightness of the joints under the desired water pressure.

32.8 TESTING OF MAINS BEFORE COMMENCING WORK: All pipes, fittings and appliances shall be inspected before delivery at site to see whether they bear, where appropriate, the certification mark of the Indian Standards Institution or the mark of the testing authority i.e. OEM test certificate. All pipes and fittings shall be inspected and tested by the manufacturers at their factory and shall comply with the requirements of IS code. They shall be tested hydraulically under such pressure specified as per IS. The pipes and fittings shall be inspected on site before laying and shall be sounded to disclose cracks. Any defective items shall be clearly marked as rejected and forthwith removed from the site.

32.9 TESTING OF MAINS AFTER LAYING

32.9.1 After laying and jointing, the main shall be slowly and carefully charged with water, so that all air is expelled from the main by providing a 25 mm inlet with a stopcock allowed to stand full of water for few ways if time permits, and then tested under pressure. The test pressure shall not be less that the greatest of the following:

(i) 1½ times the maximum sustained static pressure.

(ii) 1½ times the maximum pipeline static pressure.

(iii) Sum of the maximum sustained operating pressure or maximum pipe line static pressure and the maximum calculated surge pressure.

32.9.2 The field test pressure where ever possible be not less than two third of the works test pressure appropriate to the class of pipe except in case of spun iron pipes and shall be applied and maintained for at least 4 hours. Where the field test pressure is less than two third of the works test pressure, the period of test should be increased to at least 24 hours. The test pressure shall be gradually raised at the rate of nearly 1 Kg/cm2/Min.

32.9.3 The main shall be tested in sections as the work of laying proceeds. It is essential to have the joints exposed for inspection during the testing. The open end of the main may be temporarily closed for testing under moderate pressure by fitting a water tight expanding plug of which several types are available. The end of the main and the plug shall be secured by struts or otherwise, to resist the end thrust of the water pressure in the mains.

32.10 FACTORY INSPECTION: Rep of accepting officer shall be detailed for factory inspection of MS ERW & DI pipes and cost of the same shall be borne by the tenderer.

32.11 BALL VALVES: Ball valves shall be of brass or bronze, high pressure type, and shall conform to IS 1703:2000, Specification for Ball valves (horizontal plunger type) including floats for water supply purposes. The float shall be of polyethylene. High pressure ball valve with float immersed to not more than half its volume shall remain closed against test pressure of 1.05 MPa.

32.12 GATE VALVES/NON RETURN VALVE: These shall be of size and specification as given in respective item of Schedule "A" and MES Schedule Part-I, these shall be ISI marked and of approved make specified here in after.

PARTICULAR SPECIFICATIONS [Contd…]

32.13 MOTOR ACTUATED BUTTERFLY VALVE: These shall be of size and specification as given in respective item of Schedule "A" and shall be ISI marked and of approved make specified here in after. These shall be motorised 3 Phase operation with Inching duty. Pressure rating shall be PN 1.6 and torque shall be as per relevant IS.

32.14 ACTUATORS: Actuators shall be weather proof electrical actuators with integral starter suitable for inching duty with following fittings: -

(a) 2 Nos Limit switches of 2NO + 2NC contacts and 2 Nos Torque switches of 2NO+2NC contacts, current rating 5A/0.40A at 240V, AC/DC, Enclosure of switches IP 66.
(b) Motor suitable for 415Volt, 50Hz, 3 phase AC Power supply, Class –F insulation, 3 thermo switches are embedded in each motor winding for protection against burn out. Enclosure IP 67 after mounting on actuator. Duty S2-15mins (max 150 starts/hr max for ON /OFF duty).
(c) Hand wheel for emergency manual operation which disengages as soon as motor operation is resumed.
(d) Continuous dial type mechanical position indicator for local indication.
(e) Space Heater in switch compartment.
(f) Contact type position feedback transmitter suitable for 4-20mA feedback signal.
(g) Cable entries of suitable size with metal plugs.
(h) Suitable for an ambient temperature -20 degree Centigrade to + 80 degree centigrade.
(j) All switches and motor connections are brought out to a common terminal box for customer connections for power and control. Terminals are suitable to accommodate incoming wires of cross section upto 4 Sqmm for power and 2.5Sqmm for control.
(k) Enclosure of actuators – IP 68 protection.
(l) Paint : Epoxy based paint of Smoke grey shade 692 as per IS.
(m) Integral starter with;
(i) Reversing Contractors (Electrically and Mechanically interlocked)
(ii) Push buttons for "OPEN – STOP – CLOSE".
(iii) Selector Switches (LOCAL / OFF/REMOTE) with potential free contacts for remote indication.
(iv) Control Transformer 415/110Volt.
(v) Input command signals "OPEN – STOP – CLOSE" (potential free contacts) OPEN – STOP – CLOSE" with 24Volt, DC from internal power supply or from external source.
(vi) Single Phasing Protection + Phase reversal protection.

32.15 Contractor shall submit applicable wiring diagram for actuators showing all connected details for approval of GE before execution of work.

32.16 SLUICE VALVE: These shall be of size and specification as given in respective item of Schedule "A" and MES Schedule Part-I, these shall be ISI marked and of approved make specified here in after. All cut off valve shall be of right hand type and valve wheels should have on arrow head engraved or cast thereon showing direction for turning "Open" and "Close".

PARTICULAR SPECIFICATIONS [Contd...]

33.0 **EOT CRANE**

33.1 The EOT crane of 5 Ton capacity as specified in BOQ shall have the following specifications: -

(a)	Speed, Span, Lift, Bay length etc.,	-	As specified in BOQ
(b)	Complete operation	-	Wireless and also by Pendent control panel
(c)	Hook type	-	As per applicable IS specification.
(d)	Limit switches/Automatic	-	When limits of lift-lower, cross travel Cut offs with self-resets and longitudinal travel reached to be incorporated as art of crane automatic control and safety system irrespective of operator operation.
(e)	Braking - Smooth braking to decelerate without work piece winging dangerously.		
(f)	Maintenance	-	Accessibility in subsequent upkeep and maintenance.

33.2 **INSPECTION & PERFORMANCE TESTS**

33.2.1 **SHOP TEST & INSPECTION**

33.2.1.1 Test at manufacturer's works shall be conducted as specified in IS: 3177 and test certificates shall be furnished.

33.2.1.2 The contractor shall submit material test certificates for structural steel and mechanical components such as couplings, gears, gearboxes, rope drums, brake drums, pulley, shafts, wheels etc. and electrical components motor, brake, limit switches, panels etc.

33.2.1.3 **Rep of accepting officer shall be detailed for factory inspection as well as Pre commissioning inspection at site.**

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

33.2.3 **THE CRANE AFTER ERECTION SHALL BE TESTED AS FOLLOWS:**

33.2.3.1 **DEFECTION TEST:** The deflection test shall be conformed as per IS 3177 and the deflection of the bridge girders shall not exceed 1/900 of span.

33.2.3.2 **SPEED TESTS:** All the motions of the crane shall be tested with rated load and the rated speeds shall be attained within the tolerance as per IS 3177. All the motions of the crane shall be tested with 25% overload in which case the rated speeds need not be attained but the crane shall show itself capable of dealing with the overload without difficulty.

33.2.3.3 **PERFORMANCE TESTS:** The crane shall be tested with rated load for performance of long travel and cross travel motions to develop the required acceleration.

33.2.3.4 **BRAKE TESTS:** The hoist brakes shall be capable of breaking the movement.

33.2.4 **INSTRUCTION FOR ERECTION, TESTING AND COMMISSIONING OF THE CRANE**

33.2.4.1 Crane shall be tested; as per latest IS code/standard engineering practices/instructions as deemed fit by the department.

33.2.4.2 Crane shall be supplied and erected complete with electric motors, starters, lubricating system, pendent control, isolator, down shop lead, cables, limit switches, brakes, drive shafts, hook, gear box, crab, control panel, platform, gantry, wire rope, rope drum, festoon cable etc.

33.2.4.3 Supply of LT rail straightening/ alignment and erecting of the same on gantry by clamping etc; is also included in the scope of the work.

33.2.4.4 The design, erection, commissioning shall be subject to 3rd party inspection (LRS/IRS/DNV). Rep of accepting officer shall be detailed for factory inspection as well as pre commissioning inspection at site. Cost of 3rd party inspection shall be borne by the tenderer.

33.2.5 COMPLETION DRAWINGS: The quoted rate shall also include for preparation and supply of 03 sets of completion drawings of work as directed by GE.

34 **HOT/COOLING APPLIENCES / AIR CONDITIONING**: All as specified in Schedule 'A' and as specified here in after.

34.1 All Air cooled packaged air conditioners / VRV / VRF /TFA type ACs of capacity shall be provided as specified in BOQ and as enumerated in these particular specifications.

34.2 DESIGN CRITERIA

34.2.1 The AC unit should be designed as per following conditions:-

[i] Rated capacity : As per Schedule 'A' Items

[ii] Flow direction : Upward flow/Downward flow

[iii] Air inlet temp. : 25 deg C (DB) at 50% RH (Return Air)

[iv] Saturated Suction Temp : Between 9 deg C and 10 deg C

[v] Minimum Super heat : 2 deg C

[vi] Saturated discharge Temperature: Max 53 deg C (at ambient of 43 deg C)

[vii] Ambient air design temperature: 43 deg C (However the system should be (Entering the condenser) able to work with ambient temp upto 50 deg C

[viii] Air quantity : >550 CFM/TR

[ix] Total static pressure: 35 mm of WG between inlet and outlet of Blower i.e. across the blower.

[x] Filters : EU – As specified in Schedules

[xi] Face velocity across the : < 2.5 m/sec Cooling coil

[xii] Type of load : The exchanges are having high sensible heat Load (Sensible Heat factor > 0.95)

[xiii] Minimum C.O.P. : 2.90

34.3 CABINET

34.3.1 The Cabinet should be constructed from best quality GI sheet steel of thickness not less than 16 gauge for top, bottom and side panels & 20 gauge for front and back panels suitably treated for weather protection, corrosion and shall be powder coated.

PARTICULAR SPECIFICATIONS [Contd…]

34.3.2 The casing may be of CRCA Powder coated, 1.2 to 1.6 mm thick. Coil and blower sections should be insulated internally for both acoustics and thermal purposes with 12 mm thick resin bonded Fibre Glass of density 48Kg/m3 glass wool covered with glass cloth of fire retardant grade.

34.3.3 The cabinet insulation may have open cell polyurethane foam or mineral wool of 25 mm may be used which complies to fire classification B according to DIN 4102 self extinguishing, sound absorbent / fibre glass insulation of 25 mm thickness may be used.

34.3.4 Suitable arrangement shall be provided for lifting/easy handling of machines.

34.4 COMPRESSOR (SCROLL)

34.4.1 All units having twin circuit shall be provided with two scroll type compressors having independent refrigerant circuit each rated for 50% capacity having energy efficiency ratio.

34.4.2 The compressor should be of Reputed make hermetic sealed type.

34.4.3 Compressor should be suitable for operation on Non CFC refrigerant gases.

34.4.4 Compressor Motor should be suitable for operation on 415 + 10% variations, 50Hz, 3 phase, AC supply.

34.4.5 The compressors should be located in such a way that removal of one compressor should not affect the operation of the other circuit (for twin circuit units).

34.4.6 Compressors should be installed on spring mounted floating platform/rubber pads or manufacturer's recommended approved mounting.

34.4.7 Overload protection should be provided in compressor.

34.4.8 Gauge Ports should be provided at appropriate location to measure suction and discharge pressures.

34.5 EVAPORATOR COIL

34.5.1 Evaporator coil should be two in numbers one for each refrigerant circuit for twin circuit machines. Each coil should be rated for 50% of TR rating of package unit.

34.5.2 Evaporator coil should be constructed out of copper tubes not less than 0.31 mm thick expanded on to aluminium fins to give a good mechanical bond for maximum heat transfer. Approximately 13 to 14 fins per inch should be provided. Fin thickness should not be less than 0.1 mm with hydrophilic coating.

34.5.3 Face area of coil should be selected corresponding to air velocity not exceeding 2.5 m/sec.

34.5.4 A condensate drip tray of stainless steel / GI Powder coated / heavy gauge aluminium having minimum 18 SWG thick along with a special plastic pipe to drain out condensate water should be provided.

34.6 BLOWER SECTION

34.6.1 Total static pressure should be 35 mm of WG. To confirm static pressure of blower 35 mm of WG, it should be measured between inlet and outlet of blower i. e. across the blower. Blower fans should be statically and dynamically balanced.

PARTICULAR SPECIFICATIONS [Contd...]

34.7 FAN MOTOR ASSEMBLY

34.7.1 Fan should driven by a weather proof electric motor suitable for operation on 415V+10% variation 3 phase, 50Hz, AC supply. The motor housing shall be of IP 55/ IP 54 grade.

34.7.2 The fan should be directly coupled/belt driven having a maximum speed of 1400 rpm (cocked 'V' belts are to be used for better efficiency & control)

34.7.3 Energy efficient motors as per relavant latest IS on subject matter should be used.

34.8 PRECISE HUMIDIFICATION FEATURE

34.8.1 Electrode steam generator (generating pure steam from boiling water by direct acting electrodes) having precision drainage and feed, steam supply matching thedemand, accurate conductivity control and minimal disruption in steam production.

34.9 REFRIGERANT PIPING

34.9.1 There should be two self contained independent refrigerant circuits in each air conditioner for twin circuit machines. A totally independent piping hook up for each combination of compressor-evaporator and air cooled condenser constituting one refrigerant circuit. For single refrigerant circuit only one refrigerant circuit is required.

34.9.2 Each refrigerant circuit should be suitable for operation on R-22 and should include the following items :-

[i] Thermostatic Expansion Valve with external Pressure equalization.

[ii] Removable liquid line filter drier with hand shut off valves.

[iii] Liquid Line sight Glass with Moisture indicator.

[iv] Suitable charging valves.

34.9.3 The serviceable/removable components should have union connections for easy removal/assembly.

34.9.4 All pipe works should be carried out with refrigerant quality copper tubes and where bends are required these should be completed using either a proprietary bending tool or radius fittings.

34.10 ELECTICAL SYSTEM

34.10.1 The Electrical power system should confirm to relevant I.S. standard. A main incoming MCB of suitable rating and having a rupturing capacity of 10 KA for each AC package unit should be provided on the unit sized to meet the total power requirements for AC package unit circuit.

34.10.2 Within the panel individual power loads should be distributed equally across the three phases.

34.10.3 All individual wires should be of copper and colour coded or should be numbered at their point of termination to facilitate servicing.

34.10.4 Low voltage control wiring and power wiring should be segregated from each other.

34.10.5 Heaters shall be suitably provided with insulators with safety thermostats and contactors of suitable ratings.

34.10.6 The following shall be incorporated:-

[i] MCB of suitable rating and having a rupturing capacity of 10 KA should be provided for each sub-circuit.

[ii] Contactors for motors of suitable rating.

[iii] Electronic overload protection against overload, phase loss & reverse phase sequence and sensing negative sequence current for individual 3 phase motors.

34.11 AIR COOLED CONDENSER

34.11.1 For each air conditioner unit (with twin circuits) there should be two air cooled condenser units; each having a matching heat rejection duty for one refrigerant circuit.

34.11.2 condenser unit should incorporate the followings:-

[i] A heat rejecting coil block constructed from copper tubes of not less than 0.3 mm thick expanded on to straight aluminium fins. Approximately 13 to 14 number of fins/inch should be provided. Fin thickness should not be less than 0.1 mm with hydrophilic coating.

[ii] Minimum two propeller fans shall be provided for each condenser unit and should be selected for low speed quiet operation. The condenser unit should be selected for low speed quiet operation. The condenser unit should be suitably designed for noise level < 75 db at a distance of 1 meter away from O/D unit.

34.11.3 The condenser should be vertical mounting type with horizontal throw of air, ensuring even air flow over the coil block. Suitable GSS collar shall be provided at fan outlet.

34.11.4 All the foregoing items should be factory assembled with body made of 1.6 mm (16 SWG) GI sheet Powder coated OR Condenser body shall be of GI powder coated / casing of condenser shall be made of marine grade aluminium and stainless steel hardware and thickness of casing shall be 1.2mm.

34.11.5 The entire assembly should be supported by a corrosion treated frame.

34.11.6 Separate MCB of suitable rating and having a rupturing capacity of 10 KA for each motor near its vicinity in suitable weather proof enclosure should be provided.

34.12 CONTROLS

34.12.1 Following controls should be provided :-

[i] High pressure trip – Auto reset (for each compressor)

[ii] Low pressure trip – Auto reset (for each compressor)

34.12.2 The unit shall trip if operated on HT or LP trip for more than three times.

34.13 SAFETY INTERLOCKS

34.13.1 Interlock between condenser fan motor and compressor motor to prevent starting of compressor without condenser fan in operation.

34.13.2 Condenser fan should stop along with compressor.

34.13.3 Provision should also be made to operate the evaporator fan without, the operation of condenser and compressor.

34.14 CONTROLLER

34.14.1 Microprocessor based programmable logic controller fully compliant with EEC directives for electromagnetic compatibility with following broad features:-

[i] Operates, monitors and displays so that the room temperature and humidity is kept at 21 +1 deg.C & 50 + 5% RH respectively. However the parameters should be site settable HP/low LP, low humidifier water, overload, air flow failure, dirty filter and high heater temperature)

[ii] Programming of AC units shall be based on (i) Equal run hours per 24 hours in a day and (ii) if the designated unit is unhealthy, then stop the unhealthy unit and start command shall be passed on to next unit.

[iii] In case of more than one number of AC Package unit, the optimum number of package units shall be made operational in order to maintain the necessary temperature & humidity conditions in the switch room / conditioned room.

[iv] Unhealthy condition: Current drawn by individual units as well as supply air temperature at the individual AC units should be displayed simultaneously in the controller. There should be option to program the high and low acceptable levels of both of these parameters (i.e supply air temperature as well as current) through front panel depending on the site requirement. In case of fault, the respective AC unit should be switched OFF and taken out of the running sequence. Alarm should be available for the faulty unit.

[v] Separate auto / manual switch for each circuit is to be provided for bypassing the controller. However manual mode should not be made effective through control card i. e. it should be independent of the control card. All the safeties such as HP / LP, overload, thermostat etc. plus the starting sequence of blower, condenser, compressor and the interlocking of blower with condenser & compressor should be functional in manual mode also.

34.15 AIR DISTRIBUTION SYSTEM

34.15.1 Air distribution system shall comprising of the following:-

[i] Supply & Return Air ducting factory made of commercial grade GI sheet Zinc coating 120 grade, IS: 277 and factory fabricated as per SMACNA-1995 standards and IS-655, but not less than 22 SWG thick. Ducting shall be acoustically insulated with standard size of AC sheets, insulated with 25mm thick resin bonded fibre glass wool (density 24 Kg/Cum) covered with factory laminated aluminium foil fixed with adhesive tape and finally cladded with 26 SWG aluminium sheet & supported by internal channel and clamping. Where these ducts passing through un-conditioned space shall be insulated with 50mm thick fibre glass wool density 24 Kg/Cum, covered with GI chicken wire mesh and cladded with aluminium foil fixed with adhesive tape and finally cladded with 26 SWG aluminium sheet & supported by internal channel & clamping. Wherever the ducting for exposed to sky shall be insulated with 50mm thick resin bonded fibre glass wool of density 24 Kg/Cum covered with polythene sheet faced hessian cloth, GI chicken wire mesh and cladded with sand and cement plaster and supported by MS channel & clamps complete in all respect. Make shall be Rolastar / Zeco / Sail / Tata / Jindal.

34.15.2 The contractor shall examine the entry of supply air duct before quoting.

34.15.3 Aluminium powder coated double deflection adjustable type Supply air grills/diffusers with MS volume control dampers and Aluminium powder coated fixed bar type return air grills/diffusers as required without volume control damper for return air.

34.15.4 Fire dampers automatic type UL stamped fusible plug (CBRI Certified) and operated with stainless steel spring made out of 16 SWG GI sheet and limit switch to be provided in each main supply air duct near plenum in AHU room for each AHU and interlocked with AHU motor to cut off circulation of air in case of fire.

34.15.5 Suitability of existing supply and return air duct examined by the tenderer and to be replaced the same shall be carried out as per approved design by Accepting Officer and all as specified by Engineer-in-charge.

34.15.6 Contractor should submit the drawings of supply and return air ducting with respect to capacity of plants to get the desired room temperature conditions for the approval of Accepting Officer.

34.16 MAIN ELECTRICAL PANEL BOARD

34.16.1 Main electrical panel board shall be provided as specified in schedule items

34.17 EARTHING

34.17.1 Suitable Earthing shall be done with Galvanized steel earth plate electrode of size 600x600x6mm thick buried directly in ground with earth pit not less than 2.25m deep below the normal ground level with top edge of plate not less than 1.5m below normal GL connected to GI strip of size 32x6mm as earth lead by means of bolts, nuts, check nuts and washers of Galvanized iron or steel all as shown in electrical plate No. 3 of SSR Part-I connected to earthing test point all as specified or indicated including testing on completion and as directed.

34.18 **NOTES**

34.18.1 All civil works required to install, test and commissioning of the equipments i.e earth work excavation, foundation for equipment, necessary cable ducts with MS covers 10mm thick duly painted with two coats of synthetic enamel paint over a coat of red oxide primer, excavation for laying pipes, etc and making good the disturbed/demolished/broken surfaces and finish to match with existing specifications including fixing the ducting etc, complete shall deemed to included in the rate quoted by the tenderer.

34.18.2 Manufacturers Technical back up after sales service support shall provided for chiller package.

34.18.3 Suitable supports for holding the ducts will be provided by tenderer as specified and directed. The tenderer shall also examine at site the method of provision of Supply Ducts from unit to entry of the bldg and inside the Conditioned space and any columns/ beams /Angle iron frames etc if required to support the ducts grills is deemed to be included in the quoted rate.

34.18.4 All loads upto 63A shall be controlled by MCB and MCCB for loads above 63A.

34.18.5 Perforated GI sheet cable tray fixed on angle iron supports grouted in wall for carrying all cables shall be provided as specified in Schedules.

34.18.6 Initial charging of oil and refrigerant gas shall deemed to included in the quoted rate.

34.18.7 Any work not included in the above details, but which are essential for technical requirement for the efficient performance and smooth functioning of the plant shall be clearly specified and included in the quoted rate.

34.18.8 The complete plant shall be installed, tested and commissioned only by the **skilled Engineer of the original Manufacturer** of ACs. Necessary confirmation shall be submitted by the contractor after completion of the work with test certificates before department undertakes further testings as per tender and cost is deemed to be included in the quoted rate.

34.18.9 All Equipment shall be connected with earth strip of size 32x6 mm shall deemed to be included in the quoted rate.

34.19 **TESTING OF AC PLANTS**

34.19.1 The contractor shall make arrangements for providing artificial heat load to compensate for the internal load upto the extent specified in the contract if the equipment load is not arranged by the users. Contractor shall make arrangements for providing the occupancy load, if testing with occupancy load is considered necessary.

34.19.2 The testing shall be carried out in the presence of Contractor's qualified representative who shall make such connections, adjustments and modifications as considered necessary to ensure that 'PHYSHOMETRIC' conditions continue to be maintained with the tolerance specified for varying values of internal equipment and occupancy loads and outside conditions of temperature and humidity. All arrangements including various instruments required to facilitate testing shall be arranged by the contractor.

34.19.3 The test results shall be recorded on proper charts as directed by Engineer-in-Charge duly signed by the accredited representative of contractor and department.

34.20 **PHASE – I TEST**

34.20.1 The installation shall be taken over after the plant has been commissioned and the GE is satisfied on the points given below which constitutes **Phase I Test:-**

[i] That the plant equipment and accessories provided are as per contract specifications.

[ii] That all plants, equipments and accessories are mechanically sound and other related items of the air conditioning work are of adequate structural strength and the installation is in conformity with the specifications embodied in the contract.

[iii] That the finish and the general appearance of the work is as per contract specifications.

[iv] That all duct pipes, fittings etc., are of specified size & type, quality design and workmanship and are neatly laid, fixed and painted to match the surrounding work.

[v] That the inside design conditions are achieved and maintained during a test taken for 24 hour continuous running irrespective of any variation in specified equipment and occupancy loads and irrespective of any variation in the ambient condition. Test results shall be recorded. This initial takeover shall be deemed provisional and without prejudice to phase-II test.

34.21 **PHASE – II TEST**

34.21.1 After completion of Phase-I test, the plant shall be continuously run for 24 hours basis by the contractor till completion of all Phase-II tests. Contractor shall deploy adequate technical staff to operate the plant continuously and he shall be liable to carry out all the maintenance required during this period and quoted rates shall be deemed to cater for the same. **The Phase-II test will be carried out by the Accepting Officer or his authorised representative in presence of Engineer-in-Charge and the contractor**. Each test shall last continuously for 3 days [72 hours]. The contractor shall afford all facilities and make all necessary arrangements for these tests. The Phase-II tests shall be carried out as soon as the stipulated load and weather conditions are available but not later than one year after Phase-I test. In case the required load is not available arrangements will be made by the contractor to provide artificial load. These tests comprise of following:-

[i] Hot weather test to be conducted in summer month of April / May / June when the summer condition prevail. The performance results of the plant as a whole shall be recorded in the forms as directed by testing officer duly signed by the accredited representative of contractor and department.

[ii] Monsoon test to be conducted during monsoon period generally during July to September. The performance results of the plant as a whole shall be recorded in the forms as directed by testing officer duly signed by the accredited representative of contractor and department.

[iii] Winter test to be conducted in Dec / Jan and performance results of the plant as a whole will be recorded. The performance results of the plant as a whole shall be recorded in the forms as directed by testing officer duly signed by the accredited representative of contractor and department.

[iv] The GE will be responsible for intimating the dates of Phase-I and Phase-II tests to the contractor.

[v] All expenditure in connection with the tests will be borne by the contractor. The charges for consumption of water and electricity for phase – II tests shall be borne by the department. However, energy charges for electricity will be borne by the contractor if Phase – II test fails and is redone after due repairs. If there are leakages of refrigerant / compressor oil after Phase – I test the same shall be made good by the contractor at his own cost, if it is attributed to the faulty materials / workmanship of the contractor. In case of dispute the decision of the Accepting Officer will be final and binding.

[vi] If the Phase-II tests do not show satisfactory results, the contractor shall at his own expense rectify / replace the defective installation or any part thereof as directed by the Accepting Officer or his authorised representative within three months. The decision of the Accepting Officer shall be final and binding. In such rectification of defect, power consumption charges will be borne by the contractor.

34.22 The installation shall be finally taken over after the contractor has given satisfactory Phase-II test results as certified by the Accepting officer or his representative. The defects liability period of two year as per Condition 46 General conditions of contract [IAFW-2249] shall start from the date of final taking over the plant after Phase-II tests. Thereafter he shall forward a certified final account as stipulated in condition 65 General conditions of contract [IAFW-2249].

34.23 If the contractor fails to attend the repairs / renewals required in the plants / notified during Phase-II test due o which next due seasonal Phase-II test is delayed or shifted over to next year season, this shall be at the cost of contractor.

34.24 **TRAINING OF MES / USERS PERSONNEL**

34.24.1 The contractor shall during installation of the plant be responsible for training personnel [MES or Users] deputed by the Govt for running and maintenance of the installation. The rate quoted by the tenderer shall deemed to be inclusive for the same.

34.25 SPLIT TYPE AC: The machinery shall conform to IS 1391 Part (I & II) 1992, suitable for operation on 230 volts+ 10% single phase AC supply. The unit shall be capable of cooling, dehumidifying, air circulation, ventilation and filtering in the sizes of nominal cooling capacities provided with environment friendly refrigerant. The indoor unit i.e fan coil unit shall be fitted with bacteriological filters, remote operation sensors and suitable drainage arrangement for dehumidified water in fan coil unit. The connection piping between indoor and outdoor unit shall be with copper stranded conductor of adequate size and length.

34.26 HOT /COOLING APPLIENCES: These shall be as specified in Schedule A and approved make shall be fixed in position as directed.

35. **LIGHTENING PROTECTION:**

35.1. **SCOPE OF WORK:** The work shall be carried out as specified hereinbefore and shall comply with code of practice vide IS – 2309-1989 and as specified in clause No. 19.147 to 19.147.9 of MES Schedule Part-I.

35.2. **GENERAL:**

[a] The work under this contract shall be carried out as per IS-2309 and other relevant specifications as applicable to this work and the specifications given hereinafter.

[b] Lightning protection shall be provided generally conforming to the design as furnished in the drawing and specifications. The contractor is advised to study the site conditions before quoting.

35.3. **MATERIALS:** All materials incorporated in the work shall conform to the relevant BS/IS, specifications and shall be of best indigenous make approved by the Garrison Engineer.

35.4. **SAMPLE:** Before commencing the work the contractor shall produce samples of all materials including accessories proposed to be incorporated in the work for the approval of the GE. Samples that are approved will be retained by GE, until the work is finally completed and accepted. Only materials conforming to the approved samples shall be incorporated in the work.

35.5. **HORIZONTAL CONDUCTORS FIXED ON ROOF:** Where horizontal conductors are used for air termination, no part of the roof should be more than 9m away from the nearest horizontal protective conductor except that an additional 300mm may be allowed for each 300mm by which the part to be protected is below the nearest protective conductor. Horizontal conductor shall be provided at the quarter perimeter. The size of the conductor shall be as per Schedule 'A'. Wherever lapping of joints is made the length of the overlap should not be less than this also applies to other types of conductors used in this work. The contact surfaces should be first cleaned and then inhibited from oxidation with a suitable non-corrosive compound.

35.6. **DOWN CONDUCTORS:** The down conductors shall be aluminium strip of size 25x3.15mm [and shall be connecting the air termination to the test poles]. The number of down conductors shall be as shown in the drawing and described in the Schedule, but shall not be less than number indicated in the clause 10.2 of IS – 2309. The down conductor shall be well distributed round the walls of the structure. The place adopted should be such that it is accessible for inspection, testing and maintenance. It should allow the most direct path possible. Fixing arrangements shall be similar to these specified for air terminations. While-right angle bends, if necessary are permissible deep re-entrant loops shall be avoided. Where a loop not be avoided, the conductor shall be arrange in such a way that the distance across the open side of the loop shall be such that it is more than 1/8 the length the loop of the conductor forming the loop. Any extended metal running from the structure shall be bounded to the down conductor at the top and bottom unless the clearance is in accordance with clause 12 of IS – 2309.

35.7. **FASTENERS:**

35.7.1 The fasteners used for fixing various conductors shall be mechanically strong substantial in construction and not subject to breakage. The materials used should be such that no corrosion is caused. The fasteners, similar to these shown in IS – 2309 may be used. Full details of the fastener to be used, method of fixing these to roofs, poles etc, shall be furnished by the contractor. The unit rates inserted for air terminations, down conductors etc, are deemed to include the cost of the fastener also.

35.7.2. The hylam block shall be in two halves with control [grip] slot for holding the horizontal/down conductor. First half of the block of size 75x40x10mm shall be fixed to roof/wall/column by 2 Nos. 50mm long heavy gauge [not less than No 9] brass wood screws/eye bolts and nuts. The screws/bolts shall be fixed in suitable rawl jumper holes filled with grip powder [fill plug powder] by adding 10% cement. The second half shall be screwed half shall be screwed to bottom half by 2 Nos. 20mm long heavy gauge [not less than No.9] brass wood screws.

35.8. **TEST JOINT:** Each down conductor shall be providing with testing joint in such a position that while not inviting unauthorised interference, it is convenient to use when testing. This joint will be provided with suitable cover as shown in drawings. Where aluminium conductors are connected to copper, the joint shall be a thick layer of lead as shown in drawings. The rate for the test joints is deemed to include such joints. No connection, other than one direct to an earth electrode shall be made below the test joint.

35.9. **JOINTS AND BONDS:**

35.9.1. The lightning protection system shall have as few joints as possible. In the down Conductors below ground level there shall be no joints. Where joints are necessary they shall be mechanically and electrically effective and shall be so made as exclude moister completely.

35.9.2. Joints and bonds other than at testing points shall be protected by a suitable material against corrosion. Joints for strip shall be tinned, soldered, welded or braced and at least double reverted. Clamped or bolted joints shall only be used on test points or on bonds to existing metal, but joints for rods may be clamped or screwed type. Protective coating used shall be permanent and non inflammable.

35.10. **EARTH TERMINATION:** An earth termination shall be connected to each down conductor directly or through the earth ring as the case may be. Each of this earth termination shall have a resistance to earth not exceeding 10 ohms. The whole of lightning protection system should have a combined resistance to earth not exceed 2 ohms before any bonding has been effected to metallic or on a structure or to service below ground level. If the value exceeds 2 Ohms reduction should be achieved by increasing the number of earth points. Earth termination should be capable of isolation for testing purposes.

35.11. **CLEARANCE BETWEEN THE LIGHTENING PROTECTION SYSTEM AND METAL ON A STRUCTURE:** Where it is not possible to bond the metal in or on a structure the contractor will ensure the total clearance between the lightning protective system and other metals in the structure shall be as directed by GE.

35.12. **MAKING GOOD OF DISTURBED SURFACES:** The contractor shall make good any disturbed portion of the work to match the surroundings. He shall also make good any minor damages caused to the structures. The rates quoted by the contractor in Schedule 'A' are deemed to include the above provision.

35.13. **AIR TERMINATION:**

35.13.1. This shall be horizontal type comprising of 25x3.15mm aluminium Conductor as shown on drawings. The fixing arrangement to roof/parapet/wall Column shall be by means of hylum blocks of size 75x40x10mm, fixed to roof/parapet/wall/column by 2 Nos. heavy gauge [not less than No.9] 50mm long brass connecting screws/eye bolts and fixed in rawl jumper holes filled by grip powder [fill plug powder] by adding 10% cement. The hylam block shall be in two Valves with a control slot for holding, the conductor firmly. The top half shall be screwed to bottom half by 2 Nos. 20mm long heavy gauge brass screws. The hylam blocks shall be provided at 600mm centres and 150mm distance from edges of Air final termination, test point box and at lap joints. The rate inserted in Schedule 'A' Part IX for horizontal/vertical conductors shall interalia include cost of fixing as above.

35.13.2. Air finial, aluminium with anodized finish of 12mm dia, 600mm long shall be fixed by threading reverted and welded top and bottom of aluminium base plate of size 125x125x10mm.The entire system shall be fixed to hylam block of size 175x175x10mm by 04 Nos. heavy gauge screws [not less than No.9] and shall be fixed to wall/parapet/roof/columns by GI foundation bolts and nuts session on drawing. The rate inserted in Schedule "A" for air terminal shall deem to include the cost of fixing as above and as shown on drawing.

35.14. **TESTING JOINTS/TESTING POINTS CUM GI ENCLOSED BOX:** Phosper bronze / Gun metal / copper test block of size 100x40x30mm, drilled, screwed and fixed to aluminium strip and GI strip by means of 4 Nos. 8mm dia brass screws and washers after drilled and topped. The block shall be fixed to bracket welded to bottom plate of GI box top cover shall be made out of 2mm thick sheet and the bottom shall be 5mm thick MS plate. 4 Nos. suitable studs 8mm dia shall be welded to 5mm thick MS plate at four corners and top cover bottom plate by means of 4 Nos GI nuts and washers. The entire box of size 200x100x100mm shall be hot dip galvanised. Internal surfaces of box and test joint shall be applied with anticorrosive compound. The base plate of box shall be fixed to wall/column by 500mm long brass wood heavy gauge [not less than No.9] screws. Brass screws shall be fixed in rawl jumper holes by means of grip powder [fill plug powder] by adding 10 % cement.

35.15. **EARTH RESISTANCE**

35.15.1. Properly made earth connections are essential to the effective functioning of lightning protection system. Every effort shall be made to provide ample contract with the earth so that the earth resistance can be as low as possible.

35.15.2. The whole of lightning protection system should have a combined resistance to earth not exceeding 10 Ohms before any bonding has been effected to metal in or on a structure or to surface below ground.

35.16. **TESTING:** After completion of work, the entire system shall be tested by contractor in the presence of Engineer-in-Charge and the results of such test shall be recorded and signed by both parties.

35.17 Record Drawings: Contractor has to submit 3 sets of following drawings: - (i) Layout of lightning protection system. (ii) Inventory of fittings & fixtures (iii) Earthing Test Records."

PARTICULAR SPECIFICATIONS [Contd...]

36. **FIRE ALARM & FIRE FIGHTING:**

36.1 **INTELLIGENT – ANALOGUE – ADDRESSABLE – FIRE – ALARM – SYSTEM:**

[a] The work under Fire fighting, fire detection and fire alarm system shall be carried out all as detailed in Schedule "A".

[b] The work under this head shall include provision of intelligent Analogue Addressable Fire Detection and alarm system all as specified in Sch 'A'. The work under system shall consist of furnishing all materials, equipment's and appliances and Labour necessary to install the said system, complete with Detectors, Main Control Panel, Sounders, Strobes, Manual Call stations, relays etc, for interfacing with other systems.

[c] The Tenders shall also undertake to trip from the Fire Alarm Panel through the use of Addressable Output Modules, individual AHU activated by the fire signal of specified detectors and Input Modules for monitoring water flow switches and other contacts like magnetic door contacts.

[d] The general layout of the wiring, detectors, modules etc., shall be designed by reputed fire agency and submitted to GE in four copies for further approval of accepting officer. On approval of layout, the contractor shall submit six sets of approved design to GE and on completion of the contractor shall laminate on set of design and fixed to wall near fire alarm panel.

36.2 **STANDARD:** The system shall meet the following design standard as required by the law of the country. If no specific local laws are available NFPA 72 shall be followed.

36.2.1 Nation Fire Protection Association [NFPA] – USA

No.72	–	National Fire Alarm Code Underwriters Laboratories inc. [UL]-USA
No. 268	–	Smoke Detectors for Fire Protective Signaling Systems
No. 864	–	Control Units for Fire Protective Signaling Systems.
No. 268A	–	Smoke Detectors for Duct Applications.
No. 521	–	Heat Detectors for Fire Protective Signaling Systems
No. 464	–	Audible Signaling Appliances.
No. 38	–	Manually Actuated Signaling Boxes.
No. 346	–	Water flow indicators for Fire Protective Signaling Systems
No. 1971	–	Visual Notification Appliances.

BS 5839 & Local Fire Code.

36.3 **APPROVALS:** The system shall have proper listing and/or approval from the following nationally recognized agencies:

EN-54	EU-Germany
UL	Underwriters Laboratories inc
ULC	Underwriters Laboratories Canada

FM	Factory Mutual
MEA	Material Equipment Acceptance [NYC]
GSFM	California State Fire Marshals

36.4 **FIRE ALARM CONTROL PANEL [FACP]:** This refers to the Intelligent Analogue Addressable Panel that shall be connected to the various detector/devices by means of 2 wire loops. The FACP shall be able to supervise individual detectors for proper performance as well as to give pin point location of fire alarm. Hooter alarm as well as facility for cutting off of AHU's and electrical power is also be included. The panel shall also have the facility for automatically dialing select phone numbers in case of fire.

36.5 **LOOP:** A loop shall mean a 2-wire circuit connecting 250 Addressable Devices, which shall include not more than 125 Intelligent Analogue Addressable Detectors and 125 Intelligent Analogue Addressable input/output Modules. The loop card shall have built in short circuit isolators to accommodate Class A wiring.

36.6 **INTELLIGENT ADDRESSABLE DEVICES:** This term indicates the complete group of intelligent addressable devices such as detectors, Manual Call Stations, Addressable Output/Input Modules etc.

36.7 **DETECTORS:** The detectors shall have intelligent analogue addressable type. The chamber should be easily removable for the purpose of easy maintenance. The address programming shall be done by a hand held programmer or from the FACP. The detectors shall have a common base to allow easy interchange of various types of detectors. Address setting by DIP Switch shall not be acceptable.

36.8 **MANUAL CALL STATION:** The Manual Call station shall be Intelligent Analogue Addressable type with input modules to define the station. The function shall be similar to that of Conventional Manual Call Box and should be reset table with replacing the glass.

36.9. **OUTPUT MODULE:** Output Module shall be Intelligent Analogue Addressable type and shall be used for.

[a] Control and supervision of a notification appliance circuit for 24V DC polarized notification appliance.

[b] Tripping the AHU, fan etc.

36.10 **INPUT MODULE:** The input modules shall be Intelligent Analogue Addressable dual/single channel type Input module shall be used to connect the any normally opened dry contact devices such as break glass point, water flow switches etc.

36.11 **FAULT ISOLATOR MODULE/BASE:** This unit shall be placed on the loop preferably after every 15-20 devices and shall be able to isolate electrical short circuit in the wiring. All the other detectors shall remain functional because of the Class A wiring of the loop. The isolator base shall not utilize an address and shall be built into the detector base wherever required.

36.12 **MONITOR MODULE:** Monitor Module shall be Intelligent Analogue Addressable type. Module shall be used for to connect non-addressable smoke detectors and normally opened dry contact devices such as break glass unit, water flow switches etc.

36.13 **SOUNDERS:** Sounders shall be addressable type. The sounder shall drive power from separate 24 V DC from Control Panel. It shall be capable of being directly mounted on the wall/ceiling. The sounder shall have and output of at least 100 db at 1 m. The Sounder shall be program to get activated in event of an alarm from a single detector/device or a group of detectors/devices.

PARTICULAR SPECIFICATIONS [Contd...]

36.14 **SPECIFICATION:** The design, supply and installation and testing of the entire fire alarm system shall conform to UL, ULC & NFPA 71 & 72. The detectors shall conform to relevant codes of Fire Alarm Systems.

36.15 **FIRE ALARM SYSTEM:**

36.15.1 The fire alarm system shall conform to UL, ULC & NFPA 71/72 in respect of design and installation, and it shall give Audio/Visual Alarm signals when the temperature in case of Heat Detector or smoke density in case of Smoke Detector exceeds the pre-set limit. The system shall give pinpoint location of fire with warning system and voice communication for commands and instruction if required.

36.15.2 The system shall be Intelligent Analogue addressable type. The basic function of the system shall be able to achieve pinpoint location of alarm indicator.

36.15.3 It shall be possible to program each loop with up to specified detectors and input/output modules.

36.15.4 Annunciation facility shall also be added into the FACP, the panel being able to initiate alarm signal for any particular zone.

36.15.5 The system shall be fully supervised for all fault conditions with distinctive alarm operated for fault and fire conditions.

36.15.6 The FACP shall be so programmed that when a particular detector or group of detectors gives a fire signal the FACP should be able to trip an individual AHU automatically. In case of fire in a area handled by an AHU the FACP shall be able to trigger a Relay that shall shut off the AHU through an additional contact provided in the AHU panel by the AC contractor.

36.15.7 The FACP shall have the provision for adding extra loop cards. One loop cards shall be incorporated it the FACP at all times. The software shall allow changing the terminal of any of the loops from any operating card to the spare card.

36.15.8 The FACP shall be networkable and shall be connect up to specified FACP & 1,60,000 Addressable devices.

36.15.9 All detectors input/output modules and control panel should be of same manufacturer.

36.15.10 System itself shall have facility to connect security and access control devices such as motion detectors, keypad/display, card reader, card reader controller etc.

36.15.11 System Fire Graphics software shall have provision to interface and monitor the CCTV cameras.

36.16 **FIRE ALARM CONTROL PANEL [FACP]:**

36.16.1 The control panel shall be one of the latest generations of Intelligent Analogue Addressable System. The Fire Alarm Control Panel shall be microprocessor based fully Intelligent Analogue Addressable, Intelligent Analogue Control unit which shall control all Intelligent, Analogue, Addressable, Detectors, Manual Call stations and Switching Systems. [For disconnecting AHU and power supply] connected to it. All addressable units shall be connected to the FACP through the loop cards and shall be addressed through individual numbers.

36.16.2 Loop card shall communicate with devices in digital form.

36.16.3 The FACP shall itself have one loop card build in and expandable to ten loops by adding loop cards. Each loop shall be able to address 250 Addressable Devices. At least specified FACP unit may be networked to enhance system capacity as and when required. All the networked panels shall display all the events occurring anywhere in system. Each FACP on the network shall effectively function as a repeater panel as well.

36.16.4 Loop Card shall have auto-lane facility. Auto-lane facility means loop card lanes where each device is installed relative to other devices on the circuit.

36.16.5 Control panel shall allow for cross zoning or looping of sensors i.e. a detector on any loop may be assigned to any zone. This will prevent the need for excessive wiring.

36.16.6 The control panel should contain a non-volatile Historical Event Log with date and time and with minimum of 1500 events ready for display or printing.

36.16.7 The control panel shall have a CPU watch dog circuit to initiate trouble should the CPU fail.

36.16.8 The control panel shall have automatic detector maintenance alert.

36.16.9 The control panel shall have provision to enable or disable any addressable devices through panel keypad.

36.16.10 The control panel shall allow the programming of any input to activate any output or group of outputs.

36.16.11 Passwords shall protect any changes to system operation.

36.16.12 System shall provide with Ground fault LED to indicate system Ground Fault. The general layout of the wiring, detectors, modules, etc., is o be designed by reputed fire agency duly approved by CFEES Delhi is to be submitted to GE in two copies for further approval of Accepting Officer within one month of acceptance of tender. On approval the contractor shall submit six sets of approved design to GE and on completion of work the contractor shall laminate one set of design and fixed to wall near fire alarm panel.

36.16.13 The FACP shall also give adequate warning signal whenever there is dust accumulation in detectors, and up to the point of its replacement it should be possible to change the level of ambient alarm calibration condition either by the use of software program operable by the owner or by resetting the detector.

36.16.14 Short/Open circuit units shall also be reported at the FACP. In such cases, the system through the use of fault isolators shall be able to isolate that segment between the two fault isolators. The missing Detectors/Devices shall also be reported at the FACP with identification of the location.

36.16.15 The FACP shall have the facility to perform walk test smoke sensor sensitivity remotely. It shall also be possible to set the sensitivity to a global high or global low based on night or day time.

36.16.16 The FACP shall have the facility to perform walk test such that an operation can periodically checked out for all initiating devices. As such device is placed into alarm the FACP shall print the condition and automatically reset the device. If a zone is inadvertently let in walk test mode, it shall automatically reset to normal after the idle time is exceeded. During the work test the zones other than the programmed zones shall be under continuous supervision [normal mode]. In case of any alarm initiated by detector/devices the walk test shall get terminated automatically.

PARTICULAR SPECIFICATIONS [Contd…]

36.16.17 Programming function shall include alarm/trouble type assignment, point descriptor assignment, alarm message assignment, etc.

36.16.18. Utilising the PC setup software via laptop/desktop computer may carry out programming by authorized trained person only.

36.16.19 The FACP shall have a Liquid Crystal Display of Alphanumeric type to indicate immediately all conditions. The display should be high resolution, backlit 8 [Lines] X 21 Character. The FACP shall also be able to carry out continuous self-monitoring when in normal condition.

36.16.20 FACP shall have external printer coupled to the FACP, which shall log all events with time. The printout shall clearly indicate the event-Fire/Fault etc., with the unit address and time.

36.16.21 The FACP also is able to actuate switches automatically in case of Fire condition that of AHU's and power supply or other systems such as piped pressurized gas supply.

36.16.22 The system shall be fail safe and adequate safe guards should be undertaken that in the event of failure of a part of the system it should not handicap the complete system.

36.16.23 The FACP shall also have its own Battery Backup of a minimum of 48 hours in normal run and then half an hour in alarm condition.

36.16.24 It shall be able to withstand temperature variations from O centigrade to 55 centigrade Further, Relative Humidity [non-condensing type] up to 95% shall not hamper its performance. The voltage rating shall be from 17 V DC to 31 V DC, through the voltage may change depending upon the working voltages of a proprietary FACP.

36.16.25 The FACP shall be totally enclosed dust and vermin proof type made of minimum 16 gaude dust inhibited sheet with even baked finish. The FACP shall be of completely solid stage design. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

36.16.26 The logic circuitry shall be based on high noise immunity solid stage hardware employing modular construction. Logic Cards shall be of epoxy fiber glass construction.

36.16.27 The FACP shall have UL, ULC, LPCB, FM approval.

36.16.28 The system shall be designed such that it shall be possible to add at least 20% of the specified Detectors for future expansion without extra cost on the panel.

36.16.29 The FACP shall be capable of being networked [future expansion] with other same make FACP's located at different part of the premises through a single RS 485 bus.

36.16.30 The FACP shall have provision for interfacing with the Public Address System.

36.16.31 The FACP shall have integrated voice evacuation facility.

36.16.32 The panel should have a minimum of specified zones and each zone shall have LED's to indicate independently fire and fault conditions on the panel.

PARTICULAR SPECIFICATIONS [Contd…]

36.17 **ADDRESSABLE DETECTORS:**

36.17.1 Detectors shall be intelligent Analogue Addressable types.

36.17.2 Each Detector shall have integral microprocessor. That measure and analyse gathered information and make its own decision and shall not be depends on loop controller.

36.17.3 Detectors addressing by means of electronics [not dip switches type].

36.17.4 Detectors shall have self-diagnostics and history log.

36.17.5 Detectors shall have automatic day/night sensitivity adjustments.

36.17.6 Detectors shall have automatic identification of dirty on defective detectors.

36.17.7 Detectors should work as standalone incase of CPU failure.

36.17.8 The detector shall have environmental compensation Environmental compensation means the sensing element adapts to long-term changes caused by direct, humidity, aging etc.

36.17.9 Detector shall have non-voltaic memory for storing detector type, serial number, address, date of manufacture, hours of operation, last maintenance date, date and time of last alarm, number of recorded alarms and troubles.

36.17.10 All detectors are fitted with plug-in system type connection, from the maintenance and compatibility point of views. An alarm release will not effect a detector's good functioning. After resetting the alarm, the detector will resume operations without readjustment of any kind.

36.17.11 The detector shall be able to sense incipient fire by detecting the presence of visible and invisible products of combustion. The detector shall be suitable for low voltage [17 V to 24 DC] two wire supply. The detector shall be provided with Twin LED indication for fire and normal condition, the sensitivity of the detector shall not vary with change in ambient temperature, humidity, and pressure or voltage variation.

36.17.12 Neither its performance shall be affected by air velocity up to 20 metres per second. The detector shall be suitable protected against dust accumulation/ingress and it shall be free from maintenance and functional tested at intervals. All detectors shall be identical in construction design and characteristic to facilitate easy replacement.

36.17.13 The coverage per smoke detector shall strictly follow IS – 2189 standards. It shall be possible to connect Smoke Detector with Heat Detector or Manual Push Button in the same circuit. The sensitivity of Detector shall be set from the FACP to suit the site requirement.

36.17.14 It shall have in built locking mechanism to check the removal and pilferage of the detector. The quiescent current flow must be exceeding 50 micro amps and alarm condition current shall be maximum 50 milliamps.

36.17.15 The smoke detector shall be Intelligent Analogue Addressable type and be able to send digital output to the FACP by the pulses emitted from the FACP.

36.17.16 The base of the Detector shall be electronic free and interchangeable with other smoke or heat detectors. The enclosures shall meet IP-42 protection grade.

36.17.17 It shall be able to withstand temperature variations from -10 degree centigrade to 50 degree centigrade. Further, relative Humidity [non-condensing type] upto 80% shall not hamper its performance. The voltage rating shall be from 17V-24V DC though the voltage may be changed depending upon the working voltages of a proprietary FACP.

36.17.18 The detector shall have UL/FM, ULC, LPCB approval.

36.17.19 It shall be possible to mount the detectors in Duch Casting Unit for sampling of supplying Air from the AHU's.

36.17.20 Secondary response indicators shall be provided for all the Above False Ceiling Detectors and closed room detectors.

36.17.21 LED on the detector shall blink each time the sensor is scanned by the FACP, if the FACP determines that the sensor is in alarm., the FACP will command the sensor LED to remain on to indicated the same.

36.17.22 It shall be possible to connect sounder base on the detector loop. The sounder shall have a sound output of at least 100 db at 1 mtr.

36.18 **INTELLIGENT ANALOGUE ADDRESSABLE PHOTOELECTRIC SMOKE:**

36.18.1 These detectors should be able to detect fire by sensing smoke at incipient stage. The sensor should be able sense the visible aerosol of fire.

36.18.2 Photo Electric Smoke Detector shall operate on the light scattering principles.

36.19 **INTELLIGENT ANALOGUE ADDRESSABLE HEAT DETECTOR**

36.19.1 Detectors shall be Intelligent Analogue Addressable types.

36.19.2 Detectors shall have both rate of rise and fixed temperature operation.

36.19.3 Each Detector shall have integral microprocessor. That measure and analyse gathered information from connected components and makes its own decision.

36.19.4 Detectors addressing by means of electronics [not dip switches type]

36.19.5 Detectors shall have self-diagnostics and history log.

36.19.6 Detectors shall have automatic identification of dirty on defective detectors.

36.19.7 Detectors shall have non-environmental compensation. Environment Compensations means the sensing element adapts to log-term changes caused by direct, humidity, aging etc.

36.19.8 Detectors shall have non-volatile memory for storing detector type, serial number, address, date of manufacture, hours of operation, last maintenance date, date and time of last alarm, number of recorded alarms and troubles

36.19.9 All detectors are fitted with plug-in system type connections, from the maintenance and compatibility point of views. An alarm release will not effect a detector's good functioning. After resetting the alarm, the detector will resume operations without readjustment of any kind.

36.19.10 The detector shall be suitable for low voltage [17V to 24V DC] two wire supply. The detector shall be provided with Twin LED indication.

36.19.11 Neither, its performance shall be affected by air current up to 25 metre per second. The detector shall be suitably protected against dust accumulation/ingress and it shall be free from maintenance and functionally tested at intervals. All detectors shall be identical in construction design and characteristic to facilitate easy replacement.

36.19.12 The coverage per heat detector shall strictly follow IS – 2189 standards. It shall be possible to connect Smoke Detector with Heat Detector or Manual Push Button in the same circuit.

36.19.13 It shall have in-built locking mechanism to check the removal and pilferage of the detector. The quiescent current flow must be exceeded 50 micro amps and alarm condition current shall be maximum 50 milliamps.

36.19.14 The Heat Detectors shall be Intelligent Analogue Addressable type and be able to send digital output to the FACP regarding its condition. It shall be able to communicate with the FACP by the pulses emitted from the FACP.

36.19.15 The base of the Detector shall be electronics free and interchangeable with other smoke or Heat Detectors. The enclosures shall meet IP 42 protection standard.

36.19.16 It shall be able to withstand temperature variations from 0 degree centigrade to 55 degree centigrade. Further, Relative Humidity [non-condensing type] upto 95% shall not hamper its performance. The voltage rating shall be from 17V-24V DC though the voltage may be changed depending upon the working voltages of a proprietary FACP.

36.19.17 The Detector shall have UL/FM, ULC approval.

36.19.18 Secondary response indicators shall be provided for all the above False Ceiling Detectors.

36.19.19 LED on the detector shall blink each time the sensor is scanned by the FAS. If the FACP determines that the sensor is in alarm, the FACP will command the sensor LED to remain on to indicated the same.

36.19.20 The shall be possible to connect sounder base on the detector loop. The sounder shall have a sound output of at least 100 db at 1 mtr distance.

36.20 **MANUAL CALL STATIONS**:

36.20.1 The manual Call Stations shall have UL, ULC, LPCB, FM approval.

36.20.2 Manual Call Station shall be Intelligent Analogue Addressable types.

36.20.3 The Manual Station shall be a press to break type. The device shall be red in colour and suitable for surface or flush mounting. Manual Station shall be interfaceable to an addressable input module that can be accommodated within these devices. The manual station shall have normally open fire alarm and Annunciator contacts and these contacts shall close on activation. Contacts shall remain closed until station is manually reset.

36.20.4 Each manual Call stations shall have integral microprocessor. That measure and analyses gathered information and makes its own decision and shall not be depends on loop controller.

36.20.5 Manual Call Station addressing by means of electronic [not deep switches type,]

36.20.6 Manual Call Stations shall have self-diagnostics and history log.

36.20.7 Manual Call Stations shall have non-volatile memory for storing module type serial number, address, date of manufacture, hours of operation last maintenance date, date and time of last alarm, number of recorded alarm and troubles.

36.21 **INPUT MODULES:**

36.21.1 The input modules shall be Intelligent Analogue Addressable dual/single channel types. Input module shall be used to connect any normally opened by dry contact devices such as manual break glass unit, water flow switches etc.

36.21.2 The Input Modules shall have UL, ULC, LPCB, FM approval.

36.21.3 Modules shall be Intelligent Analogue Addressable types.

36.21.4 Each module shall have integral microprocessor. That measure and analyses gathered information from connected components and makes its own decision.

36.21.5 Modules addressing by means of electronics [not dip switches type].

36.21.6 Modules shall have self-diagnostics and history log.

36.21.7 Modules shall have non-volatile memory for storing Module type, serial number, address, date of manufacture, hours of operation, last maintenance date, date and time of last alarm, number of recorded alarms and troubles.

36.21.8 Modules shall be suitable for low voltage [17 V to 24V DC] two wire supply. Modules shall be provided with Twin LED indication.

36.21.9 Input modules shall have multiple applications such as alarm, delayed latching [retard] for water flow switches, supervisory, etc.

36.21.10 Module shall allow the programmer to select the Module for particular application.

36.22 **OUTPUT MODULES**:

36.22.1 Output Module shall be Intelligent Analogue Addressable type and shall be used for:

[a] Control and supervision of a notification appliance circuit for 24V DC polarized notification appliances.

[b] Tripping the AHU fan etc.

36.22.2 The output module shall have UL, ULC, LPCB, FM approval.

36.22.3 Modules shall be Intelligent Analogue Addressable types.

36.22.4 Each Module shall have integral microprocessors. The measures and analysis gathered information from connected components and makes its own decision.

36.22.5 Modules addressing by means of electronics [not dip switches types].

36.22.6 Modules shall have self-diagnostics and history log.

36.22.7 Modules shall have non-volatile memory for storing Module type, serial number, address, date of manufacture, hours of operation, last maintenance date, date and time of last alarm, number of recorded alarms and troubles.

36.22.8 The Modules shall be suitable for low voltage [17V to 24 V DC] two wire supply. The Modules shall be provided with Twin LED indication.

36.23 **REPEATER PANEL**:

36.23.1 The repeater Panel shall have UL, ULC, LPCB FM approval.

36.23.2 The Alarm Repeater/Annunciator Panel shall display fire/fault messages simultaneously with the FACP, it shall be capable of interfacing with FACP on a single RS 485 Bus. The Panel shall be capable of operating on 24 V DC supply.

36.23.3 The panel shall have 8x21 character backlit alphanumeric LCD Display which shall display date time and description of alarm/trouble events that are displayed in the FACP with an inbuilt buzzer to indicate fault/fire alarm.

36.23.4 The Repeater Panel shall be powered from the FACP.

36.23.5 It shall have control keys for Alarm Silence, Trouble Silence and to Reset the FACP from the repeater station.

36.23.5 More number of LCD Repeater Panels [Only Repeat Panels] should be able to be connected on the same communication line.

36.23.6 Repeater Panel shall allow the programmer to program the Repeater Panel to display the fire and fault condition of a particular loop or a particular panel.

36.24 **SPRINKLER SYSTEM:**

36.24.1 Tapping shall be taken from each riser and a network of piping shall be kept under pressure and whenever sprinkler bulb breaks, water sprinkled immediately and the reduction of pressure automatically sensed thereby switching ON the sprinkler pump. The applicable codes and Latest Standards published by the Bureau of India Standards shall govern the design, workmanship, quality and properties of materials and method of testing.

36.24.2 After erection, the sprinkler system shall be tested to show the satisfactory performance in line with the requirements of the specification. The following tests shall be undertaken:

[i] Automatic starting of sprinkler pumps by actuating the sprinkler head.

[ii] Automatic starting of all fire pumps without breaking the sprinkler bulbs by operating the test valves in the pump house.

[iii] Complete sequence of sprinkler annunciator panel shall be activated for the system requirement.

36.24.3 **Record Drawings**: Contractor has to submit 3 sets of following drawings: -

(i) Layout /line plan of fire alarm system.
(ii) Inventory of fittings & fixtures
(iii) Operation & Maintenance manual.
(iv) Site Test Records."

36.25 **FIRE HOSE PIPE & HOSE COUPLING:**

36.25.1 This shall be of size 63mm controlled percolation type manufactured by Jai Shree Textiles Limited and bearing the ISI mark specially designed for Fire Fighting purpose and duly approved by Tariff Advisory Committee. It shall comply with IS-8423 – 1977.

36.25.2 All hose coupling shall be of instantaneous spring lock type and nozzle shall be of 20mm dia.

36.25.3 **HOSE CABINET:** This shall be made of mild steel with glass in front to accommodate two pieces of hoses pipes and one branch pipe with lock and key.

36.26 Record drawings: Contractor has to submit 3 sets of following drawings: -

(i) Layout /line plan of fire alarm system.
(ii) Inventory of fittings & fixtures
(iii) Operation & Maintenance manual.
(iv) Site Test Records."

36.26.1 After completion of work, the entire system shall be tested by contractor by 3rd party viz TUV/ LRS/ IRS as approved by GE in the presence of Engineer-in-Charge and the results of such test shall be recorded and signed by both parties. Quoted rates shall be inclusive of testing in accordance with the modern Engineering practice and MES SSR Part-I (specifications).

36.27 **FIRE FIGHTING:**

36.27.1 **SCOPE OF WORK:** The scope of work consists of the following:

[a] Provision of MS ERW/ DI pipes.

[b] Fire fighting Equipment viz. Fire hydrant's Stand Post type, Rubber lined hoses, first aid hose reel, fire hose delivery couplings, branch pipes, nozzles etc.

[c] Provision of Sluice Valves, Butterfly Valves, Valve pits etc.

[d] Third Party Inspection of pipes

[e] Testing and commissioning of installation

[f] Spilt Casing, multistage, electrical motor driven centrifugal pump, Diesel engine driven pumps, jockey centrifugal pump, centrifugal mono block pump and connected items as specified in Schedule "A".

36.27.2 **GENERAL:** Scope of work has been specified in Schedule "A". Tenderer is to design, supply, install, test and commission of fire fighting system. Pipeline layout and position of each fire hydrant to be shown in as built drawing.

36.27.3 APPLICABLE CODES AND STANDARDS:

IS – 908	Fire Hydrants stand post type
IS – 636	Specification for rubber lined hose [63mm dia hoses]
IS – 14846	Specification for sluice valves for water works purpose
IS – 884	Specification for fire hose delivery couplings, branch pipe, nozzles and nozzle spanner
IS – 8329	Ductile Iron pipes
IS – 9523	Ductile Iron fittings
IS – 12288	Laying of Ductile Iron Pipes
IS – 5382	Quality of Rubber Gasket
IS – 12820	Dimension of Rubber Gasket
IS – 1239, IS 3589, IS 4923	Steel pipes, ERW Steel tubes dimensions

The IS codes specified as above or latest IS codes applicable

36.27.4 **FIRE FIGHTING PUMP:**

36.27.5 **PUMP:**

[a]	Discharge	As specified in Schedule "A"
[b]	Head	As specified in Schedule "A"
[c]	Type of Pumps	As specified in Schedule "A"
[d]	Pipe line size	As specified in Schedule "A" or As shown on drawing
[e]	Minimum pressure required at each fire hydrant at fag end	5.25 KG/Sq.cm or higher if needed
[f]	Minimum discharge required through 5 mm nozzle when fixed on 30 m length of hose pipe	800 Litres / Minute or as per latest standards
[g]	Height up to which one jet shall throw water	As specified in Schedule "A"
[h]	Horizontal distance to be covered by one water jet	As specified in Schedule "A"

36.27.6 Pump shall conform to provision of IS – 12469. Material used in pump will be corrosion resistant like brass or bronze having minimum copper content of 80 percent.

36.27.7 The pump casing shall be axially split or radially split with back pullout features to permit examination of impellers and other interior parts without disturbing suction of discharge piping. A drain opening shall be provided so that all the water piping. A drain opening shall be provided so that all the water in pump casing can be drained. Impellers and wearing rings shall be of corrosion and abrasion resistant material. Shaft sleeve, sealing cage, gland nut and drain plug shall be of corrosion resistant material. Impeller shall be of stainless steel.

36.27.8 Line shaft sections shall be connected by a threaded coupling or a muff or a sleeve coupling. Water lubricated bearing shall be used. It shall consist of cutlets rubber molded in corrosion resistant metal shells.

36.27.9 The pump shall have continuously rising type performance characteristic. The pump shall give not less than 150% of the rated capacity at a total head of not less than 65% of the total rated head. The shut off head shall not exceed 120% of the rated head.

36.27.10 **ELECTRIC INTERLOCK:**

36.27.10.1 Jockey pump will be connected from main fire fighting tank for suction and to the main header which is again connected to air vessel. Air Vessel will have three pressure differential switches. First pressure differential switch will give command signal to Jockey pump starters to start the pump when pressure in air vessel goes lower than 9.0 KG/Sq.cm. Second pressure switch will give command signal to stop jockey pump when pressure in air vessel reaches 10.5 KG/Sq.cm. Third pressure switch will give command signal to start main fire fighting pump when pressure goes lower than 5.25 KG/Sq.cm. All these four pumps shall have interlocking and safety feature as enumerated below:

[a]In case main pump starts and jockey pump is also running then jockey pump should stop automatically,

[b] In case first jockey pump gets the command signal to start but fails to start, it will give command signal to second jockey pump. If both the jockey pumps fail to start, then it should give an alarm which will stop when it is acknowledged. Same arrangement shall be made for main fire fighting pumps.

[c] Both the main fire fighting pumps shall be numbered as 1 & 2. Command signal to start the main pump will first give command to pump No.1. In case it fails to start, it will give command signal to pump No. 2 to start and give alarm also.

36.27.10.2 There shall be a panel to house all the starters and logic control connected from differential pressure switches. Cost of all these arrangement including hooter for alarm, relay, contactors, panel, wiring required for making logical control for all these pumps and their safety features is deemed to be included in the quoted cost of Jockey running/ OFF position through green/red lights.

36.27.10.3 In Schedule "A", pressure gauge have been catered though position of pressure gauges has not been marked in drawing. Position of fixing these gauges will be shown by Engineer-in-Charge during the course of execution. These pressure gauges shall be fixed on line but not in the pump house. Pressure gauges to be fixed with pumps and air vessel is already covered under Schedule "A" with respective items.

36.27.10.4 At each hydrant point fitted externally, 100 mm dia stand post shall be provided with 63 mm dia single outlet landing valve as shown in drawing. For internal fire hydrant fitted inside the building. Suitable CI Pipe shall be provided as a stand post and single outlet fire hydrant with hose reel as given in Schedule "A" shall be fixed. The location of single out let fire hydrant has been shown is firm as fire hydrants, for Bldg shall be the location as directed by GE.

36.27.11 **BRANCH PIPE:** It shall conform to IS – 9871 or latest IS. Branch pipe shall consist of body, diffuser and nozzle. Casting and forging of branch pipe shall be made of copper alloys. All parts shall be of good workmanship and finish. The forging and casting shall be sound and free from pits, blow holes, scales, cracks and other imperfections and hall not repaired or filled so as to hide casting defects. The waterway shall have a smooth finish. The interior of the fitting hall be rounded and made smooth.

36.27.12 **LANDING VALVE:**

36.27.12.1 Valves shall confirm to IS – 5290 or latest IS. Valve body, stop valve, check nut, instantaneous female outlet, male outlet and blank cap shall be made of leaded tin bronze. The valve spindle shall be made of brass rod. The hand wheel shall be made of mild steel.

36.27.12.2 All parts shall be of good finish, clear of burrs and sharp edges. All castings shall be clean and sound and shall be free from plugging, welding or repair of any defect.

36.27.12.3 The valve top except the face of the flange and the instantaneous outlet shall be painted fire red of shade No. 536 of IS – 5 or latest IS. The outside of instantaneous outlet hall be highly polished. The hand wheel shall be painted black. Paints shall conform to IS – 2932 or latest IS.

36.27.13 **HOSE PIPE:** All hose shall be of 63 mm dia of rubber lined, woven jacketed complying with Type – II [reinforced] rubber lined conforming to IS – 636.

36.27.14 **COUPLING:**

36.27.14.1 All male/female coupling fitted with hose, nozzle shall be of instantaneous spring lock type and the nozzle shall be of not less than 25mm in dia. Coupling branch pipe and nozzle hall comply with IS – 903. Material of coupling shall be copper alloy conforming to details given in IS – 903. Hose shall be attached to the coupling the following manner:

36.27.14.2 Each half of the coupling shall have two 5 mm diameter holes drilled in the tail. The hose shall be first fixed to the tail of the coupling with copper rivets then served or bound with 1.5 mm copper wire for a length of 50 mm which will extend to the outer end of the grooving on the coupling tail; over the copper wire leather or equally protective band shall be bound with four strands of 1.12 mm copper wire at each end of the band. The protective band shall be carried beyond the tail of the coupling to prevent kinking. Copper wire used shall be softened before being used. Coupling attached to the shoe otherwise than by copper rivets shall not be accepted as they are apt to become dislodged under pressure.

36.27.15 **AIR VESSEL:**

36.27.15.1 Air vessel of adequate capacity should be installed in the pump house, with pressure switches incorporated on the delivery pipe. There should be two pressure switches – one with upper and lower limit for jockey pump and another only for lower pressure limit for the main pump. Topping of main pump should be done by manual push button which should be prominently indicated on the pump panel.

36.27.15.2 The air vessel required to be connected with common header so that Jockey pump and main pumps can be monitored. Pressure vessel shall be of vertical type having built in flanged inlet outlet connection of suitable size. The pressure vessel should be fabricated with min 6.0 mm thick M.S sheet and given two coat of epoxy paint over a coat of primer on both inside and outside surface. Minimum dimension of Air vessel shall be as under:

[a] Dia of air vessel **:** 0.80 Metres

[b] Height of air Vessel **:** 1.20 Metres

[c] Volume of air vessel **:** 540 Litres

36.27.16 **HOSE CABINET:** Hose cabinet will have adequate space to house 30 metre long hose, Fire hydrant, branch pipe, adopter etc. Hose cabinet shall be fabricated with 3 mm thick MS sheet duly coated with 1 mm thick FRP coating on both surfaces [internal and external]. Each box shall include the following features:

[a] Glazed with wired glass.

[b] Fire brigade dry hose painted on the inner face of the glass in 50 mm block letters.

[c] Fastened only by a spring lock which can also be operated from the inside without a key after the glass has been broken.

36.27.17 **FIRE HYDRANT STAND POST:** Fire hydrant shall consist of MS pipe as per IS – 1239 or latest IS. The fire hydrant valve shall be gunmetal as per IS – 318, LTB2 grade, spindle shall be brass. The complete item shall have TAC approval.

PARTICULAR SPECIFICATIONS [Contd…]

36.27.18 **NON – RETURN VALVE:** For domestic fresh water, technological water and recalculating water pumps, non return valve shall be able to withstand gauge working pressure as 1.0 MPA. For fire fighting it shall be able to withstand 1.6 MPA gauge working pressure. Material, size, weight and design shall conform to IS – 5312 [Part – I]. Material of various parts shall conform to basic material given in IS – 5312 [Part – I] and not alternative material suggested in the IS. Valves shall be provided with by pass arrangement, 15mm size stop valve conforming to IS – 781 shall be provided to control the flow in by pass line and cost of this line and valve is deemed to be included in the quoted cost of non return valve.

36.27.19 **FOOT VALVE:** Foot valve will have a strainer as an integral part. It should conform to IS – 10808 / IS – 4038. The total area of the opening in a strainer should be such that the velocity head is minimum. In any case it should be more than the cross sectional area of the suction pipe. The strainer should have smooth slotted perforations, which are properly streamlined to reduce turbulence of flow into it. Area of opening of the base plate on which the valve rests should be equal to or more than the area of the suction pipe. The valve should be so hinged that it opens nearly full.

36.27.20 **DIESEL ENGINE DRIVEN PUMP:**

36.27.20.1 Design, Supply, installation, testing & commissioning of diesel Engine driven pumps, horizontal split case, with gland packing and cables etc., to deliver Capacity as specified in BOQ or suitable HP discharge, It should confirm to NFPA-20/IS-12469, complete with level switch arrangement for fuel oil storage tank accordance with latest IS code, coupling, foundation bolts coupling guard, Residential grade exhaust, cooling piping etc.

36.27.20.2 Exhaust piping should be thermal insulated. Shut off pressure shall not exceed 120%. The power rating should consider the altitude and temperature factor of the site and have the base power higher of the following two factors - (The power required to drive the pump set at 150% of its rated discharge). Materials of construction of the pump should be C.I. (IS:210 Gr FG260) casing, Bronze LTB2 (IS:318, Gr LTB2) impeller and SS 410 shaft & shaft sleeve.

36.27.20.3 The panel shall be provided with battery charger along with all necessary selector switches and indicators such as Indication lamp (LED type) - Ac supply on, start failure, Low lub oil pressure, high water temp., over speed trip, low fuel level, water heater on, engine running, hooter off, Hydrant pressure normal, Switch / Push buttons - Start, stop, reseat, hooter on/ off, supply on / off, charging selection, auto / off / manual, water heater on / off , Meters – DC Amps., DC voltage. assembled and Factory Tested complete confirming to latest IS code.

36.27.20.4 TESTING: Pump performance shall be computed from the pump curves provided by manufacturer.

36.27.21 **APPROVAL DRAWING:** The contractor has to submit the drawings for approval of accepting officer before manufacture and supply for execution at site.

36.27.22 **INSPECTION:** The contractor has to arrange online/visual factory inspection before dispatch of material to the site and the cost incurred for the same is deemed to be included in the quoted rate and the same has to be intimated to the department.

36.27.23 **TESTING AND COMMISSIONING:** The Diesel Engine load test in accordance with latest NFPA 20/IS code, which is deemed to be included in quoted rate will be carried out after successful testing and commissioning of Diesel Engine driven pump set in presence of Electrical Inspector/rep of DGNP(V) nominated by accepting officer and the contractor has to be submit the test results obtained in 03 copies to the department.

36.27.24 **RECORD OF MANNUAL & DOCUMENTATION:**

(a) The contractor has to submit the 03 sets of as built drawings and submission of manuals and documentations complete after successful completion of testing and commissioning of the Pumps and Motors.
(b) The complete external fire fighting pipe line and hydrant system including the Coordinates of pipe line and numbering of hydrants complete all as specified and directed by Engr-in-Charge.

(c) The Third party inspection test reports of the fire fighting hydrant system complete to be submitted to the department in 03 sets.

36.28 COUPLED CENTRIFUGAL PUMPING SET EQUIPMENT [PUMPS]:

36.28.1 **TYPE:** The domestic water pumps shall be Horizontal split casing multi stage pump shall conforming to IS – 1520: 1980 or latest IS and shall be of make given in the tender. The equipment shall be capable of developing the required total head at rated capacity. The pumps shall run smooth without undue noise and vibration. The magnitude of peak to peak vibration at shop shall be limited to 75 microns at the bearing housing. After installation at site the magnitude of vibration shall be limited to 50 microns. The pump shall be coupled or connected to motor.

36.28.2 **PUMP:** The pump shall be coupled or connected to motor. The pump casing shall be of cast iron. Impeller shall be of bronze hydraulically balanced and keyed to shaft. Stuffing boxes with mechanical seal shall be integral with casing and water sealed shaft sleeve shall be of gunmetal extending through stuffing boxes.

36.28.3 **CASING:** Pump casing shall be close-grained cast iron of heavy section, horizontal split-casing making possible complete servicing of rotating parts without breaking piping or motor connection. Motor to pump connection shall be done with flexible coupling. Suction passages shall be of volute form promoting smooth entry to impeller and increased efficiency.

36.28.4 **IMPELLER:** Impeller shall be of bronze or gunmetal double suction, enclosed type and hydraulically balanced so as not to cause any vibration during operation. Impeller shall be securely keyed to the shaft. Means shall be provided to prevent loosening during operation including rotation in reverse direction. Impeller fastening nuts [if provided] shall be of cap type and shall tighten in the direction of normal rotation.

36.28.5 **WEARING RINGS:** Wearing rings shall be renewable type. These shall be held in place by screwing against rotation, press fit and locked with pins, flanged and screwed.

36.28.6 **SHAFT:** Shaft shall be made of steel, protected by gunmetal sleeves. It shall be finished to close tolerance at the impeller coupling pulley and bearing diameter. The impellers pulley and shaft sleeves shall be firmly secured to the shaft by key/nuts. The shafts size shall be calculated on the maximum combined shear stress. The shear stress shall not exceed 30 per cent of the elastic limit in tension or 18 percent of ultimate tensile strength whichever is lower.

36.28.7 **SHAFT SLEEVES:** Shaft sleeves shall be of gunmetal, provided to protect the shaft where it passes through stuffing boxes. Shaft sleeves shall be securely locked or keyed to the shaft to prevent loosening. Rotating shaft and shaft sleeves shall be machined and assembled for concentric rotation.

36.28.8 **BEARINGS:** The bearing may be ball roller or sleeves type. Provision shall be made to take axial and radial loads. Oil level indicators shall be provided in oil baths. Where there is a possibility of liquid entering the bearing, the pump shall be provided with suitable preventive arrangement such as water deflectors. Bearings shall be easily accessible without disturbing the alignment of the pump.

36.28.9 Stuffing boxes shall be of such design that it can be re-packed, without removing any part other than the gland and lantern ring. Stuffing boxes shall be so designed by mechanical seals. In case where lantern ring is used, it shall be sandwiched between rows of packing and shall be easily removable. Lantern ring shall be of axially split type.

36.28.10 **COUPLINGS:** Pumps shall be furnished complete with and approved type of flexible couplings. Spacer type couplings shall be provided when required, to permit disassembling or without disturbing pump driver. Coupling guards shall be made of expanded metal and bolted to the base plate shall be furnished for all coupled pumps.

36.28.11 **BASE PLATES:** The common base plate for pump and motor shall be in one place and it shall be made of cast iron or welded steel construction. Suitable holes shall be provided for grouting and they shall be so located that the base can be grouted in places without disturbing the pump and motor. All pumps and motors shall be properly aligned bolted and doweled to the base plates. Adequate space shall be provided between pump drain connections and base plate for installation of minimum 15mm drain piping. Pump shall be supplied with suitable drain pans or base plates with trapped drain connections.

36.28.12 **PUMP MOUNTING:** The pump should be mounted firmly on concrete foundation of minimum 150mm thickness with vibration absorbing layer. The foundation should be at least equal in length to the common base plate of pump, motor and flexible coupling between pump and motor. A minimum clearance of 1.00 meter at front and back and 0.75 meter on sides and between pumps should be provided for the pumps. For smaller pumps like Jockey pumps, clearance required should be 0.75 meter at front and back, 0.6 meter at sides and between pumps. The pumps shall be mounted on proper vibration pad to isolate the vibration generated due to miss alignment/defect in bearing or any other rotating part. Vibration pad should have proper match with weight of the pump and working condition at site. Cost of vibration pad is deemed to be included in the quoted cost of pump.

36.28.13 **MATERIAL:** Material of different parts of pump will be as under:

[a]	Casing	:	Cast iron (IS:210 Gr FG260)
[b]	Impeller	:	Bronze /Gun metal LTB2 (IS:318, Gr LTB2)
[c]	Neck ring	:	Bronze
[d]	Shaft	:	Stainless steel (SS 410)
[e]	Shaft sleeve and nut	:	Bronze /Gun metal
[f]	Bearing housing	:	Cast iron
[g]	Logging ring	:	Brass
[h]	Gland	:	Brass
[j]	Packing	:	Graphite packing
[k]	Stuffing box	:	Bronze

36.28.14 **ELECTRIC MOTOR:**

36.28.14.1 Motor shall be squirrel case induction, SPDP or TEFC type as approval by GE. It shall be suitable for operation on AC, 3 Phase, 50 Hz, 415 ±10% Volts supply. Motor shall have capacity to run the pumps at its full load at 1450 rpm power for jockey pump motor 2900 is permitted. Motor shall be provided with extra capacity to meet the throttling load. Capacity of motor shall be selected in such a manner that it shall be capable to operate the pump with its full capacity. The make of the pump and motor shall be of the same manufacturer. The motor shall be of continuous rating type. Motor of main pumps of Fresh water shall have soft starter or Star Delta starter as mentioned in Schedule "A". Necessary back up protection shall be provided to soft starter or Star Delta starter in the form of SFU with the ACB/MCCB/HRC fuses.

36.28.14.2 The motor shall be TEFC type, having their air inlets and outlets covering with iron meshed wire, panels to avoid entry of rodents, reptiles and insects.

PARTICULAR SPECIFICATIONS [Contd…]

36.28.14.3 The motor shall be wounded for class "B" insulation and windings shall be vacuum impregnated with heat and moisture resisting varnish and preferably glass fiber insulated to withstand tropical conditions. Provision shall be made for overload protection of the motor. Protective relays shall be provided on the pump control panel to protect the pump against phase reversal, low voltage and phase failure. The cost of such protective devices is deemed to be included in the rate quoted by the contractor.

36.28.15 **LUBRICATION:** Upon installation of the complete system and before testing, the pump shall be lubricated strictly in accordance with the manufacturer's instructions.

36.28.16 **PUMP ALIGNMENT:** All pumps prior to testing shall be aligned with a dial indicator within 0.05 mm.

36.28.17 **PAINTING:** All pump motors and bases shall be supplied with approved finish. Shop coat of paint that have become marred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas and then coated with enamel paint to match the adjoining areas.

36.28.18 ELECTRICAL WIRING AND APPARATUS: All electricity supply lines and apparatus in connection with pump installation shall be so installed. Protected and maintained that there will be no danger to persons there from. All metal castings or metallic coverings containing or protecting any supply lines or apparatus shall be efficiently earthed.

36.28.19 PERFORMANCE DATA: Pump performance curves and power consumption with operating points clearly indicated shall be submitted and verified at the time of testing and commissioning of the installation.

36.28.20 TESTING: Pump performance shall be computed from the pump curves provided by manufacturer.

36.28.21 **EARTHING:**

36.28.21.1 Earthing terminals and earth connections to various equipment's and accessories forming part of the generating set installation which normally carry electrical current and all metallic parts which are likely to be electrical charged shall be earthed with suitable earth continuity conductor[s] all in conformity with requirements of IS – 3043 and as per IE rule.

36.28.21.2 In all panel, a GI strip of size 32 mm X 6 mm shall be provided to the full length of panel. Every incoming and out going switch and metal parts of panel board shall be connected to the earth strip through suitable size conductor at two points. Cost of copper strip fixed inside in the panel is deemed to be included in the cost of panel. Earthing will conform to IS – 3043: 1987. Two distinct earths shall be provided and connected to copper strip or GI strip as directed by Engineer – in – Charge.

36.28.21.3 The location of earth termination shall be directed by Engineer – in – Charge. Earth electrode shall be of galvanised mild steel. The maximum of resistance to earth termination shall not be more than 2.0 ohm. The earthing work shall be carried out in accordance with IS – 3043 or latest IS code of practice for earthing.

36.28.22 **APPROVAL DRAWING:** The contractor has to submit the drawings for approval of accepting officer before manufacture and supply for execution at site.

36.28.23 **RECORD OF MANNUAL & DOCUMENTATION:** The contractor has to submit the 03 sets of as built drawings and submission of manuals and documentations complete after successful completion of testing and commissioning of the Pumps and Motors.

36.28.24 **INSPECTION:** The contractor has to arrange online/visual factory inspection before dispatch of material to the site and the cost incurred for the same is deemed to be included in the quoted rate and the same has to be intimated to the department.

PARTICULAR SPECIFICATIONS [Contd...]

37. **LIFTS:** Quoted Rate shall be inclusive of comprehensive maintenance of all the lifts during Defects Liability Period [24Months after completion of Phase-II]. Comprehensive maintenance of all the lifts after Defects liability Period shall be measured and Paid Saperately under respective Schedules.

37.1. **SCOPE OF WORK:**

37.1.1. The work under this contract comprises fabricating, supplying, installing, commissioning and testing of electrically operated lifts. The contractor shall include for provision of landing door at each floor landing as specified as well as wiring from the MCCB Four Pole 63 A [1 Each] in machine rooms to various circuits and motors including provision of joists for mounting the machines and earth connections for equipment from one independent point and earth pit in machine rooms.

37.1.2. The specifications are intended to cover the complete supply and installation of the lifts in first class workman like manner for the above mentioned purposes and to include all work and materials as specified and shown in the drawing.

37.1.3. The work shall be carried out in accordance with:

[i] The Local / State / Municipal Rules for electric lifts.

[ii] The code of practice for installation, operation and maintenance of Electric Lifts for passengers IS – 1980.

[iii] Outline Dimensions of Electric lifts IS – 9534.

[iv] Indian Electricity Act 1910

37.1.4. In case of any discrepancy in Specification between the State Acts/Rules and relevant IS specification, the superior specifications shall be adopted and shall be clearly brought out in their offer. All materials fittings appliances etc used in electrical installation shall confirm to the relevant ISS. Where ISS do not exist, the materials shall be approved by the Garrison Engineer which shall be in writing.

37.1.5. Tenderer shall have to check dimensions given in drawings.

37.1.6. The dimensions shown in the drawing for the lift pits may be at slight variance with the stipulation of IS for lift cars. The tenderer is required to offer the car size to accommodate the persons and or capacity of lift as specified in Schedule "A". The tenderer shall give the confirmation to this effect specifically.

37.1.7. In the machine room, the position of ISMB Hooks for lifting lift and cut out is as per relevant IS.

37.1.8. The design of the floor of the machine room, foundations, and beams etc for erecting / hoisting of the motor and other equipment shall be checked by the contractor and any change in structural details landing details of floors and beams of layout details of the machine room etc shall be carried out as approved by the engineer in charge.

37.1.9. Changes, if any in the lift well dimensions as given in the drawing shall be brought out by the tenderer in his offer.

37.1.10. Requirement of power switches, their capacity, light points [if any] and their exact positions shall also be notified by the tenderer in his offer ,the cost of provision of the same deemed to be included in the rate quoted.

37.1.11. A general schematic arrangements of lifts for each type of building shall be submitted by the contractor within one month from the date of acceptance of tender. The general schematic arrangement should depict the outline of all major components of the lift, namely car, motor, counter weight, buffers, relays etc along with outline dimensions and other broad specifications.

37.1.12. Any deviation in tenders offer vis-à-vis the description of Schedule "A" and particular specifications, drawings etc forming part of this tender shall be clearly brought out by the tenderer with financial effect if any.

37.2. **PERMITS AND INSPECTIONS:**

37.2.1. The contractor shall obtain approval of all necessary / Local / State / Central Government authorities as the case may be and make arrangements for inspections and tests required thereof.

37.2.2. The charges, if any, for obtaining approval, inspection and tests required by above stated authorities shall be borne by the contractor and nothing extra is payable on any reason.

37.3. **DESIGN STANDARD:**

37.3.1. The design and manufacturer of the lift car, lifting equipment and all other accessories to be incorporated in this work shall be of the highest standard and in conformity with modern engineering practice robust in construction liberally rated for efficient and economical operation.

37.3.2. All elements of works, equipment's, accessories and safety measures which may not have been specifically brought out in these specifications but which are essential for efficient and trouble free performance for the lifts shall be deemed to be provided by the tenderer and the cost of the same shall be deemed to be covered under the unit rate quoted by the tenderer against Schedule "A". Contractor shall furnish details in respect of each type of lift offered vis-à-vis Schedule "A" as per Appendix "B" to these Particular Specifications.

37.3.3. **The contractor shall submit within 120 days of acceptance his tender his own specifications and detailed design in accordance with the tender specifications and shall submit details of lifts and equipment's offered by him as per Appendix "C" given in these particular specifications of these tender documents and as per IS – 3534, IS – 1860, IS- 4501, IS – 4666, IS – 4289, IS – 732, IS – 325, IS – 1626 and IS – 2266 and existing Andhra Pradesh Government Lift Rules and Local Greater Visakhapatnam Municipal Corporation Rules for approval of Accepting Officer before placing order for procurement and Inspection and Testing of the Lift on completion shall be carried out by the representative of the Accepting Officer.**

37.3.3A A ref of accepting officer shall visit OEMs factory permises for factory testing of lifts and he shall submit the report to the Accepting Officer. The contractor shall intimate the GE/Accepting Officer in advance for factory inspection before despatch of lift and shall make all arrangements for visit of the officer. However, TA/DA of the officer shall be borne by the Govt.

37.3.4. The work shall be carried out in accordance with the following standards, code of practice etc. The same shall be latest print incorporating up to date amendments.

[a] The local/state/Municipal rules / Acts of Electric lifts.
[b] Indian Electricity Act 1910
[c] Indian Electricity Rules 1956
[d] IS – 1960 Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts.
[e] IS – 3534 Outline Dimensions of Electric Lifts.
[f] IS – 4666 Electric Passenger and Goods Lifts, Specifications
[g] IS – 4289 [Part I] Specifications for Flexible Cables for Lifts and other connections.
[h] IS – 2365 Specification for Steel Wire Suspension Ropes for Lifts, Elevators and Hoists.
[i] IS – 732 Code of Practice for Electrical Wiring Installations.
[j] IS – 325 Specification for Three Phase Indicator Motors.
[k] IS – 3043: Code of Practice for Earthing

[l] IS – 9878: Specifications for Safety Gears and Governor for Electric Passenger and Goods Lifts.
[m] IS – 10191: Specification for Car and Counter Weight Guide Rails, Guide Rail Supports and Fastenings of Lifts.
[n] IS – 9803: Specification for Buffers for Electric Passenger and Goods Lifts.
[o] National Building Code 1993
[p] IS – 7759: Specification for Lift Door Locking Devices and Contacts.
[q] IS – 10913: Specification for Brakes for Electric Passenger and Goods Lift
[r] IS – 11615: Specification for Car and Counter Weight Guide for Electric Passenger and Good Lifts.
[s] IS – 11633: Specification for lift doors.
[t] IS – 11706 General Requirements of Car Frame for Electric Passenger and Goods Lift.
[u] Fire Resistance as per Clause 8.3.14.1 of IS – 14665.
[v] Over Load Protection as per Clause 6.2 of IS – 14665 [Para 3 Section 2].
[w] Emergency Alarm Bell as per Table 2 of IS – 14665 [Part – 5] for Standard Passenger.
[x] IS – 14665 [Part – I]: Electric traction lifts, Part – I Guidelines for outline dimension of passenger, goods, service and hospital lifts.

37.3.5. The contractor shall supply lifts of any one make specified here- in- after. The components / Parts of Lifts manufactured by the OEM and those components / Parts not manufactured by OEM then makes / manufacturers provided as per his standard and total lift under DLP is 24 months after completion..

37.3.6. All elements of work, requirement, accessories, safety gear etc. which may have not been specifically brought out in these specifications but which are essential for efficient and trouble free performance for the lift shall deemed to be provided by the contractor and the cost of the same shall deemed to be covered under the unit rate quoted by the tenderer against the Schedule "A".

37.4. **DRAWINGS:**

37.4.1. The tenderer shall submit 3 Sets of full dimensioned working drawings for each equipment offered together with detailed technical specifications thereof and illustrative descriptive, literature to enable full technical appreciation of the offer. The tenderer shall also submit drawings showing foundation details of equipment, layout of equipment and accessories and electrical wiring diagrams.

37.4.2. Corrections of design and relevant drawings to obtain complete upto date and functionally efficient installation shall be the responsibility of the tenderer and any approval that may be given to detailed drawings furnished by the tenderer shall in no way relieve the tenderer of his responsibility for their correctness and execution of work in accordance with the specifications and requirements detailed in the tender.

37.5. **PAINTING:** All surfaces of steel and cast iron [except aluminium or Aluminium alloy] carried out under these specifications shall be properly painted with two coats of approved natural enamel paint over one coat of approved primer zinc chromate.

37.6. **ELECTRIC SUPPLY FOR EXECUTION OF CONTRACT:**

37.6.1. Electric supply at 415 / 240 Volts, AC, 3 Phase 50 Cycles will be made available for installation and testing of the lifts. The contractor shall provide all necessary connections, cables through conduit fittings, etc from the main switch in order to ensure a proper and suitable supply of electricity for the execution of works.

37.6.2. The contractor shall be charged for electric energy consumed at the rates mentioned in Special Conditions of tender.

37.6.3. The tenderer shall ensure that the power factor of his electrical load does not fall below 0.9 and shall include for necessary power factor improvement condensers in case the power factor is expected to fall below 0.9. The contractor shall provide necessary PF meter as approved by the GE to keep a watch on the actual PF of his load. Penalty charges, if any, payable due to his account. The decision of the GE in this matter shall be final and binding.

37.7. **TEST INSTRUMENTS:** All equipment including the instruments for testing of lift shall be provided by the contractor. This will remain as his property after the tests are over and shall be taken away after successful completion of tests.

37.8. **INSTRUCTION BOOKS, SPARE PARTS, CATALOGUE**

37.8.1. Two sets of complete literature giving technical information of all component parts of the equipment.

37.8.3. Manufacturers instruction book for the care maintenance and operation of the equipment.

37.8.4. Complete literature giving technical information of all components/parts of the equipment offered.

37.9. **SCAFFOLDING:** The contractor shall make his own arrangements of scaffolding required for the erection of the lift which will be removed by the contractor after the completion of work.

37.10. **Two earthing points required in connection with the installation of lifts shall be provided by the contractor.** Rate deemed to be included in the rate quoted for the respective Item of Schedule "A" Part-XVI.

37.11. **DESIGN STANDARDS INTERCHANGEABILITY OF PARTS AND COMPLETENESS OF INSTALLATION:**

37.11.1. All materials plant equipment and the lift car to be incorporated in the lift system shall conform to highest standard and the latest practice in design and manufacture and shall be of robust construction liberally rated and capable of operation efficiently and economically under the stipulated service conditions.

37.11.2. Cost of all elements of installation plant, equipment apparatus and accessories, fittings and fixtures, electric works of every nature of the outgoing terminals 400/440 volts, 3 phase switch fuse in machine room, beam supported anchor bolts, etc, which may not have been specifically mentioned in these specifications but which are required and notified by the GE for efficient operation and performance of the installation shall be deemed to be covered in the quoted rates.

37.11.3. **SCOPE:** This section deals with technical requirements of lift installation, its components, safety devices various type of controls and methods of operation.

37.12. **PROTECTION AGAINST FIRE ACCIDENTS:** When the car unit rests on fully compressed buffer no part of the car or any equipment attached thereto shall strike any part of the pit or any part of the equipment located thereon.

37.13. **CAPACITY:** The passenger and goods lifts and their specification shall conform to relevant latest IS specifications.

37.14. **SPEED:** The speed of the lift should correspond to IS – 3534 and IS – 1860 suitable for lift and should be as shown in Appendix "A" and mentioned in the Schedule "A".

37.15. **TRAVEL:** The lift should serve from ground floor to the number of upper floors as per Schedule "A".

37.16. **GENERAL DETAILS FOR PROVISION OF LIFTS:**

37.16.1. **DRIVE MACHINERY:**

37.16.2. Electric Supply, Three Phase, 50 Hz, 415 Volts shall be made available. The entire lift equipment should be suitable for operation at + 10 % to – 20 % of the rated supply voltage.

37.16.3. Gearless machine the gearless machine shall consist of a motor, traction sheave and break-drum or brake-disc completely aligned on a single shaft. Gearless machine shall be AC Gearless with VVVF drive.

37.16.4. **SHEAVES:** Sheaves and pulleys shall be of hard alloy, cast iron, SG iron or steel and free from cracks, sand holes and others defects. They shall have machined rope grooves. The traction sheave shall be grooved to produce proper traction and shall be of sufficient dimension to provide for wear in the groove. The deflector sheave shall be grooved so as to provide a smooth bed for the rope. The deflector or secondary sheave assemblies where used shall be mounted in proper alignment with the traction sheave. Such deflector sheaves shall have groves larger than rope diameter as specified in clause 8 of IS – 14665 [Part – 4 – Sec 3]. The size of all the sheaves shall be in accordance with clause 8.4 of IS – 146654 [Part – 4 – Sec 3]. Wherever necessary, suitable protective guards shall be provided.

37.16.5. **SHAFT KEYS:** Shafts which supports sheaves, gears, coupling and other members which transmit torque shall be provided with tight fittings keys of sufficient strength and quality.

37.16.6. **HAND WINDING WHEEL OR HANDLE:** At times of lift stopping due to any reasons, it shall be possible to move the lift car to the nearest landing manually. The manual operation shall be by means of a winding wheel or handle mounted on the end of the motor shaft. The up or down direction of the movement of the car should be clearly marked on the motor or at suitable location. A warning plate written in bold signal red colour advising the maintenance staff to switch off the mains supply before releasing the brake and operating the wheel is to be prominently displayed.

37.16.7. **BEARINGS:** Bearings shall be either of the anti-friction metal sleeve type with oil reservoirs, self, lubrication, oil gauges, capped filler openings and drains of the ball roller or sintered type subject to oil flood lubrication or grease lubrication. Grease lubricated bearings shall have grease gun connections and drain plugs. The bearings and lubricant reservoirs shall be dust tight and shall incorporate effective seals to prevent leakage. The outer end of the bearings shall be closed with a removable oil tight plate. Thrust bearings shall be of the ball or roller type and shall have two sets of balls or rollers arranged to minimize backlash for efficient working.

37.16.8. **TYPE OF CONTROLS:**

37.16.8.1. **VARIABLE VOLTAGE VARIABLE FREQUENCY:** Incoming mains AC power is first rectified to DC and then inverted to provide controlled AC current to the elevator drive. Precision monitoring of motor speed and car direction, position and load enable the pulse width of the AC power supplied to the motor to be adjusted to ensure that elevator speed is maintained very accurately to an ideal profile. Thus in VVVF controls pulse width modulation control of AC motors has following advantages compared with the older servo controlled elevators:

[a] Total control at all stages of the motion cycle.

[b] A consistent fully adjustable smooth ride.

[c] Better leveling accuracy under all conditions.

[d] A higher power factor.

[e] Lower starting currents.

[f] Energy saving through reduced power consumption.

37.16.9. **INSTALLATION ASPECTS:**

37.16.9.1. Installation in machine room: Lift machine room to accommodate the drive machinery, controller, etc. shall as far as possible be located on top of the lift shaft. The layout of equipment shall be such as to allow free movement of maintenance personnel inside. Machine room shall not be used for storage purpose.

37.16.9.2. Ventilation of machine room: Machine room shall be provided with natural air and mechanical ventilation to avoid over heating of the electrical equipments and to ensure proper operation of the controller. Entry of dust etc. shall also be suitably prevented.

37.16.9.3. Vibration, Isolation Vibration and isolation arrangement shall be provided to prevent transmission of vibration to the building and structure.

37.16.10. General Illumination of Lift well Suitable light points shall be provided in the lift well at a spacing of not more than 10 meters in between, starting at the ground floor. All the points should be group controlled from the M/C room. The wiring shall be carried out in surface conduit. One socket outlet shall be provided in the shaft for use by maintenance personnel at a level slightly above the ground floor landing.

37.17. **GUIDE RAILS:** Guide rails shall be in accordance with Clause 3 of IS – 14665 [Part 4 – Sec 2]. Only machined guide rails shall be permitted for cars for passengers and hospital lifts. Formed sheet metal rails shall be used up to speeds of 1.75 mps for counter weight applications. In the case of goods lifts, un-machined guide rails shall be permitted for the counter weight for all speeds and for the cars only up to a speed of 0.05 m/sec. The guide rails shall be continuous throughout the entire travel and shall withstand without any deformation the action of safety gear with a fully loaded car. Generally the guide rails shall be supported by brackets secured to the hoist way frame at each floor. The rails shall be securely fastened to the brackets or other supports by approved heavy rail clamps. All necessary guide rails packing or additional supports shall be provided to prevent guide rail deflection and stresses exceeding the prescribed limits. The stresses on the guide rail due to the horizontal forces imposed on it during loading, unloading and running calculated without impact, shall not exceed 1100 KG/Sq.cm based upon the class of loading and the deflection shall not exceed 5mm. The guide rail brackets, their fastenings and supports shall be capable of resisting the horizontal forces mentioned above, with the total deflection at the point of support not in excess of 3mm.

Guide rails shall extend from pit floor to the underside of concrete slabs or graphing at top of the lift well. They shall be erected in plumb and parallel with a maximum deviation of 3mm. All shimming required shall be of metal securely held in place. Jointing plates shall be so located as not to interfere with supporting clamps and brackets. The bolts shall be used with spring lock washers. The guide rail anchorage at pit floor must be made without puncturing the water proofing. The expansion joints in the guide rails shall be so designed as to avoid jerks in the lift car. Machined guide rails shall have finished surfaces which shall be coated with corrosion preventive compound which shall be maintained till the commissioning of the installation. Before the car is placed in operation, the preventive coating shall be removed and the guide rails thoroughly cleaned and smoothened.

PARTICULAR SPECIFICATIONS [Contd…]

37.18. **LIFT CAR:** Car Frame The car frame shall be in accordance with clause – 4 of IS – 14665 [Part 4 – Sec 3] made of sheet steel of rigid construction to withstand without permanent deformation the operation of safety gear. The car shall be so mounted on the frame that vibration and noise transmitted to the passengers inside is minimized.

37.19. **CAR PLATFORM:**

37.19.1. The car platform shall be of framed construction and designed on the basis of rated load evenly distributed. The dimensions shall conform to IS – 14665 [Part 1] unless otherwise specified. The flooring shall be smooth and of anti-skid surface. The flooring for goods lift shall be strong enough to take the rated load without any deformation or damage.

37.19.2. A load plate along with overload alarm, giving the rated load and permissible maximum number of passengers should be fitted in each lift car in a conspicuous position.

37.20. **CAR BODY:** The car shall be enclosed on all sides by a metallic enclosure. The enclosure including the door shall withstand without deformation a thrust of 35kg applied normally at any point and as per IS – 14665 [Part 4 / Sec 3]. Ventilation openings if specified shall be as per IS – 14665 [Part 4 / Sec 3].

37.21. **CAR ROOF:** The roof of the car shall be solid type capable of supporting a weight of at least 140 kg and as per IS – 14665 [Part – 4 – Sec 3].

37.22. **CAR THRESHOLDS:** Car entrance shall be provided with metal thresholds having a grooved surface. Thresholds for lifts having horizontally sliding car doors or gates shall have machined or extruded guide grooves.

37.23. **TOE GUARD APRONS:** The toe guard apron of gauge not less than 1.6 mm sheet steel may be provided extending at least 15mm beyond entrance jambs at each side. The guards shall have a straight vertical face extending below the level of the finished car floor and not less than the depth of the leveling zone plus 7.5mm. The bottom of guard shall extend 700mm for lifts upto speed of 1.5 mps & 1000 mm for lifts above speed of 1.5 mps below vertical face and beveled at 15° angle from the vertical. It shall be seamed to car platform construction and be reinforced and braced.

37.24. **CLEARANCE:** The clearance between the top of the car and the soffit of the lift shaft roof, bottom of the car and the pit floor, the buffers, etc. and the clearness between the car and the lift well, between the car and the landing sill, between two lift cars in the same shaft etc, shall be provided as per IS – 14665 [Part 1, 2 & 4].

37.25. **CAR APRON, LANDING THRESHOLDS AND SILLS:** An apron shall be fitted to the car platform such that no dangerous gap exists at any time when the landing door is opening. Thresholds and sill plates shall be provided at the landings also. The distance between landing sill and the sill on car platform shall not be more than 30mm.

37.26. **INTER – COMMUNICATION SYSTEM:**

37.26.1. Though para 8.4.3 of IS 147665 [Part 2 / Sec 1] recommends for provision of either an emergency signal or a telephone inside the car but as a general experience. It is seen that over a period of time these devices become inoperative due to one reasons or the other. Therefore, in order to have at least one device of communication functioning at all the times, as an alternative arrangement, provision of both i.e. telephone with minimum two connections – one at the operator's room and other at guard room and the emergency signal with re-chargeable batteries as source of supply shall be made in the lift cars.

37.26.2. The device used for emergency signals should incorporate a feature that gives immediate feedback to the car passengers that the device has worked prop0erly and the signal has been passed on to the intended agency. This shall be achieved by pressing of button form control room which shall give audio signal to the passengers in the car.

37.26.3. Provision of group indicator panel in the control room shall be made to indicate working of lifts.

37.26.4. **EMERGENCY POWER SUPPLY FOR LIFT CAR:** This shall include suitable secondary battery with trickle / boost charge arrangement and inverter power pack with necessary contactors for supplying the light fixtures in the lift car. The same battery shall also feed the alarm bell and communication equipment.

37.27. **RATINGS AND INSTRUCTIONS:** Inside the lift car, the lift supplier shall also provide a stainless steel metallic plate indicating the rated load and detailed instructions for the passengers. This shall be mounted at a suitable place.

37.28. **LIFT CAR INTERIOR FINISH:** The side, rear and fascia panel shall be of scratch free stainless steel moon rock finish. The flooring shall be with 1.5mm thick PVC tiles for passenger lifts. The False ceiling in the lift car shall be crafted from stainless steel with LED lamps and fan.

37.29. **OPERATING PANEL INSIDE THE CAR:** The car operating panel shall be of metal, flush mounted and duly finished to match the car interior décor and shall contain all the devices as may be specified depending upon the type of operation required. In addition, separate illuminated panel for indication the floor and direction may be provided on the top or the door way. All switches shall be fade proof and the devices shall be of suitable quality. Each device and its operating position shall be legible fade proof and marked.

37.30. **CAR AND LANDING ENTRANCES:** The car and landing doors shall be of flush type sheet steel only for power operation. The flush type may further be of single sliding, centre opening or two speed construction. Power operated car and landing doors shall be so designed as not to injure any person during their closure by means of provision of a safety pressure switch which shall cause the doors to reopen on the slightest pressure. In case of power operated doors, it shall be possible on power failure, to open them from the car side. All the openings for passenger lifts shall be 2000 mm clear in height. For goods lift vertical by – parting doors or collapsible gates as specified shall be used. The door opening and closing shall be accomplished smoothly and quickly without undue noise, vibration and shock and their movements shall be cushioned and checked at both limits.

37.31. **CAR DOORS:** The car door shall be hung from the top MS fabricated track and means shall be provided to prevent the door from jumping off the track. The doors shall be provided with two point suspension sheave type hangers suitable for the type of door operation specified. The hangers shall be provided for vertical and lateral adjustment of car door. The sheaves shall move on a MS fabricated track so shaped as to permit free movement of sheaves with regard to vertical adjustment of sheave bracket or hosting. The car door shall be centre opening horizontal sliding stainless steel scratch proof [moon rock finish] for office, residential & goods lift applications whereas telescopic horizontal sliding stainless scratch proof surface [moon rock finish] for hospitals.

37.32. A potential cause of accidents could be the attempts made to open the landing door lock of lower floor in case the car stops away from floor level due to power failure. Since the car door can be opened in case of power failure so as to improve the ventilation and avoid claustrophobic situations etc. as outlined in IS – 14665 [Part 2 / Sec 1] para 10.9.1, there is a tendency among trapped passengers to make attempts to open any accessible landing door which can be opened by a electromechanical latch in the landing doors as the lock is accessible through open car doors. This attempt in panic may result in accidental fall into the lift pit. In order to ensure that the trapped passenger do not attempt opening the landing door, the electromechanically latch should be so designed that it is inaccessible or invisible to the passengers in the car.

37.33. In order to avoid accidental closure of doors while boarding or alighting the car, a tamper proof infrared curtain covering almost the entire height of the door shall be provided in the lift doors.

37.34. **LANDING DOORS:** Each landing door shall be completed with locks, header, cills, frames, rims, hanger supports with cover plates, facia plates etc. The finished work shall be strong, rigid, and neat in appearance. Plan surfaces shall be smooth and free from warp or buckle. Moulded surfaces shall be clean out, straight and true. Fastenings shall be concealed from the face side of the material. Steel Sills shall be provided with a suitable nosing of approximately 25 mm depth on the shaft side. The opening for the landing gates or doors shall not be wider than that of the lift car. In the case of bi-parting type steel doors, the locking of the two leafs locking of the doors should be positive.

37.35. **CAR LANDING:**

37.35.1. All the lift car landings shall be well lit to an illumination level of 150 lux and shall be free from obstructions. The control for landing lights and the sign lights be tamper proof. Wherever standby power supply is available, these lights shall be connected to standby circuits also.

37.35.2. For the purpose of identification, the lift number should be displayed outside the landing door, inside the car and in the machine room. The numbering may be used as reference for the purpose of routine / preventive maintenance for operating from machine rooms and reporting of any incidents etc.

37.35.3. **INSTRUCTIONS:** Detailed instruction as specified for guidance of passengers shall be prominently displayed inside the car and outside the car at all landings. The Braille signage will be posted by the department outside lift lobby at all landings for the lift meant for barrier free requirement.

37.35.4. It is seen generally, that though the instruction on DO's and Don'ts, as per provision of the relevant IS, are displayed in lift cars but the same are either displayed in inconspicuous location, or are very small in size or are in one language only. To make these instructions serve the intended purpose and not a mere compliance of relevant IS clause; that these instructions should be displayed at a conspicuous location with larger and understandable script and should be written in Hindi, English and Regional Language [where official regional language is notified].

37.36. **LEVELLING:** All lift [s] shall be incorporated with suitable floor leveling devices. In case of lifts with automatic power operated doors and with AC VVVF controller a separate level device for automatic leveling with leveling accuracy of + 5 mm shall be incorporated.

37.37. **COUNTER WEIGHT:** The counter weight for lift car shall be in accordance with clause 6 of IS – 14665 [Part 4 / Sec – 3] and shall be designed to balance the weight of empty lift car plus approximately 50 per cent of the rated load. It shall consist of cast sections firmly secured in relative movement by at least two numbers steel tie rods having lock nuts/split pins at each end passing through each section and Housed in a rigid steel frame work. Cracked and broken sub weight shall not be accepted.

37.38. **GUIDE SHOES:** Types of Shoes shall be as follows:

37.38.1. **FOR LIFTS:**

[a] For speed up to 1.5 MPS, sliding guide shoes shall be used. Sliding guide shoes for car shall be always flexible and for counterweight solid guide shoes can be used up to 1.0 MPS.

[b] For speed more than 1.5 MPS roller guide shall be used for car and counter weight.

37.38.2. For good lifts solid shoes can be used.

37.38.3. **FLEXIBLE TYPE / SOLID TYPE SLIDING GUIDE SHOES:** The car shall be provided with solid or spring loaded swiveling guide shoes with renewable liners, where the lift car speeds are up to and including 1 MPS. The cars with the speeds beyond 1 MPS shall be provided with spring loaded guide shoes with renewable liners or the guide shoes shall be of roller type.

37.38.4. **ROLLER TYPE GUIDE SHOES:** Each roller type shoe shall be of an approved type consisting of rollers assembled on a substantial metal base and mounted as to provide continuous contact of all rollers with the corresponding guide rail surfaces under all conditions of load and operation. The rollers shall run on the three finished guide rail surface and shall operate quietly.

37.38.5. **MOUNTING OF GUIDE SHOES:** Guide shoes shall be provided with adjustable mountings & shall be rigidly secured in accurate alignment at the top and bottom on each side of the car sling and counter weight frame construction. When oil buffers attached to the bottom of counter weight are used, additional guide shoe shall be provided on each side of the buffer frame. The design of guide shoes and car safety device shall be coordinated do as to ensure the provision an installation of equipment with clearance specified in clause 5.7 of this chapter.

37.39. The general details of lifts are furnished in Appendix "A" & "B" of these tender documents and the contractor is required to submit his offer conforming to these details.

37.40. **MACHINE LOCATION:** The lift machine shall be placed directly above the hoist way upon machine room slab and supported on rolled steel joints which will in turn be built in and supported on walls so that load of machines will not be on the floor slab. Structural steel beams with bearing plates shall be provided for mounting the machine by the contractor. Joints and bearing plates will be designed and provided by the contractor. In order to avoid overloading of the machine room of the side load walls bearing the tenderer shall furnish [along with his tender] a detailed layout drawing of the machine room along with intimation of total load to be supported separately by machine room slabs or side walls bearing indicating the breakdown details of various loads / forces due to the lift machinery. Cage passengers, counterweight impact effect, etc and any other information / factors to be taken into consideration for the design of the flooring etc. Lifts shaft constructed is enclosed by 200mm thick brick walls on all sides [with in framed work of columns and beams.]

37.41. **SOUND REDUCTION:** The contractor shall provide necessary sound reducing materials preferably rubber pads of proper density to effectively isolate the machine from supporting beams and flooring as recommended in clause 6.11 of IS – 1860.

37.42. **MACHINE:** The machine shall be of the single worm gear traction type and shall include a motor electromagnetic brakes, steel worms bronze gear, steel sheave etc all completely mounted on a single base or bed plate. The worm shaft shall be provided with all bearing to take the end thrust and tapered roller bearings shall be provided for the sheave shaft to ensure alignment and bearing lift. The driving sheave shall be grooved to ensure sufficient traction and minimum rope wear. Adequate means of lubrication shall be provided for all bearings and worm gear. The machine shall be equipped with an arrangement or manual winding of the machine for testing purposes or for operation when the power supply fails.

PARTICULAR SPECIFICATIONS [Contd…]

37.43. **BRAKE:** The lift drive machinery shall be provided with an electro-magnetic brake or motor operated brake normally applied by means of springs in compression when the operating device is in off position. The brake shall be suitably curved over the brake drum or brake disc and provided with fire proof friction lining. The operation of brake shall be smooth, gradual and with minimum noise. The brake shall be designed to be of sufficient size and strength to stop and hold the car at rest with rated load. The brake shall be capable of operation automatically by the various safety devices, current failure and by the normal stopping of the car. The brake shall be released electrically. It shall also be possible to release the brake manually, such releases requiring the permanent application of manual force so as to move the lift car in short stops for this purpose suitable brake release equipment wherever necessary shall be supplied with each lift installation and the same shall be kept in safe custody to prevent misuse. The tenderer shall specify the make of rectifier and the arrangement of DC supply.

37.44. **REVERSED PHASE RELAY:** A reverse phase relay shall be provided on the controller to protect the lift equipment against phase reversal, low voltage and phase failure. Switches / relays shall have suitable contacts to withstand wearing due to frequent make / break operations on the floor controller in the machine room and in the contacts height way.

37.45. **MOTOR:** The motor shall be suitable for AC variable control AC 415 Volts, 3 phase 50' cycles, squirrel cage induction complete with switch reversible type particularly designed for lift services with high starting torque, low starting current and suitable for repeated start and stops.

37.46. **PROTECTION FOR MOTOR:**

37.46.1. Provision shall be made for overload protection of the motor. Protective relays shall be provided by the contractor to protect the lift equipment against phase reversal, low voltage and phase failure.

37.46.2. The slow speed winding of this motor shall function automatically when the car is approaching a floor stop so as to provide a greater stopping accuracy.

37.47. **SHEAVES AND SUPPORTING BEAMS:** Deflector and overhead sheaves with their steel supporting beams shall be provided as needed for obtaining the proper lead of the ropes to the car and counter weights. All sheaves shall be fixed by means of two sunk keys of sufficient strength and quality drums, sheaves and pulleys shall be of cast iron or steel. They shall have machined rope grooves and suitable flanges. The grooving of a drum deviator sheaves of pulley shall have radius larger than the radius of the rope but not less than that specified in IS 1860 of 1961 as amended vide IS – 1860 of 1980 and shall extend over one third of the circumference of the rope.

37.48. **BUFFERS:** Suitable heavy duty spring buffers shall be provided for car and counter weights as required under IS 1860 – 1980.Efficient automatic device shall be provided whereby power shall be out off from the motor before the car or balance weights lands on the buffers.

37.49. **COUNTER WEIGHT:** The counter weight shall consist of cast iron weights and contained in rigid steel frame and shall be equal to the weight of the elevator car plus approximately 40% to 50% of the capacity specified. Suitable guide shoes shall be provided for structural steel frames. Specifications given in IS 1860 – 1980 shall be complied with.

37.50. **COUNTER WEIGHT GUARD:** Contractor shall provide expanded metal counter weight guard of required length at the bottom of the hoist way and at the place where car and counter weight meet.

37.51. **SUSPENSION ROPES:** The hoist ropes shall be of traction steel of suitable size, construction and number to ensure the proper operation of the elevator and shall give satisfactory wearing qualities Governor ropes shall be of steel. All ropes shall consist of at least eight strand wound about a hamp core. No car or counter weight ropes shall be of repaired or lengthened by splicing. Fixing arrangements shall conform to IS – 1860. The rope shall be of Usha Martin or make conform to IS provisions.

37.52. **AUTOMATIC TERMINAL STOPS:** The elevator shall be equipped with an automatic stopping device, arrange to bring the car to a stop at the terminal landing, independent of the regular operating device in the car final limit switches operated by the cars to stop the car and prevent normal operation should travel beyond the zone of normal stopping device and shall be provided in the hoist way.

37.53. **ALARM HOOTER:** Battery operated emergency alarm hooter including wiring shall be provided and connected to a plainly marked push button in the car operating panel, the alarm hooter shall be located at the main floor landing. This shall be clearly audible outside the lift way in order to obtain assistance in case of breakdown of failure between the floors.

37.54. **CAR AND CAR FRAME:**

37.54.1. The rated car platform measurements should be as given in IS – 3534, Table 2. Contractor shall inspect the all existing building drawings and ensure that car platform measurements for all the lifts can be achieved.

37.54.2. The lift car shall be insulated from frames to prevent vibration from the ropes and guide shoes being transmitted. Internal and upward motion of the car shall be restrained by looking blocks but there shall not be metal to metal connection between the car and the frame. The frame shall be of steel members properly and securely braced and shall be sufficiently rigid to withstand the operation of the safety gear without permanent deformation of the car frame. At least four renewable guide shoes or guide shoes with renewable lining or sets of roller guides [depending upon the type of lift] shall be provided two at the top and two at the bottom of the car frame.

37.54.3. The car shall be of Stainless Steel sheet. The thickness of the sheet used for construction should be 16 guage.

37.54.4. The panels shall be suitably stiffened. The floor shall be sufficiently strong and rigid and covered with aluminium chequered plate of 3 mm thick. Flooring design to blend with remainder of the car, the roof shall be solid capable of supporting 68 kg equivalent to a man's weight. Where the car leveling devices are used substantial aprons of sufficient depth shall be fitted to the car floor to ensure that no space is permitted between the threshold and the landing while the car is being leveled to a floor. Threshold and oil plates shall also fit to the landing.

37.54.5. At the entrance of each floor the gaps between lift car and landing position is required to be covered with architrave work matching with the existing surfaces to the entire satisfaction of Engineer – in – Charge. The unit rate quoted by the tenderer against respective item of Schedule "A" shall interalia be deemed to include for this work.

37.54.6. The car shall be adequately ventilated and shall be provided with the following:

[a] One 30 cm [12"] fan on the ceiling with proper grills. The fan shall be connected on electric mains independent of the mains supplying power to the lift machine. Ventilation opening shall be provided inside enclosure as per standard practice of the lift manufacturer.

[b] Two 11 watts compact LED lighting fixture in recessed at top of car with all accessories complete and operated by switch in car panel including necessary wiring connected to electric outlet at centre of hoist way.

37.55. **SIGNALS:**

37.55.1. Illuminated direction indicators showing "UP/DOWN" directional movement of the car are to be fitted on ground floor and on each landing [at all upper floors].

37.55.2. Following items shall also be provided for the lift:

[a] Floor position indicator in the car.

[b] Car position indicator on ground floor.

[c] Car position indicator at all landings of upper floor.

[d] Annunciator [Call Registration Indicator]

[e] Push button fitted at all landings either for calling lift or for activating the call indicator.

[f] A bell with indicator board on the car for the purposes of registering the requirement of the car at a particular landing shall be provided.

[g] Car call indicator in car to indicate to the attendant the lift landings from which calls are made.

[h] One specification plate showing capacity speed and other installation details.

[j] One operating panel.

[K] A light point above 5cm every floor level along with electric bulb and switch for proper lighting of lift pit.

37.56. **CAR DOOR CONTACT:** An electric contact for the car door with infra red sensor shall be provided which will prevent elevator movement away from the landing unless the door is in the closed position.

37.57. **HOIST WAY DOOR INTERLOCKS:** Each Hoist way door shall be equipped with a positive electromechanical interlock and auxiliary foot closing including infra red sensor so that the elevator can be operated only after the interlock circuit is established i.e. the car cannot be moved unless the landing door is in a fully closed position.

37.58. **GOVERNOR:** The car shall be provided with a governor operated safety gear. The governor shall be placed where they cannot be struck by the lift car or counter weight in the vent of over run. Governor for car safety gears shall be adjusted to activate the safety gears not less than 115 percent of rated speed and not more than the tripping speed.

37.59. **EMERGENCY SAFETY DEVICES: T**he lift shall be provided with one or more safety devices, attached to the lift car frame and placed beneath the car. The safety devices shall be capable of stopping and sustaining the lift car with full rated load in the car at tripping speed. The safety gear shall operated to stop and sustain the lift car in the event of lift exceeding a predetermined maximum speed in the descending direction when a speed governor is fitted. Every safety gear shall operate positively and mechanically independent of any springs used in its construction.

37.60. **GUIDES:**

37.60.1. Car and counter weight guides shall be of rigid steel. The sections shall be used continuous throughout the entire length and shall be provided with steel brackets or equivalent fixing of such design and spacing that the guide shall not deflect more than 5mm under normal operation. Guides shall be arranged to withstand the action of the safety gear when stopping a counter weight or fully loaded car. Guides shall be of such length that it shall not be possible for any of the car or counter weight shoes to run off the guides.

37.60.2. Guide shoes shall be spring loaded and shall be a suitable alloy and shaped to fit in the guide.

PARTICULAR SPECIFICATIONS [Contd…]

37.61. **ELECTRICAL AND MECHANICAL DOOR LOCKS:** Electrical and mechanical door locks shall be provided. The landing door locks shall be such that the door cannot be operated unless the car is at the particular landing. It shall also not be possible to move the car unless the car door is locked in the closed position.

37.62. **CAR DOOR:** The car door shall be automatic central opening type all as mentioned in Schedule "A".

37.63 **LANDING DOORS:** The landing door shall be of steel panel, central opening type suitable for manual operation. When opened the door shall provide full width in entrance.

37.64. **ELECTRICAL WIRING AND APPARATUS:**

37.64.1. All necessary insulated wiring and conduit or tubing together with necessary fittings, metal boxes, through walls / floors shall be provided. All electrical work in connection with installation of electric lifts shall be carried out in accordance with provisions of Indian Electricity Act, 1910 and IE Rules 1956 and shall also comply with the provisions of IS – 732, Code of practice for Electrical wiring and relating to fire insurance of buildings is applicable.

37.64.2. All electric supply lines and apparatus in connection with lift installation shall be so installed, protected and maintained that there may be no danger to persons there from. All metal casings or metallic coverings containing or protecting any supply lines of apparatus shall be sufficiently earthed. No bare conductor shall be used in any lift.

37.64.3. All cables and other wiring in connection with lift installation shall be of suitable grade for the voltage at which these are intended to be worked and if metallic covering is used it shall be efficiently earthen. Suitable caution notice shall be fixed near every motor or other apparatus in which energy is used at a pressure exceeding 250 Volts. Circuits which supply current to the motor shall not be included in any twin or multi core trailing cable used in connection with control and safety device. A trailing cable which incorporates conductors for the control circuits shall be separate and distinct from that which incorporated lighting and signaling circuits.

37.64.4. Power wiring between the controller and main board and controller to various landings shall be done in heavy gauge conduit conforming to IE Rules 1956. All cables used in lift installation shall conform to IS – 4209, Specification for lift cables, where installation of heavy gauge conduit presents difficulties, short length of flexible conduits may be permitted but contractor should specify places where flexible conduit is proposed to be used. The lengths of the cables shall be such that they are not subjected to strain due to movement of car from end to end.

37.64.5. All electrical wires shall be FRLS multi thread copper cable with not less than 1.5 Sq.mm

37.65. **CONTROLLER UNIT:**

37.65.1. The controller unit with main circuit breaker shall be with adjustable over load release single phase preventer and phase reverse relays AC Transformer, Rectifier, DC Control relays contractors etc enclosed in a vermin proof sheet floor mounted cabinet of standard design.

37.65.2. The controller shall be located in the machine room and shall be suitable for the control system and facilities required in case and landings as detailed in these specifications.

37.65.3. All control wiring shall be suitably secured and conform to standard wiring practice. Ferrules of insulating material shall be fastened on all terminations with identification letters of numerals corresponding to the wiring diagram to be supplied by the contractor.

37.65.4. An inspector's change over switch [Fireman switch] shall be provided in the controller. Operation of the inspector's change over switch shall make both the car and landing buttons in-operative and permit lift to be worked from the inspector switch in either direction from the machine room for purpose of test.

37.66. **DUAL OPERATION WITH ATTENDANT:** Provision shall be made for automatic operation as given below:

[i] Without attendant.

[ii] With Attendant: For the use of the attendant the following additional equipment shall be added to the car operating panel:

[a] Key operated switch for cutting in and out the additional requirement for "with Attendant" operation.

[b] Emergency buttons.

[c] Car call indicator.

37.67. **AUTOMATIC SELF LEVELLING DEVICE:** This device should be operated in slow speed automatically to bring the car door in level with the landing doors.

37.68. **CIVIL AND MISCELLANEOUS WORKS:** The tenderer shall include in his tender the cost of all civil and miscellaneous works as given below works including:

[i] Scaffolding.

[ii] Foundation of plant/machinery and equipment.

[iii] Buffers [with buffer support channel] tees, machine beams, bearing plates, hoist way beams, stretchers and any other steel works as required.

[iv] Cutting holes in walls, floors etc and demolition of hand rails/grills installed at the opening and making good to match the existing surface of walls, floors etc any other requirement to be modified to suit the lifts.

[v] Supplying and fixing necessary bolts, nuts, etc of adequate size required for fixing brackets, etc in the walls etc of the lift shafts/pits and making good to match the existing surfaces of walls, etc.

[vi] Supplying and fixing necessary ladder or steel rungs of adequate size and strength for access to inside the lift pits and making good the surfaces of walls, floors, etc of lift pits to match the existing surfaces.

[vii] All miscellaneous works required for erection of lift.

[viii] Conduit work from machine room to various floors for control system and indicator wiring system etc, power wiring between controller and main board and from controller to various landings.

[ix] All temporary electrical wiring required during installation shall conform to relevant Act and Rules and full proof safety requirements.

37.69. **METHOD OF OPERATION:**

37.69.1. The operation of the elevator shall be single automatic push button which is automatic in operation by means of one button in the car for each landing level served and one button at each landing so arranged that if any car or landing button has been pressed, the pressure if any other car or landing operating button will have no effect on the operation of the car until the response to the first button has been completed. After the car stops at landing in response to a car or landing calls the car will remain inoperative from the landing buttons for a predetermined interval to allow a car passenger to leave or landing passenger to enter and register his call.

37.69.2. The elevator shall also have a system of operation by an attendant. All calls shall register on an Annunciator in the car. The attendant will press corresponding floor button on the car operating panel and serve the call.

37.70. **CAR OPERATING PANEL:** The car operating panel shall be flush mounted in the car enclosure and shall contain the following:

[a] A bank of buttons numbered to correspond to the various floors / landing served.

[b] An emergency stop switch for stopping the car independent of the regular operating service.

[c] An emergency alarm button connected to an alarm hooter provided by the contractor and located at the main floor landing outside or adjacent to the hoist way. The alarm shall be operated through DC battery provided by contractor.

[d] Light and fan control switches.

[e] A key operated switch to operate elevator "Automatic without Attendant" and "With Attendant".

[f] The tenderer shall also provide a toggle or two button switch situated in a glass fronted box adjacent to the passenger lift at the entrance level which when put "ON" whether the car is in travel or not, when the doors will open, landing call points will become inoperative and the lift will be on car control only to serve a fire emergency when the switch is OFF, the lift will return to normal working.

37.71. **EARTHING:** Earth terminals and earth connections to the various equipment's and accessories forming part of the lift installation which normally carry electrical current and all metallic parts which are likely to be electrically charged shall all be earthen with suitable earth continuity conductor[s], all in conformity with IS – 1860 and as per IE Rules and Regulations and as per IS – 732. However, earth connection with bare copper earth continuity conductor from the main switch provided in the machine room to the earth points outside [including provision of two electrical and earth connections beyond the main switch are existing in the machine room will be the responsibility of the contractor.

37.72. **LUBRICATION:** All bearings shall provide for adequate means for lubrication for easy access without having to disconnect the machine during normal maintenance.

37.73. **TRAILING CABLES:** The trailing cable shall have flame retarding and moisture resistant outer cover. They shall be flexible and flat and shall be suitably suspended to relieve strain in the individual conductors.

37.74. **LIFT ROPES: IS – 14665 [PART – 4 / SECTION 8]:**

37.74.1. Round strand steel wires ropes made from steel wire ropes having a tensile strength not less than 12.5 tonnes / Sq.cm and of good flexibility shall be used for lift. Lubrications between the strands shall be achieved by providing impregnated hemp core. The lift ropes shall conform to IS – 14665 – [Part – 4/Sec – 8] and the following factor of safety shall be adhered to. The minimum diameter of rope for cars and counter weight of passenger and goods lift shall be 8mm.

37.74.2. Rope speed of passenger & goods lifts [m/s] Factor of safeties 0.5 or less or Exceeding 0.5 to 1.0 or Exceeding 1.0 to 2.0 or Exceeding 2.0 to 3.5 or Exceeding 3.5 as specified.

37.74.3. **ROPE FASTENINGS:** The ends of lift ropes shall be properly secured to the car and counter weight hitch plates as the case may be with adjustable rope shackles having individual tapers babbit sockets, or any other suitable arrangement. Each lift rope shackle shall be fitted with a suitable shackle spring, seat washer, shackle nut & lock & shackle nut split pin.

37.74.4. **GUARDS FOR LIFT ROPES:** Where lift ropes run round a sheave or sheaves on the car and / or counter weight of geared gearless machine suitable guards shall be provide injury to maintenance personnel.

37.74.5. **NUMBER & SIZE OF ROPES**: The contractor must indicate the number and size of lift ropes and governor ropes proposed to be used, their origin, type, ultimate strength and factor of safety. The contractor should furnish certificate of ropes from the rope manufacturers issued by competent authority.

37.75. **SAFETY EQUIPMENTS:** Every lift installation shall necessarily be provided with the following safety features:

37.75.1. The safety gear shall be provided in accordance with IS – 14665 [Part – 4 / Sec – 4], each type of car safety shall be actuated by a speed governor.

37.75.2. **GOVERNOR:** The car safety shall be operated by speed governor located overhead and driven by governor rope suitably connected to the car and mounted on its own pulleys. The rope shall be maintained in tension by means of weighted or spring loaded tension sheaves located in the pit. Governor shall be provided for lifts with a travel of more than 5.5 meters. The governor rope shall be not less than 6 mm in dia and shall be made of steel or phosphor bronze. These shall be in accordance with IS – 14665 [Part - 4 / Sec – 4]. Governor for car safety gears shall be adjusted to actuate the safety gear at the following speeds:

[a] For rated speeds upto 1 m/s maximum governor tripping speed shall be either 140 percent of rated speed or 0.88 m/s, whichever is higher. For rated speed above 1 m/s maximum governor nor tripping speed shall be 115 per cent of the rated speed plus 0.25 m/s.

[b] Minimum governor tripping speed shall be 115 per cent of the rated speed.

37.75.3. The governor shall be of "V" groove wheel design and only wheel is stopped to actuate the car safety upon a pre-determined over speed downward without damaging the rope.

37.75.4. The governor, rope and sheave shall be so located so as to minimize danger of accidental injury to the equipment.

37.75.5. The governor sheave and tension sheave shall be according to clause 2.3 and the sheave bearing shall be according to clause 2.6 above.

37.75.6. The requirements for field tests on car safety and governor and for drop tests to sliding type car safeties shall be as specified in section IV of this specifications.

37.76. **TERMINAL LIMIT SWITCHES:**

37.76.1. **TERMINAL SWITCHES:** These shall stop the car automatically at terminal floors within the top and bottom permissible over travel. They shall act independently of the operating devices, the ultimate limits switches and the buffers. They shall be in accordance with clause 8 of IS – 14665 [part 3 –Sec 1].

37.76.2. Terminal stopping devices located in shaft or in the car and operated by cams shall be fitted with rollers having a rubber or other approved composition to provide silent operation when actuated by the cam. When the lift car cross head Is 60cm from the nearest obstruction above it, no projection on the cart shall strike any part of the overhead structure.

37.76.2. Lifts with speeds over 1.25 meters/ second shall have the normal terminal stopping device located on the car or on the guide rails or in the machine room. 12.5 Ultimate Terminal Switches These shall be provided in accordance with the statutory requirements and standing practices. When provided these shall arrange to stop the car automatically within top and bottom clearances independently of the normal terminal switches but with the buffers operative. These shall be in accordance with clause 8 of IS – 14665 [Part – 3 / Sec – 1]. 12.6 Buffers – [IS 14665 [Part 4 / Sec 1] – 2001] Buffers shall be oil resistant rubber pad type for speeds upto 0.25 mps and spring /oil type for speed up-to 1.5 mps and only oil type for speeds higher than 1.5 mps. Buffers shall be suitable for installation in the space available. Buffer anchorage at pit floors shall be installed avoiding puncturing of water proofing. Oil buffers of the car and counter weight shall be of the spring return type or of gravity type.

37.76.3. The partial compression of spring return oil buffers when the car is in level with terminal landing will not be acceptable. All buffers shall be tested at manufactures works and a copy of the test report shall be submitted. When the lift car rests on fully compressed buffers there shall be at least 60cms clearance between the lowest point in its car frame and any obstruction in the pit exclusive of buffers and their supports. Similarly when the lift cars cross head is 60 cm from the nearest obstruction above it, no projection on the car shall strike any part of the overhead structure. The contractor must indicate the name of buffer manufactures, buffer stroke & certified maximum loads.

37.76.4. **DOOR LOCKS:** Electro mechanical door lock shall be provided for all the landing doors and they shall be such that the doors cannot open unless the car is at rest at the particular landing. It shall not be possible to move the car unless all the landing doors and the car door are closed and locked. This requirement however does not apply when the lift car is provided with automatic leveling devices and in such cases, it shall be permitted to move the car with both the doors open in the leveling zone for the purpose of leveling. All the locks and contacts shall conform to IS – 14665 [Part 1/Sec 6] shall be positive and pass the prescribed endurance and reliability test from a recognized testing laboratory. They shall be so located as to be inaccessible to un-authorized personnel. The electromechanical latch should be so designed that it is inaccessible or invisible to the passengers in the car.

37.76.5. **OTHER SAFETIES:** Besides these safety devices mentioned above, motor operated electro-mechanical brake [Clause 1.6] counter-weight guards [Clause 8.1] alarm bell, emergency door lock release operating key and associated safety and other safety requirements shall also be included.

37.77. **TESTING OF INSTALLATION:**

37.77.1. Tests shall be carried out in accordance with IS – 4666. In particular, the following tests shall be carried out in the completed lift installation. The necessary test weights and instruments shall be provided by the lift contractor during test and the electric power at the declared voltage [and frequency] required for adjusting the testing shall be supplied by the Department on payment at the rates mentioned in Special Conditions.

37.77.2. Test to determine that the insulation resistance between power control lines and earth is not less than 0.5 mega ohms when measured with a DC voltage of 500 Volts. The test shall be with conductors so connected together as to ensure that all parts of every circuit are simultaneously tested.

37.77.3. Test to determine that the earthing of all conduits switch casings and similar metal work are continuous and of low resistance. Tests shall be made from all terminal points of a substantial current to ensure that the resistance of earth path is sufficiently low to enable fuses or circuits operated under faulty conditions.

37.77.3. Test to determine that the motor brake control equipment and door locking devices function correctly.

37.77.4. Tests to determine that the lift car will attain rated speed.

37.77.5. Test to determine that the lift car will raise and lower at rated load.

37.77.6. Tests to determine that the safety gear will stop the lift car with rated load. Over speed tests will be made with ropes attached and all electrical apparatus operative except the over speed switch on the governor two tests shall be carried out, one with rated load and the other with empty car and the safety gear shall be examined for signs of permanent distortion if any safety gear designed to stop the lift car on counter weights speed shall stop lift car with rated load or the counter weights speed shall stop lift car with rated load or the counter weight from governor tripping speed within the range of stopping distance.

37.77.7. After the installation of each lift the contractor will have to get rated load test to determine whether the safety gear operates satisfactorily within the specified limits. The testing of lifts as per IS to be carried out in presence of representative of Accepting officer. The test report shall be signed by the contractor, Engineer-in-charge and representative of Accepting officer.

37.77.8. The test results shall be filled up in the format given under Appendix "C" for all the lifts.

37.78. **EMERGENCY RESCUE DEVICE:** The contractor shall provide an automatic emergency rescue device which shall bring the car trapped due to power failure to the nearest floor and both the car and landing doors will open for the passengers and goods to come out. In addition to automatic, manual winding arrangements may also be provided for rescue as well as for testing purposes.

37.79. **TAKING OVER:** The installation will be taken over only if the above mentioned acceptance of this effect is issued by the rep of Accepting Officer.

37.80. **GUARANTEE:**

37.80.1. The contractor shall submit a certificate to GE that over all specifications given in the tender and shall guarantee that materials and workmanship of the lift and connected equipment offered and installed by him under the contract are new and first class in every respect and he will make good any defects damages which are not attributed to normal wear and tear or misuses and will be **responsible for repairing and/or replacing any parts which are rendered defective during the maintenance period of 24 months from the certified date of completion by GE** .The contractor or his rep shall inspect the each lift every month after completion of the work and provide all lubrications during the defects liability period i.e **24 months from the certified date of completion by GE**.

37.80.2. He will produce test and inspection certificate of components incorporated in the lift of having passed necessary tests required under IS – 1860 and IS – 4666.

37.81. **LIFT OPERATIONS:**

37.81.1. Collective Selective Operation With / Without attendant: Automatic operation by means of one button in the car for each landing level served and by up-and-down buttons at the landings, wherein all stops registered by the momentary actuation of the car made as defined under non-selective Automatic Operation but where in the stops registered by the momentary actuation of the landing buttons are made in the order in which the landings are reached in each direction of travel [irrespective of the sequence in which the buttons have been actuated]. With this type of operation, all 'up' landing calls are answered when the car is travelling in the up direction and all 'down' landing calls are answered when the car is travelling in the down direction, except in the case of the uppermost or lowermost calls which are answered as soon as they are reached in-respective of the direction of travel of the car. It shall be arranged to co-ordinate both cars for efficient service and prevent them from answering the same calls by the provisions of only one set of landing cell button fixtures. It shall automatically assign each call to the car that will be in the best position to answer promptly. The system shall be so arranged that when the cars are idle, normally one car will be parked at the lower main landing with its doors closed or open and the other car shall be free car parked with the doors closed or open to the landing where it answered its last call, and shall be the one to attend to the nearest call.

37.81.2. Each car shall always respond to call registered by its own car call buttons. When either car is parked out of service for any reasons the other car shall function as single car [simplex] selective collective. Besides the control system shall also be arranged for independent service from inside the car. A by-pass button [non-stop button] shall be provided inside the car to enable the attendant to by-pass any landing if the car is full or if otherwise so required. The two lifts shall be arranged with or without attendant operation and shall function as described using single car selective-collective operation. When the transfer switch is in the attendant position the operation of the cars shall be identical with that described for automatic operations except that:

[a] Closing of doors and starting of cars shall be initiated by the car buttons only;

[b] Buzzers and directional lights in the car are operative, and

[c] Landing by-pass shall be effective.

The pressing of an up or down landing call shall illuminate appropriate direction indicator in the car panel, which is to answer that call and if the doors are open shall also sound buzzers as a signal to the attendant. If both cars are parked at the lower landing the above signals shall be given to the car which has been at the floor for longest time.

37.82. **AUTOMATIC GROUP SUPERVISORY CONTROL:**

37.82.1. General operating principal the calls registered inside the car as well as the landings are answered in the sequence in which the floors are reached irrespective of the sequence in which the buttons have been pressed. Only one car will stop in response to any one landing call and will be the nearest car travelling in the corresponding direction of the call. White this car is stopping at this landing, the call will be automatically cancelled to prevent other cars stopping against the same call.

37.82.2. **AUTOMATIC SELECTION OF TRAFFIC PROGRAM:** The group supervisory control continuously examines traffic conditions in the building and automatically puts into operation the program which can best cope with the demand at any particular time. This is fully automatic and requires no supervision or attendant. To suit the traffic demand in the building, suitable traffic programmers available:

[a] Up Peak Program

[b] Down Peak Program

[c] Up Down Inter Floor Program and

[d] Night Program

[a] **UP PEAK PROGRAM:** The group supervisory control responds to the increasing influx of passengers at the main landing in the morning hours, at the start of work, by automatically switching on the up peak program. The cars are dispatched from the main landing automatically at a pre-determined interval after the previous dispatched car. The 'Leaves First' signal is transferred instantaneously from the car dispatched to another car at the main landing. The car answers the registered calls in the natural sequence of the floors and returns directly to the main landing after last passenger has been discharged. At the main landing they are kept for a predetermined time for taking new passengers. However, a car starts its up travel the moment it becomes fully loaded, without waiting for the dispatch interval to lapse.

[b] **DOWN PEAK PROGRAM:** An intense traffic flow from the upper floors towards main landing will automatically switch on the down peak program. The cars, when fully loaded at upper floors, travel directly to the main landing and after discharging the passenger, immediately start up to answer further down calls, which ensures equal service to all floors.

[c] **UP DOWN INTER FLOOR PROGRAM:** A steady traffic between main floor and upper floor, and between floor to floor causes automatic switching on of the inter floor Program. Specific cars are assigned to answer specific calls by traffic analyzer so that the calls are handled most efficiently. The cars are so well distributed that every call gets equal service with short waiting intervals. As soon as the numbers of calls drop to occasional calls only such as at night, the cars get automatically parked in their assigned zones to give personalized service with minimum lift travel. If no calls are registered for some time the motor generator sets are automatically switched off.

[d] **NIGHT PROGRAM:** When the traffic ceases to occasional calls only, the supervisory control automatically switches over to Night Programmer. All cars remain parked at the main landing with doors closed, but are at all times ready for operation. One of the lifts has its 'Leave first' signal lighted. On pressing of call button at the main landing, the doors of this particular lift open and the passenger can travel with the lift. The same lift also responds to landing calls from above. The moment this car leaves the main landing the "Leave First" signal is transferred to a second lift. Further passengers entering main lobby will take this second lift. This second lift also responds to landing calls from above if one lift can no longer cope with the demand. After these lifts have answered their calls, the one reaching the main landing last will retain the "Leave first" signal. Thereby, the service is practically confined to one lift alone and motor generator sets of the remaining lifts remain switched off. If no calls are registered for some time, the meteor generator of the stand by lift also automatically be switched off. The motor generator will start up again, the moment the call is received. The number of lifts going into action is automatically regulated to just so many as are necessary to cope with occasional traffic surge. In case where more than 3 lifts installed in a bank, a better utilization of these lifts can be obtained by two additional programmers to deal with heavier traffic in each direction in difficult time. These are [i] Heavier "Up" Program [ii] Heavier "DOWN" Program].

[i] **HEAVIER "UP" PROGRAM:** This shall require the cars to make more stops in the up direction, necessitating more time for the up travel. For this purpose the automatic traffic analyzer shall dispatch cars from both terminal at automatically adjusted time intervals so that the cars are equally spaced, thus reducing passenger waiting interval [this program caters for the traffic which is likely to be in both directions but predominantly in the up direction e.g. immediately after the morning peak or after lunch.

[ii] **HEAVIER "DOWN" PROGRAM:** This shall require the cars to make more stops in the down direction and the dispatch times shall be adjusted accordingly by the traffic analyzer. If any of the cars in the group develops any defect it shall be automatically disconnected from the group control until it is rectified. In the event of failure of automatic dispatch system the lifts shall function by auxiliary means to avoid any disruption of service. Audio visual indication shall be provided to bring such failures to notice.

37.82.3. The lifts shall be designed for attendant operation as described under single [simplex] selective collective operation car except as follow:

[a] The indicating lights in car shall be operative to inform the attendant when to start loading a car at a terminal and when to leave the terminal.

[b] Landing call by pass switch and car reversal switch and switches shall be effective and load weighing devices shall be inoperative.

[c] Call above signal shall be illuminated whenever a call is registered at a landing above the car location indicating to attendant that car is to proceed upwards. When the highest call has been answered the light shall be extinguished indicating to the attendant that when the car is started it will proceed downward.

37.83. **CONTROLLING EQUIPMENT:**

37.83.1. The movement of the car shall be electrically controlled by means of a controller located in the machine room.

37.83.2. **CONTROL CIRCUITS:** The control circuit shall be designed to the type of lift specified for safety operation. It shall not be possible to start the car unless all the car and landing doors are fully closed and landing doors locked. The circuit shall have and independent fuse protection for fault and over loads and be arranged so that earth fault or an open circuit shall not create unsafe condition. The circuit shall be so arranged that for the stoppage of the car at specified landing or for actuation of a contactor by emergency switches or operation of safety gears the system shall not depend upon the completion or maintenance of an electrical circuit to cut off power supply and apply the brakes. This requirement is not applicable to dynamic braking and speed control devices.

37.83.3. **TERMINAL BOARDS:** All wiring for external control circuits shall be brought to a terminal board with means of identification of each wire. Metallic/plastic identification tags shall invariably be provided. All connections of wires to terminal boards shall be adequately clamped or screwed.

37.84. **AUXILIARY SWITCHES:**

37.84.1. **EMERGENCY STOP SWITCHES:** On top of the lift car an emergency stop switch shall be provided for use by maintenance personnel. Stop switch shall be provided in the machine room. Operation of these switches/ buttons shall cancel all the registered calls and landing calls for that particular lift.

37.84.2. **MAINTENANCE SWITCH ON TOP OF THE CAR:** For purpose of inspection and maintenance, maintenance switch shall be provided on top of the car. The control circuitry shall be so arranged that in the event of the operation of this switch:

[a] The car speed shall be less than the rated speed not exceeding 0.85 meters/sec.

[b] The car movement shall be possible only on the application of the continuous pressure on a button. It shall be so mounted to prevent any inadvertent operation.

37.84.3. **FIREMAN SWITCH:** Fireman switch with glass to break for access shall be provided at ground or main floor for all the lifts. The operation of this switch shall isolate/or cancel all calls to all the lifts and the lifts will stop at the next nearest landing if travelling upward. The doors will not open at this landing and the lifts will start travelling to ground floor. If these were already travelling down, they will go straight to ground floor direct without stopping enroot.

37.84.4. **INSPECTION FACILITY:** An Inspector's change over switch and set of test buttons shall be provided in the controller. Operation of the Inspector's change over switch shall make both the car and landing buttons inoperative and permit the lift to be worked in either direction from machine room for test purposes by pressing corresponding test buttons in the controller. It shall not however interfere with the emergency stop switches inside the car or on the top of the car.

37.84.5. **SAFETY LINE INDICATORS:** If specified visual tell tale lights may be provided to monitor the conditions of faults in the safety line of the lift for easier fault finding. These indicators will remain lit when safety circuits are normal. One indicator shall be provided for each safety on the controller. If any indicators fail to light up as the lift proceeds in its sequence of operation, there shall be visual indication of the safety line open circuit and also its location for easier fault finding.

37.85. **CONTROL WIRING:**

37.85.1. **WIRING IN MACHINE ROOM:** Power wiring between the controller and main board controller to various landings shall be done in heavy gauge conduit or metal duct & shall conform to I.E. Rules 1956 and MES Schedule Part – I & Part – II, Specifications for Electrical Works.

[a] Following general principles shall be followed in wiring.

[i] Control cables carrying DC and power cable carrying AC shall not be run in the same conduit or metal duct and they shall be laid as per IE Rules.

[ii] Metal duct with removable inspection cover shall be preferred.

[iii] In case of control cables also the harness shall be separate as far as feasible for separate functions and laid separately in suitably dimensioned metal duct or in a separate conduit such as the signaling, locking, lamp indication and safeties. Control cables for different voltages in the lift installation works should be laid as per IE Rules.

[b] At least 5 percent with a minimum of 5 unconnected spare wires shall be available out of all the lines to be provided in the wiring harness from the midway junction box to the machine room.

[c] There shall be a master isolating switch Fuse associated with the controller heavy duty load break, quick make quick break type TP & N preferably interlocked with controller cabinet door. Isolator handle shall have provision for external locking in off position. All relays shall be suitable for lift service and shall incorporate adequate contact wipe for reliable operation. Relays shall operate satisfactorily and Relays shall be operating 80 percent to 110 percent of their voltage. Main motor contactors shall be suitable for AC duty. Tenderer shall be required to furnish full details of make, type, applicable standard, voltage and current rating, duty class, type and routine tests done etc. on contactors and relays. Copies of type test certificates shall also be furnished by the successful tenderer. All cables shall be with copper conductors and flame retardant or PVC insulated of appropriate size. The cables feeding motor and in heavy current flow paths shall be so selected that the size matches the protecting fuses and will not result in more than 2 percent voltage drop from the main board to the terminals of motor. Control cables shall not be less than 0.5 sq.mm or equivalent if stranded; where installation of heavy gauge conduits present difficulties, short length of flexible conduits will be permitted but effective electrical continuity and earth bonding shall be ensured. Ferrules shall be slipped at the ends of all cables as per standard control wiring practice. All terminal blocks shall be suitably marked.

37.85.2. **TRAILING CABLES:** A single trailing cable for lighting control and signal circuit is permitted, if all the conductors of this trailing cable are insulated for maximum voltage running through any one conductor of this cable. The lengths of the cables shall be adequate to prevent any strain due to movement of the car. All cables shall be properly tagged by metallic/plastic tags for identification. Trailing cables shall run from a junction box on the car to a junction box located in the shaft near midpoint of travel and from these junction boxes conductors shall be run to the various locations. Trailing cables exceeding 30 meters in length shall run so that the strain on individual cable conductors will be reduced to a minimum and the cables are free from contact with the car counter-weight, shaft walls or other equipment. Trailing cables exceeding 30 meters in length shall have steel supporting fillers and shall be suspended directly by them without rubbing over other supports. Cables less that 30 meters in length shall have no-metallic fillers and shall be suspended by looping cables around supports of porcelain spools type or equivalent. 5 per cent of the total capacity subject to a minimum of 5 wires shall be available unutilized in the trailing cable everywhere suitably distributed between various functions.

37.85.3. **EARTHING:** Metal frames and all metal work of the lift controller frame etc. shall be earthed with double earth leads taken to the earth bar. Looping shall be permitted if such routing is feasible. All other individual metallic frame work of components etc. shall be loop earthed.

37.85.4. **MISCELLANEOUS:** Principle of segregation function wise shall be accepted as far as possible in the general arrangement of components. All terminal blocks shall be of 650 V grade.

37.85.5. **CONTROLLER CASING:** The controller unit comprising of the main circuit breaker adjustable overload and phase reversal and phase failure protection all the circuit elements transformer, rectifier for D.C. control supply, inverter power pack, terminal blocks etc., shall be enclosed in an insect proof, sheet steel floor or wall mounted cabinet with hinged doors at front or at both front and rear. Proper warning boards and danger plates shall be provided on both sides of the controller casing. Sheet steel used for controller cabinet shall not be less than 18 gauge and shall be properly braced where necessary. Suitable gland plate shall be provided for cable entry. The battery for the charger unit shall be suitably placed in the machine room. All sheet steel work shall be painted with two coats of synthetic enamel paint of suitable shade both inside and outside over two coats of zinc primer.

PARTICULAR SPECIFICATIONS [Contd...]

37.86. **LIFT ROPE COMPENSATION:** The lift rope compensation for lift travel shall be provided for lift travels beyond 40m in all cases.

37.87. **AUTOMATIC RESCUE DEVICES [ARD]:** The Automatic Rescue Devices [ARD] meant for the purpose of bringing the lift car to the nearest landing doors, are being used selectively and is generally restricted to commercial buildings having heavy traffic. However, frequent power failures being the common phenomenon, the provision of ARD shall be made in all the lifts. The ARD shall have the following specifications:

37.87.1. ARD shall move the elevator to the nearest landing in case of power failure during normal operation of elevator.

37.87.2. ARD should monitor the normal power supply in the main controller and shall activate rescue operation within 10 seconds of normal power supply failure. It should bring the elevator to the nearest floor at a slower speed than the normal run. While proceeding to the nearest floor the elevator will detect the zone and stop. After the elevator has stopped, it automatically opens the doors and parks with door open. After the operation is completed by the ARD the elevator is automatically switched over to normal operation as soon as normal power supply resumes.

37.87.3. In case the normal supply resume during ARD in operation the elevator will continue to run in ARD mode until it reaches the nearest landing and the doors are fully opened. If normal power supply resumes when the elevator is at the landing, it will automatically be switched to normal power operation.

37.87.4. All the lift safeties shall remain active during the ARD mode of operation.

37.87.5. The battery capacity should be adequate so as to operate the ARD at least seven times a day provided the duration between usages is at least 30 minutes.

37.88. **LIST OF INDIAN STANDARDS CONNECTED WITH LIFT & ESCALATOR INSTALLATIONS**:

Ser No.	Description	IS Number
1	Electric Traction Lifts Part – 1 Guidelines for outline Dimensions of passenger, goods, service and hospital lifts IS	IS – 14665 [Part – 1]
2.	Electric Traction Lifts Part – 2 Code of Practice for Installation Operation and Maintenance, Section – 1 Passenger and Goods Lifts, Section – 2 Service Lift	IS – 14665 [Part – 2 / Sec 1 & 2]
3.	Electric Traction Lifts Part – 3 Safety Rules Section – 1 Passenger and Goods Lifts Section – 2 Service Lifts	IS – 14665 [Part – 3 / Sec 1 & 2]
4.	Electric Traction Lifts Part – 4 Components	IS – 14665 [Part – 4 / Sec 1 to 9]
5.	Electric Traction Lifts Part – 5 Inspection Manual	IS – 14665 [Part – 5]
6.	Code of Practice for Installation and Maintenance of Escalators	IS – 4591
7.	Code of Practice for Installation and Maintenance of	IS – 14671

	Hydraulic Lift	
8.	Specifications for Hoist Way Door-Locks	IS – 7754
9	Rules for the Design, Installation Testing and Operation of Lifts, Escalators and moving Parts	IS – 1735

37.89. **TRAINING OF DEPARTMENTAL PERSONNEL:** Tenderer's offer shall be deemed to include for necessary training for 2 week of departmental personnel for operation, trouble shooting, PLC system and maintenance of the lift. GE shall nominate the departmental personal for obtaining training of lifts.

37.89A After completion of work, the entire lift installations shall be tested by contractor by 3rd party viz TUV/ LRS/ IRS as approved by GE in the presence of Engineer-in-Charge and the results of such test shall be recorded and signed by both parties. Quoted rates shall be inclusive of testing in accordance with the modern Engineering practice and MES SSR Part-I (specifications)

37.90. **COMPREHENSIVE MAINTENANCE OF LIFTS] [Electrically Operated Lifts]**

37.90.1. **SCOPE OF WORK:** The work under this part covers comprehensive maintenance of lifts by regularly and systematically examining / adjusting as required. All the parts, which warrant repair/replacement in the opinion of the GE, shall be repaired or replaced accordingly. The parts which will be replaced during currency of comprehensive maintenance contract shall be of the make / specifications provided originally by OEM. It is specifically brought out that this maintenance includes repair/replacement of each and every part of the lift except the replacement of the following:

[a] Car enclosure except floor [b] Floor doors

[c] Control panel [d] 3 Phase motor

37.90.2. The necessary T & P required shall be arranged by the contractor and cost of the same shall be deemed to be included in the rates quoted. Required all the major/minor spares shall be deemed to be inclusive of quoted rates. (ii) Sufficient manpower (One Lift Mechanic and One Electrician) having sound knowlwdge and well experience of lifts shall be employed by the contractor. All the staff employed for maintenance shall be reported to AGE E/M office daily and will give day to day progress duly entered in the concerned registers.

37.90.3. The cleanliness of car lift well and machine room shall be responsibility of the contractor. Contractor or his representative shall ensure that door / window are properly kept closed avoiding any damage to glass panes during rainy/stormy days. He will also ensure to make good the glasses to window if broken/damaged, during the rainy/stormy days. Necessary protective arrangement for equipment of M/C room shall be made to avoid any damage. The contractor shall take all necessary measures / precautions to ensure that all the equipments are properly protected from intrusion of any foreign material/agents etc.

37.90.4. Adequate arrangement shall be immediately made for dewatering the lift pit as and when water accumulates.

37.90.5. **COMPLETION CERTIFICATE**: Completion Certificate to the effect that the comprehensive maintenance was carried out shall be obtained from GE for final payment.

37.90.6. **WORKMANSHIP:** The contractor shall be responsible for proper functioning of electrical and mechanical fittings of the lifts and the maintenance of the same in sound condition. The contractor shall stock sufficient parts / major assembly to ensure immediate repairs and maintaining the lift in working condition in shortest possible time to avoid inconvenience to users. The tenderer's rate shall be deemed to include cost of such contingencies

37.90.7. **GENERAL**:

37.90.7.1. Maintenance and supervision shall be done by certified trained men from OEM of lift for the safe operation of lifts. Contractors shall carry out fortnightly servicing including adjustment lubrication, repair or replacement of parts necessary. In addition to fortnightly servicing, contractor's senior mechanic or Foremen shall carry out the inspection as per maintenance Schedule and make necessary entries in the Proforma Nos. 1, 2, 3 & 4 given in Appendix "D" respectively as applicable kept in the switch room for this purpose. It shall be the responsibility of the contractor to maintain schedule book properly.

37.90.7.2. The contractor shall obtain signature of Junior Engineer of the GE at MES office in token of satisfactory completion of defects. The contractor shall be available for 24 hours call back services for attending all types of complaints. However, the contractor shall engage additional manpower as per the job requirement without any extra cost and in case of repairs/emergencies. **Contractor shall promptly attend to and any complaint shall not be kept pending for more than 4 hours. In case of delay in repair of the lifts for more than 24 hours but less than 10 [ten] days, the GE may at his absolute discretion impose penalty on the contractor a sum of Rs. 650.00 per day per lift or part thereof and Rs. 2500.00 per day per lift or part thereof after 10 [ten] days. The decision of the GE as to whether a particular lift has been maintained or not on a particular day will be final and binding.**

37.90.7.3. The contractor shall be responsible for upkeep and maintenance of machine rooms and shall ensure that doors windows etc are properly working and the places are well lit up and kept clean.

37.90.8. **DETAILS OF MAINTENANCE RENEWAL**:

37.90.8.1. The maintenance of lifts shall be carried out as per lift rules irrespective of whether the lift is in use or not.

37.90.8.2. The contractor will carry out fortnightly, monthly, quarterly and annual maintenance as per Performa Nos 1, 2, 3 & 4 respectively. In case the contractor fails to carry out the above maintenance, the following penalty per lift will be imposed:

[a]	Not carrying out maintenance fortnightly	:	Rs. 600.00
[b]	Not carrying out maintenance monthly	:	Rs. 1,200.00
[c]	Not carrying out maintenance quarterly	:	Rs. 1,800.00
[d]	Not carrying out maintenance annually	:	Rs. 3,000.00

37.90.8.3. Lifts are required by statutory regulations to be examined at intervals, as specified by the lift Act, by a competent person, who is required to report on a prescribed form. Such reports shall normally be kept in a register. The provision of statutory report shall be deemed to be included and it shall be arranged by the tenderer at specified intervals.

37.90.9. **MAINTENANCE OF LIFTS/ DETAILING OF TECHNICAL STAFF:**

37.90.9.1. The contractor shall employ sufficient staff for efficient maintenance of lifts who shall work round the clock.

37.90.9.2. The complaints thus attended by the contractor by his accredited representative shall be recorded in proper log sheet as under and shall be submitted to Junior Engineer E/M daily for record.

Date & Time when complaint lodged	Block No & Lift No	Nature of defect	Date & time when defects rectified	Initial of defects concerned
1	2	3	4	5

37.90.10. **TESTING:** The contractor shall have the following tests to be carried out once in a year during the currency of contract at site in presence of the GE. The necessary test weights and instruments shall be provided by the Contractor.

[a] Test to determine that the insulation resistance between power and control lines and earth is not less than 9.5 mega ohms when measured with a DC voltage of 500 Volts. The test shall be carried out with the conductors so connected together as to ensure that all parts of every circuit and simultaneously tested.

[b] Test to determine that the earthing of all conduit switch casing and similar metal work is continuous and of low resistance. Tests should be made from all terminal points by means of a substantial current to ensure that the resistance of earth path is sufficiently low to enable fuses or circuits to operate under faulty conditions.

[c] Test to determine that the motor brake, control equipment and door locking devices and limit switches function correctly Brake to be tested to check whether it can sustain car at rest with contact load plus 25% of contract load.

[d] Test to determine that the safety gear stop the lift car with rated load. The over speed tests shall also be made with ropes attached and all electrical apparatus operation except the over speed switch on the Governor. The stopping distance of the lift car is the actual slide as observed from the marking on the guides. The safety gear of lift having an AC motor drive may be tested by manually tripping the governor where the speed attained by loaded descending lift car, with brake released is sufficient to operative to governor.

[e] Test to determine that the lift car raises and lowers at rated load.

[f] Tests to determine that the lift car achieves the rated speed.

[g] At the time of carrying out tests, it is the responsibility of the contractor to provide the required equipment.

37.90.11. **MAINTENANCE, INSPECTION & TESTING OF LIFTS:**

37.90.11.1. **PREVENTIVE MAINTENANCE:** The introduction of planned preventive maintenance system is for the purpose of improving the services offered to users. Through the implementation of such a system, monitoring and effective control or routine maintenance can be achieved. By following the planned maintenance system, weakness can be highlighted so that correction may be implemented that will result in improved efficiencies and reduced costs. The system should not be seen as a magic cure, it is a tool to be used for proper management of routine maintenance together with pre-arrangement, good supervision and proper analysis of call-backs, so that the desired targets and goals can then be reached. All work involved in planned maintenance is being prearranged and distributed to the supervisor who should complete the work systematically at the time of a scheduled visit to a unit. The work of the system generally divided into two following parts:

PARTICULAR SPECIFICATIONS [Contd...]

[a] ROUTINE EXAMINATION [EVERY VISIT ON FORTNIGHTLY BASIS]:

[i] See the Users representatives.

[ii] Post "Elevator under Service" Board.

[iii] Observe door operation [closing-opening-reopening].

[iv] Check Alarm Operation.

[v] Check gear oil level, motor bearing oil level and governor shaft grease.

[vi] Follow code system cycle.

[vii] Check emergency light [battery operated].

[viii] Make entry on log card of all work carried out.

[ix] Obtain signatures of users or his representative.

[x] Report materials required.

[xi] Reports any items requiring attention outside the scope of routine examination.

[b] CODE CYCLE: Maintenance of lifts is to be carried out as per code cycle I F A B C G O H E F A J followed by I A B C E F A GO H J I in retaken which is presently prevailing in other Government organisation.

Ser No	Code No	Contains
1	Code "A"	Discretional work
2	Code "B"	Hall button indicators, Cop Annunciator
3	Code "C"	controller
4	Code "D"	Driving Mechanism
5	Code "E"	Entrances, Doors, Gates
6	Code "F"	Locks, Door cam/Retiring Cam
7	Code "G"	Safety & Governor, Car & CWT, Shoes, Buffers, Cwt, Screen.
8	Code "H"	Selector, Hoistway and car limit Switches Hoistway cleaning.
9	Code "I"	Inspection switches, zoning circuits, intercom.
10	Code "J"	Ropes [Main, Governing, Compensating, Selector Tape and Travelling Cables].

PARTICULAR SPECIFICATIONS [Contd...]

37.90.11.2. **PERIODICAL EXAMINATION:**

37.90.11.2.1. **DEFINITION OF CODE:**

[a] **CODE "A" [DISCRETIONAL WORK]:** The examiner is to use his special knowledge on the unit being serviced to do additional work in maintaining components which are not included in other codes areas e.g. Lubrication of rails etc. This work period is also to be used for completing any other work specified by maintenance supervisor or any pending work of other codes.

[b] **CODE "B" [HALL BUTTON INDICATORS, COP, ANNUNCIATORS]:**

[i] Check mechanical & electrical operation of push buttons, open and clean all the hall button boxes and check all connections, replace parts as necessary.

[ii] Open and clean all the hall position Indicator and car Position Indicator Boxes, tighten, all connections and replace parts as necessary.

[iii] Open and clean the car operating Annunciator panel boxes, check all connections and replace parts as necessary.

[iv] Check car lanterns, tell tale light and car direction arrows. Check connections, also check the working of emergency light holder [230V] fixed in the car.

[v] Overhaul car fan.

[c] **CODE "C" [CONTROLLER]:**

[i] Clean as necessary, check alignment of relays, switches, check and adjust overload relays [record the adjustment timing of overload in log card].

[ii] Check controller fuses for correct rating and holders for tightness. Check relay leads, non-magnetic [brass] guards, contacts and all connections. Adjust and replace parts as necessary.

[iii] Check the entire timed relay for correct timings and record.

[iv] Check marking tags on terminal blocks, relays, resistors condensers etc. replace tags as necessary.

[d] **CODE "D" [DRIVING MECHANISM]:**

[i] Brake - Open, clean and lubricate brake mechanism, check linings and correct mechanical and electrical operation of brakes check brake drum and parts for wear.

[ii] Machine Observe backlash and end play [Thrusts play] for noise, adjust gland packing as necessary check, gear-oil condition and seal oil leakage.

[iii] Check sheave grooves for wear and signs of rope slip.

[iv] Lubricate all the machine bearings i.e. Pedestal bearing, pillow block bearing, motor bearings etc., Car, Cwt, Deflector, Overhead & compensating sheaves.

[v] Ensure bearings are tight in sheave. Check Rope Grooves for wear or rope markings. Lubricate all the sheave shaft bearings.

[vi] Motor/Generator: Check all connections, brushes, for good contact and proper seating, lubricate all bearings and seal oil leakage, if any, clean commentator segments.

PARTICULAR SPECIFICATIONS [Contd...]

[e] **CODE "E" [ENTRANCES, DOORS, GATES]:**

[i] On power operated Doors: Clean and lubricate as necessary. Check door operator for proper mechanical and electrical function. Correct if necessary. Check hanger rollers, Car Door Switch, Track Buffers and Bottom shoes of doors. Door safety shoe & 'DO' Button.

[ii] The collapsible car gate or manual operated door: Check track and hanger rollers. Check bottom shoes/ gibes and other pivot points. Clean and lubricate as necessary.

[iii] On swing doors: Clean doors, check and correct door closer operation, clean closer and lubricate pivot point of closers, check and lubricate to door lines, check clearance of door from door brake and floor.

[f] **CODE "F" [LOCKS, DOOR CAM / RETIRING CAM]:**

[i] Clean and lubricate locks as required.

[ii] Check and correct electrical and mechanical operation, replace parts as necessary

[iii] Ensure lock and lock keeper fixing are secure.

[iv] Ensure fixing of retiring cam/door spearhead cam.

[v] Overhaul retiring cam and replace parts as necessary.

[vi] Check unlocking device.

[g] **CODE "G" [SAFETY & GOVERNOR, CAR / CWT, SHOES, BUFFERS, CWT, SCREEN]:**

[i] Governor: Check mechanical functions and functions of associated electrical switches [i.e. S0S, OS etc.]

[ii] Lubricate governor and tension pulley.

[iii] Clean and check car guide shoes and safety blocks for correct guide Rail clearance.

[iv] Check Guide fixing.

[v] Check safety link arms and moving parts attached to car frame for lubrication and freedom of movement.

[vi] Check Car enclosures, steady plates or rollers and locating blocks.

[vii] Check Cwt, shoes and liners for wear.

[viii] Check oil in oil buffers, ensure fixing of buffers in the pit.

[ix] Lubricate compensation / Indier pulleys and adjust window.

[x] Check compensation chain, hitch bolts and hooks or shorten chains, if necessary.

[xi] Check Cwt screen.

[h] **CODE "H" [SELECTOR HOISTWAY & CAR LIMIT SWITCHES HOISTWAY CLEANING]:**

[i] Clean selector as necessary. Check alignment and air gap of relays. Check loads, contacts, connections on relays. Check marking tags on relays and terminal blocks and bar contacts.

[ii] Check selector cable for damage and wear, check 'PH' contacts and all the brushes and bar contacts. Check cross-head guide and gears for lubrication, wear and noise [do not over-lubricate].

[iii] Check tolerance for all moving parts.

[iv] Check machine room and meter room main switches for proper contact, fuses and connections.

[v] Clean hoistway.

[vi] Clean car hoistway limit switches, check function and connections. Lubricate, renew parts if necessary check and correct operation as necessary. Ensure fixing of switch operating cam.

[i] **CODE "I" [INSPECTION SWITCHES, ZONING CIRCUITS INTERCOM]:** Check the following operations:

[i] TCI controls.

[ii] Inspection lights on car top, bottom, hoist way and in the pit.

[iii] Duplex circuit, zoning circuit.

[iv] Fireman's switch circuit

[v] Special service key switch.

[vi] Independent key switches.

[vii] Intercommunication system.

[j] **CODE "J" [ROPES MAIN, GOVERNOR, COMPENSATING, SELECTOR TAPE AND TRAVELLING CABLES]:**

[i] Clean and lubricate ropes, if necessary.

[ii] Observe wear as per method of inspection on ropes and report shortening, if necessary.

[iii] Check selector tape for cracks, rust, tension and lubrication.

[iv] Check compensation chain, hitch bolts and hooks for wear, damage and lubrication, shorten if necessary.

[v] Ensure that the travelling cables are secured and check them for damage and necessary guards or rubber.

[vi] Clean junction boxes, Car & Midway. Check connection and marking tags, replace tags if necessary.

[vii] Annual equipment survey: Once every year, the service supervisor should thorough survey each elevator falling within his jurisdiction. The survey is intended to reveal the actual condition or the equipment broadly broken down into following:

[i] Housekeeping and lubrication

[ii] Adjustments

[viii] Based on the survey report, a work order should be prepared to carryout necessary rehabilitation and overhauling of the equipment. After this has been done, the equipment comes in a working condition which is as good as when it was first commissioned. Any items of work which are required to be carried out by users, should also be brought out to his attention through a written report.

[ix] **Safety Tests:** It has been experience of elevator companies that elevator safety devices should be examined and operated at regular intervals to determine whether or not they are working properly. All elevators should be scheduled for an annual safety test. At this time, the complete safety and its parts are to be checked for operation and any possible shortcomings are to be noted and maintained in accordance with relevant maintenance standards. In brief:

[i] Safety shall be checked annually.

[ii] Safety Governors are normally set for Electrical tripping at 15%-20% over speed and at 30%-40% over speed, the mechanical safety action must take place.

[iii] Corrosion, if unchecked, will shorten the life of the ropes by inducing unnecessary friction and obtrusive action between the wires and strands. Ropes that are subjected to considerable moisture, steam, acid or other harmful fumes should be lubricated frequently and watched for any signs of corrosive action. Every oil is not suitable as a rope lubricant. Oil that contain ingredients which are harmful to wire ropes such as acid, alkalis etc. should not be used. Therefore, only wire rope lubricant should be used for this purpose. It is compounded especially for this use and its properties are such that it penetrates the rope and does not materially affect the traction of the ropes. Care should be exercised in applying lubricants to ropes that as only a thin film is necessary otherwise the lubricant will run down the ropes and accumulate on top of the car and start gathering lint and dust. It is not advisable to pour the lubricant on the ropes. The practice of using a small brush is satisfactory for applying the lubricant on ropes. It disperses the lubricant through small holes or orifices allowing it to flow with the ropes. The car speed should not be more than 100 FPM while applying the lubricant. Clean the ropes with a house broom or mini brush to remove any accumulated dirt and lint in valleys of ropes. The frequency at which lubricant should be applied to elevator wire ropes, depends entirely upon the individual installation, the outward appearance of the ropes and the condition of the driving sheave. Fine rust, coloured dust appearing in the valleys of the ropes is an indication that the ropes need lubrication. Ropes are shiny and feel dry to the touch shows that they must be lubricated. The appearance of fine metal fillings in or about the machine bed-place, on the floor around the rope slots, under the drive sheave are signs of wear in the grooves and the ropes shall be lubricated.

[x] **Hoist rope tensioning:** It is very important that all ropes of the same set be under equal tension so that each rope can carry it's fully share of the load. If the rope set is out of balance and there are ropes that do not pick-up their share of the load, there will be excessive wear on the sheave grooves over which they pass. It has been found that this excess loosen ropes. The loosen ropes are also subjected to a development of invisible wire breaks. Thus it is evident that unequal rope loading produces unsatisfactory operation, short rope life, and grooves that do not wear evenly. Unequal tension in new ropes is generally caused by improper adjustment at the shackles. All grooves must be checked to ensure that the ropes in the set, all seat to exactly the same depth so that the length of travel of all ropes will be the same. If grooves are not the same, unbalanced load will exist between the ropes. The ropes of the set should be from the same reel. If not the tension differential can be caused.

37.90.11.3. **SAFETY OF ELEVATORS:**

[a] Electrical safety appliances for controlling the lifts

[i] Phase reversal relay.

[ii] Overload protection of the motor.

[iii] Single phase prevention.

[iv] Mechanical Interlocking of direction Relays.

[v] Governor Over speed Switch.

[vi] Safety switches on Car.

[vii] Emergency Stop Switch on Car.

[viii] Hoistway Door Locks.

[ix] Car door Lock.

[x] Direction Limit Switches.

[xi] Final Limit Switches.

[xii] Safety shoe in car Door.

[xiii] Main Fuse and controller Fuse

[b] Mechanical Safety Appliances for controlling the lifts:

[i] Hoistway mechanical interlocks.

[ii] Car & Cwt, Buffer.

[iii] Over speed Safety.

[aa] Instantaneous Safety [Knurled]

[bb] Flexible Guide Clamp

[cc] Wedge Clamp

[c] Over speed protection: If the elevator is travelling in the down direction and its speed exceeds the safety limit, then a mechanical safety device operates and first the electric power to the motor is switched-off and the elevator is stopped. The elevator car remains stationery and is gripped to the elevator guide rails, thus, even if the hoist ropes are cut, the elevator car is prevented from a "free Fall" and an accident prevented.

[d] Toe guard Protection: If the car stops above the landing, there is a chance of a person falling in hoist way. To avoid this Toe guard, a Toe guard is provided below the car sill. The height of the Toe guard varies according to the speed.

37.90.11.4. **MAINTENANCE SCHEDULES:**

[a] **FORTNIGHTLY MAINTENANCE:** Each lift is required to be visited by designated maintenance team and carry out specified maintenance activities to ensure up keep of lift is user works condition. Details of maximum checks required to be pertained are enclosed as Appendix "D".

[b] **MONTHLY MAINTENANCE:** Each lift is required to be visited by designated team compressing skilled mechanics and supper team shall check all critical components which are required to be kept in controlled condition. Details of check are listed required to be carried out are listed in Appendix "D". A proper visit record is required to be maintained duly counter signed by supervisory staff. The supervisory staff shall randomly associate or counter check certain lifts and shall endorse their remark in monthly maintenance record of respective lift.

[c] **QUARTERLY MAINTENANCE:** Each lift is required to be provided specified maintenance every quarter by designed mechanic details of maintenance required to be done and persons responsible is provided in Appendix "D".

[d] **ANNUAL MAINTENANCE SCHEDULE:** Certain specified maintenance is required to be per formal on each lift to ensure longevity and useful working of lift details of maintenance required to be done and persons responsible is provided in Appendix "D".

PARTICULAR SPECIFICATIONS [Contd...]

37.90.11.5. **INSPECTION, PERIODICAL TESTING, AND CONFORMITY WITH STATUTORY REQUIREMENTS:** The lifts shall be inspected, periodically tested by the IEM's available at the office of DGNP [V].

[a] **CONFORMITY WITH LIFTS ACT AND RULES:** The installation shall be generally carried out in conformity with lifts Act and Rules there under, wherever they are in force. It is the responsibility of the GE of the premises where the lift will be installed, to obtain necessary permission from the authority before and after the erection of lifts and for subsequent operation of lifts [s],

[b] **CONFORMITY WITH INDIAN ELECTRICITY ACT AND RULES:** All electrical work in connection with installation of electric lifts shall be carried out in accordance with the provisions of the Indian electricity act, 2003 and the provisions framed there under as amended from time to time, and shall also comply with the other provisions of Part 8 'Building Services, Section 2 Electrical and allied installation'.

[c] **CONFORMITY WITH INDIAN STANDARDS:** All materials, fittings, appliances etc used in electrical installation shall conform to Indian Standard specifications wherever these exit. In case of materials for which Indian Standard specifications do not exist, the materials shall be approved by the competent authority. For detailed specification for lifts, reference shall be made to the accepted standards.

[d] **CONFORMITY WITH FIRE REGULATIONS:** The installation shall be carried out in conformity with Part 4 "Fire and Life Safety" of NBC and local fire regulations and rules there under wherever they are in force.

[e] **FACTOR OF SAFETY:** The minimum factor of safety for any part of the lift shall not be less than five. Higher factor of safety for various parts shall be applicable in accordance with accepted standards.

[f] **TESTING OF LIFT:** The lifts shall pass the following tests when carried out quarterly at site in presence of authorized representative of the department and before it is put into normal service after major repair.

[i] Test to determine that the insulation resistance between power and control lines and earth is not loss than 0.5 mega-ohms when measured with a DC Voltage of 500 Volts. The test shall be carried out with the conductors so connected together as to ensure that all parts of every circuit are simultaneously tested.

[ii] Test determine that the earthing of all conduit switch casing and similar metallic work is continuous and of low resistance. Test should be made from all terminal points by means of substantial current to ensure that the resistance of earth path is sufficiently low to enable fuses or contactors to operate under faulty conditions.

[iii] Test to determine that motor brake control equipment and door locking device and limit switch functions correctly. Break to be tested to check whether it can sustain a car at rest with contract load plus 25% of contract load.

[iv] Test to determine that the lift car raised and lowers at rated load.

[v] Test to determine that the life car achieves the rated speed.

[vi] Test to determine that the safety gear stop the lift car with rated load. The over-speed test shall also be made with ropes attached and all electrical apparatus operative except the over speed switch on the governor. The stopping distance at the lift car is the actual slide as observes from the marking on the guide. The safety gear of a lift having an motor device may be tested by manually tripping the governor where the speed attained by a loaded descending lift car with break released. It is sufficient to operate the governor.

37.90.11.6. **TESTING AND COMMISSIONING PROCEDURE OF LIFTS:** This procedure covers the activities in preliminary tests and inspections, functional performance tests and the commissioning of newly completed installations and existing ones after major repairs.

[a] The objective of the testing and commissioning test are:

[i] To verify proper functioning of the equipment/system after installation.

[ii] To verify that the performance of the installed equipment/systems meet with the specified design intent through a series of tests and adjustments.

[iii] To capture and record performance data of the whole installation as the baseline for future operation and maintenance.

[b] List of tests and inspection to be carried out before installation:

[ba] Site Inspections prior to Delivery of Equipment

[i] Access

[ii] Barrier

[iii] Lighting and power

[iv] Storage Area

[bb] Inspection of Major Materials/Equipment delivered to site

[i] Check against approved lists

[ii] Check for any abnormalities

[bc] Lift Shaft and Lift Pit Inspection

[i] Dimensions

[ii] Finishes

[iii] Adequacy and accuracy of builder's work provision

[iv] Straightness of shaft

[v] Adequacy of safety measures

PARTICULAR SPECIFICATIONS [Contd...]

[bd] Machine Room Inspection

[i] Dimensions

[ii] Finishes

[iii] Adequacy and accuracy of builder's work provisions

[iv] Adequacy and accuracy of building services provisions

[v] Adequacy of waterproofing/drainage provisions

[vi] Adequacy of safety measures

[be] Adequacy and accuracy of associated Builder's work and building services provisions [e.g. door opening, opening on machine room floor, hoisting provisions, power supply and cabling facilities, etc.]

[bf] Other tests / inspections relating to setting-outs, safety and quality etc required before commencing installation works.

[c] Inspections to be carried out during installation

[i] Guide rails and fixing inside lift shaft

[ii] Guide shoes

[iii] Suspension rope termination including compensation chain/rope

[iv] Traction machine

[v] Over speed governor

[vi] Buffer

[vii] Electrical installation in lift shaft

[viii] Electrical installation in machine room

[ix] Inspection required before energisation

[d] Inspection and functional performance tests to be carried out upon completion

[i] Landing fixture

[ii] Car door and landing doors

[iii] Safety devices for doors

[iv] Lift car

[v] Control station in car

[vi] Car door operation

[vii] Safety gear and over speed governor

[viii] Ascending car protection means/speed reducing element

PARTICULAR SPECIFICATIONS [Contd…]

[ix] Automatic control system

[x] Installations inside machine room

[xi] Motor

[xii] Lift shaft and pit

[xiii] Counterweight [xiv] Riding quality

[xv] Hydraulic system [for hydraulic lift only]

[xvi] Automatic rescue device

[xvii] Communication system

[e] Statutory Tests as stipulated.

[f] **COMMISSIONING:** The places where lift inspections by virtue of lift rules/acts of the stated are located/posted, the commissioning of lift under the defence premises shall be under take by the such agencies. However where such agencies are not placed, the commissioning of lift shall be undertake by IEM posted with DGNP [V]

[g] Certification of Test and Examination for Lift is enclosed as Table – 1.

Appendix "A"

DATA SHEET FOR THE PROVISION OF PASSENGER LIFTS

Ser No	Nomenclature	Type of Lift : Passenger Lift	Remarks
1.	Type of Lifts	Passenger elevator	
2.	No. of Lifts required	As per Schedule	
3.	Load	As per IS	
4.	Speed	1.5 metres/Sec	
5.	Travel	Rise 3.35 metre approximately from floor to floor	
6.	Serving	As per Schedule	
7.	Entrance	One entrance on the same side	
8.	No. of the floors served	As per Schedule	
9.	Method of control	Electric motor with AC VVVF control with leveling.	
10.	Operations	Automatic operation control with or without attendant.	
11.	Position of machine room	As existing on ground	
12.	Size of lift well	As per Drawing	
13.	Position of counter weight	As suitable	

PARTICULAR SPECIFICATIONS [Contd…]

14.	Size of platform	As per IS and shown on drawings.	
15.	Construction design of car bodies	As per Schedule "A"	
16.	Car light	Recessed LED fittings – 1 No	
17.	Car entrance:		
	[a] Size and type of doors	As per ISI – 3534 of 1976.	
	[b] Door operation	Automatic with door drive operation and electronic door protection device	
18.	**Signal**		
	[a] Call indication	Position indicator with Arrow in all floors.	
	[b] Position indication	Car position indicator with Arrow in cars.	
	[c] Alarm bell and emergency light	Battery operated alarm bell and emergency light at 12 V DC supply Ground Floor landing and in car.	
19.	Power Supply	415 V, 3 phase, 50 HZ AC.	
20	Whether neutral wire available for control circuit.	Yes required.	
21.	Lighting	230V, 50HZ AC. Bulk head fittings	
22.	Whether subject to lift act rules	Yes as per lift act rules.	
23.	Additional items if required.	As brought out in Schedule 'A' and Particular Specifications.	
24.	Whether booklet giving complete details of maintenance schedule and circuit diagram required or not.	Yes complete details are required for maintenance.	

PARTICULAR SPECIFICATIONS [Contd...]

Appendix "B"

Refer Para – 37.3.2. of Particular Specifications, contractor shall furnish the following information in respect of each type of lifts offered by him in separate sheets:

[A] **Guaranteed Performance:**

[i] Contracts [a] Persons :

[b] Weight :

[ii] Speed of Operation _____ metres per second.

[iii] Type of Control :

[iv] Type of Doors and Size of Car :

[B] **Hoisting Wire Ropes:**

[i] Makers name :

[ii] Circumference of rope :

[iii] Total length provided :

[iv] Number of strands of the rope :

[v] Number and size of wire in each strand :

[vi] Lay of Rope :

[vii] Diameter of sheave at bottom of grove :

[C] **Lift Car:**

[i] Type of Construction :

[ii] Internal Dimensions :

[iii] Total Weight :

[iv] Lift Well Clearance :

[v] Car Travel :

[vi] Car Services :

[vii] Car Ventilation :

[viii] Car Lighting Device :

[D] **Counter Balance / Buffers / Guide:**

[i] Type and weight of counter balance :

[ii] Type and weight of guides and fixing :

[iii] Make of type of buffers :

PARTICULAR SPECIFICATIONS [Contd…]

[E] **Gearing:**

[i]	Makers Name	:
[ii]	Speed reduction	:
[iii]	Method of lubrication	:

[F] **Brakes**

[i]	Type and make of brakes	:
[ii]	Output	:
[iii]	Time rating	

[G] **Maker's Type and Other Details for**

[i]	Control panel	:
[ii]	Main isolating switch	:
[iii]	Emergency signal	:
[iv]	Motor resistance	:
[v]	Terminal stopping devices	:
[vi]	Trailing load	:
[vii]	Automatic electro mechanical locks	:
[viii]	Automatic electro mechanical locks	:
[ix]	Automatic leveling	:

[H] **Type of Landing Gates:**

[J] Any Other Information / Special Features Requirement to be Done by MES

PARTICULAR SPECIFICATIONS [Contd...]

Appendix "C"

ACCEPTANCE TEST INSPECTION REPORT ON _____

Particulars of the Passenger / Goods Lift : _____ KG / _____ KGs
Installed at :

INSTALLED MACHINERY

[a] AC DRIVING MOTOR OF MACHINE:

Serial No :

Sales No :

Type [Frame] :

Voltage :

Amps :

KW/HP :

Phase / HZ :

House :

Insulation class :

RPM :

[b] REDUCTION GEAR

Serial No :

Sales No :

Type :

[c] CONTROLLER

Serial No :

Sales No :

Type :

Volt :

Phase :

Wires :

Cycles :

RPM :

[d] SAFETY GOVERNOR0

PARTICULAR SPECIFICATIONS [Contd...]

Serial No. :

Sales No. :

Type :

Car Speed :

Tripping speed :

TEST REPORT

INSULATION RESISTANCE

	Class 10	AC Motor [In Mega Ohms]	Controller [In Mega Ohms]
L 1 to Earth			
E2 to Earth			
E3 to Earth			
L 1 to L 2			
L 2 to L 3			
L 3 to L 1			

Earthing: Please refer relevant Para of Particular Specifications: All equipment's motor, controller, etc are found to be connected to earth point terminated at machine room. Earthing of all wiring at conduits / troughs etc. is continuous.

Please refer relevant Para of Particular Specifications: Tested and found that the motor, brake, control equipment, door looking devices and limiting switches are found working correctly.

SPEED TEST [Please refer relevant Para of Particular Specifications]

Ser No	Load in Car [in KG]	Tachometer Reading [in MPH]	Divided by 60 [in MPS]	Speed	Remarks
1	Empty Car [UP]				
2	Empty Car [DN]				
3	Balance load [UP]				
4	Balance load [DN]				
5	Full load [UP]				
6	Full load [DN]				

AC Motor Up Down

Empty Car Running Current

Full Load Running Current

Please refer relevant Para of Particular Specifications on safety gear list.

[a] Tested and found that the safety gear stops the lift car with rated load.

PARTICULAR SPECIFICATIONS [Contd…]

[b] Tested the safety gear with rated load and also empty car and found that there is no permanent distortion.

[c] Checked and found the safety gear stops the lift car with the rated load within the range of stopping distance.

[d] Also checked that the electrical contact switch of the safety gear operates correctly.

Brake was tested and found that they sustained the car at rest with contract load + 25% of contract load.

Leveling accuracy found correct at full load and 25% overload as per IS – 4666 Para 24.1

Manufacturer's test certificates verified and copies are held with the AGE and GE.

1. Machine [AC Motor]
2. Controller
3. Governor
4. 13 mm dia hoist rope
5. Gear Box

We have examined the elevator installation furnished and completed in the above building in terms of our contract with you and hereby accept the same. All the tests are found to be satisfactory. The lift is recommended to put into operation for usage effective from _____. [Date shall be mentioned as applicable]

APPENDIX "D"

COMPREHENSIVE MAINTENANCE OF LIFT

PROFORMA No. 1

FORTNIGHTLY MAINTENANCE OPERATIONS

Ser No	Items	Checked by	Countersigned
1	Check that lift stops in down ward direction properly with 25% overload with operation of the "Emergency" stop	M	
2	Check that leveling is within limit K = +/- 75mm for single speed lifts	SM	SM
3	Check and lubricate by grease cup or top up oil on sleeve type bearing on:	SM	
	[a] Motor Shaft [b] Deflector sheave shaft [c] Governor Pulley		
4	Check and lubricate sleeve bearing of governor tensioning pulley at the pit	SM	

SM: Senior Mechanic [HS I/II]

Signature of the Contractor **Testing Officer**

Dated:

PARTICULAR SPECIFICATIONS [Contd...]

PROFORMA No. 2

MONTHLY MAINTENANCE OPERATIONS

Ser No	Items	Checked by	Countersigned
	CONTROLLER		
1	Clean contacts and shields with carbon tetra chloride [CC 11]	SM	
2	Move relay armature by hand for free movement and see that contacts are aligned.	SM	
3	Replace Carbon contacts if worn out	SM	
4	Check flexible leads to relays	SM	
5	Check fuses of controller and mains	SM	
6	Break oil in dash pots	SM	
	MOTOR GENERATOR AND/ OR D.C. MOTOR		
7	Check and adjust carbon brushes sparing pressure commutation resist brushes	SM	
8	Grease Bearings	SM	
	AC MOTOR		
9	Lubricate bearings	SM	
10	Clean ventilation passages	SM	
	GEAR BOX		
11	Inspect for tray noises	SM	FM
12	Check axial play of worn out shaft	SM	S/FM
13	Lubricate bearing and top up oil in gear box	SM	
	BRAKE		
14	Clean if oily and trace source of oil leakage	SM	
15	Adjust clearance between shoes and drum	SM	
	SELECTOR		
16	Clean cont acts	SM	
17	Adjust for proper leveling	SM	
18	Check tape safety switch	SM	
19	Lubricate shaft bearings	SM	
20	Check performance without load and with full load	SM	
	GOVERNOR		
21	Lubricate bearing	SM	
22	Check that the levers work smoothly	SM	
23	Check that electrical contact opens before the rope gets locked	SM	
	ROPES		
24	Check condition of hoist ropes and Governor ropes	SM	
25	Check black rope safety switch	SM	
26	Lubricate rope if too dry	SM	
27	Check the dia of rope in mm	M	
	HOIST WAY		
28	Lubricate guides and guide shoes	SM	
29	Check that buffers are in proper position and measure and record counter weight buffer cleans with car at the top.	SM	
	RETIRING CAR AND LOCKS		
30	Check operation of car and lock from the top at each landing. Check that retiring car solenoid is not getting overheated and that movement of car is smooth.	SM	
31	Check that all locks are functioning properly mechanically and electrically after opening the cover. Check all set screws and springs and replace if necessary. The lever should lock the brake properly.	SM	
32	Check that the retiring car does not touch the lock roller at the landing which is being passed	SM	

33	Check that the car door switch operators properly.	SM	
34	Check car stop controls and emergency stop	SM	
35	Check door closer safety, clean and adjust, if necessary	SM	
36	Lubricate top track and door motor and linkage.	SM	
37	Check that landing doors can be opened by emergency keys.	SM	

Note: If the ropes dia is reduced by 0.8 mm, the contractor will have to replace complete set of ropes and the same will be measured and paid separately by GE. The complete set of ropes shall be from same manufacturer and of same material grade, construction and diameter and preferably cut from same reel.

Signature of the Contractor

Testing Officer

Dated:

PROFORMA No. 3

QUARTERLY MAINTENANCE OPERATION

Ser No	Items	Checked by	Countersigned
	MACHINE ROOM		
1	Check and adjust overload relay and phase failure relay	M	
2	Check power wiring termination in switch, motor, controller and power switching relays.	S/FM	
3	Check commutator	SM	
4	Check lubrication of all equipments	M	
	HOIST WAY		
5	Check rope fastening at the car and counter	SM	
6	Check guide clamps	SM	
7	Check upper and lower limit switches for proper connection after physical inspection, get the lift to over travel by holding from the controller and see that the switches operate properly	SM	
8	Check guide clamps and adjust	SM	
9	Check condition of traveling cable and termination at junction boxes.	M/SM	

Signature of the Contractor **Testing Officer**

PROFORMA No. 4

ANNUAL MAINTENANCE OPERATION

Ser No	Items	Checked by	Countersigned
1	Inspect the car frame for bends or cracks	S/FM	
2	Check insulation power circuit	M	
	[a] Incoming cable		
	[b] Switch and feed up to controller		
	[c] Between difference power relays		
	[d] Power core in the traveling cables		
	[e] Motor		
3	Check operation of the car over speed safety gear by having the levers manually and see that the safety locks up properly	SM	
4	Check that sheaves are tight on the shaft. Also check with sounding for	SM	

	cracks. Check sleeve bearing, clean and lubricate. Adjust for proper play		
5	Unload car[s], check the worn gear back lash and adjust by removal of sheaves as required	S/FM	
6	Check motor bearings, clean and lubrication	SM	
7	Check that the gear coupling belts are tight	SM	
8	Check oil seals and gear box and fresh oil	SM	
9	Remove brake shoes, clean and refit or replace brake linings, inspect Pins, springs, clean and reassemble. Check that brake drum is not scored or worn unevenly.	SM	
10	Clean guide and guide shoes with Carbon Tetra Chloride [C Cl O4] and flushing all oil and re-lubrication thereafter clean the pit	M	

Signature of the Contractor **Testing Officer**

Dated:

Note: Abbreviations used in the tender are as under:

[a] O - Operator [Lift]

[b] SM - Senior Mechanic [Lifts]

[c] S - Superintendent [Lifts]

[d] M - Mechanic [Lifts]

[e] FM - Foreman

38. **Outsoucring Services for Lifts**: Manning and operation of lifts shall be carried out as specified in Schedule with manpower as specified. Quoted rate in schedule 'A' for the same is inclusive of the following: (a) In case of non function of one passenger lifts, the other lift installed in the same building to be operated as directed. (b) The unit rate is deemed to include for maintaining log books, record of repairs/replacement of perished/unserviceable, minor adjustmewnts minor repairs of all accessories, cleaning /upkeeping of lift & surrounding area. (c) One emergency light and necessary tools should be available in a tool box with operator for smooth functioning of installations. (d) Before commencement of work the contractor shall submit the list of manpower to be employed as per requisite qualifications specified in particular specifications for approval of GE duly recommended by Engr-in-Charge.(e) General cleanliness of lift room/machine room will be responsibility of the contractor repair/maintenance of internal lighting of lift room etc., Necessary dewatering as requird through pump and piping accessories from the lift chamber is also the responsibility of the contractor. The contractor has to make sufficient arrangement under his own before commencement of the contract).

38.1 The contractor shall obtain signature of Junior Engineer of the GE at MES office in token of satisfactory operation of lifts. The contractor shall be available for 24 hours call back services for attending all types of complaints. However, the contractor shall engage additional manpower as per the job requirement without any extra cost and in case of repairs/emergencies. Operator shall promptly attend to each lift for manning and operation. In case of absent from duty, the GE may at his absolute discretion impose penalty on the contractor a sum of **TWICE the quoted rate/previlling minimum wages** which ever is higher for each shift. The decision of the GE as to whether a particular lift has been operated/manned or not on a particular day will be final and binding.

38.2 The contractor shall not pay lower than the previlling minimum wages to the outsourced personal and payment shall be made direct to Aadhar linked bank account of the staff.

38.3 The contractor shall provide uniform to all the outsouced staff as approved by the GE.

39. **SWIMMING POOL**

39.1 The tenderer shall have to guarantee to the quality of the water being maintained in the swimming pool as per provisions given in IS-3328-1965, with the provision of equipments catered in the Sch 'A' and any extra provisions required to maintain the swimming pool in conformity with the provisions given in IS-3328-1965 shall be provided by the contractor at no extra cost.

39.2 The unit rate quoted by the tenderer for supply and installation of the equipments shall be deemed to include the cost of foundation wherever necessary.

39.3 The swimming pool system primarily consists of supply, installtions, test and commissioning the equipments and connected works such as quartz sand filter, pump unit, ioniser unit, pool cleaning arrangements, drain system, control panel, pool piping, pool accessories and chlorine stabilizers all as per the specifications given hereinafter.

39.4 **QUARTZ SAND FILTER**

39.4.1 This is required for filteration of suspended impuritues like dirt, dust, mud, collides and similar contamination in the pool water. Essentially this is a vertical pressure vessel consructed out of heavy structural steel plates by joining vertical cylinder with two dish ends, one at top and one at bottom. Proper heavy duty legs are provided and bottom disc to make it self standing. One manhole with cover plate at top and one hand hole with cover plate at side near bottom are provided for maintenance purposes.

39.4.2 A manifold type detachable distributor is fitted inside top disc through which water enteres in the filter. For spreading the water uniformly over entire filter cross-section, 16 Nos PP pipe laterals in assorted lengths, are fitted on this manifold distributor. A similar manifold type collector is fitted inside bottom disc on which 16 Nos of PP pipe laterals, in assorsted lengths are fitted. The filtered water is collected here for exit from filter. Both these manifolds are connected to each other by frontal piping on outside of vessel. The frontal piping is equipped with one inlet, one outlet, one backwash outlet and one rings outlet, all being a flanged type, 05 Nos of diaphragm type valves, rubber lined, flange end type, in CI material are fitted in frontal piping for easier operation and simple, quick maintenance.

39.4.3 A separate air release outlet of one inch NB size, fitted with one No rubber lined, CI diaphragm valve is provided on top dish at 90degree orientaion from frontal piping. Pressure gauge connections are provided on frontal piping at inlet and outlet points. The sand filter is constructed in str steel plates of Mild steel conforming to IS-2026/69. Frontal piping and manifolds in mild steel conforming to IS-1239. The entire fabrications are done to confirm with ASME Sec VIII, Div 1 codes. All weld joints are checkered by D.P. Test Entire Vessel is tested to 10 Kg/Sqcm by using a hydrailic pressure.

39.4.4 The sand filter is finished on internal contact surfaces by chlorine resistant bituminous coating and one external non-contact surface by two coats of zinc oxide primer followed by two coats of synthetic enamel in conformation to GMP color codes.

39.4.5 All valves are painted in identifiable color combinations to provide simplicity to operators. The filter is equipped with QUARTZ sand as filter media in five grades. The filter sand gravel shall comply with requirements of IS-8419 (Part-I) 1977.

39.5 FILTER FEED PUMP WITH PRE FILTER

39.5.1 The pump unit is required to circulate water for filration. The pump unit consists of two pumps alongwith motor and prefilter, fitted systematically on a common channel stand that is firmly grouted in floor concrete. Flange type of ball valaves in poly propalene material are fitted on both delivery as well as suction sides of each pump. These are of horizontal mounting, centrifugal type and suction, vertical delivery. Centrifugal type pumps conforming to DIN 24255.

39.6 SPECIFICATIONS FOR FILTER FEED PUMP WITH PRE FILTER: Filter feed pump of suitable capacity shall be provided as specified in Schedule A items.

39.7 Ozonator unit shall be provided with booster pump, venture, ozonator panel, piping, oxygen concentrator, ozonator electrode –SS-316, Capacity of ozonator 100 gms/hr, Electrode SS-316.

39.8 Stainless steel gratings shall be provided as specified in Schedule over drain out sumps in swimmng pool as shown in drawings.

PARTICULAR SPECIFICATIONS [Contd...]

39.9 POOL CLEANING ARRANGEMENT: This is simple but manually operated vaccum type pool cleaning arrangement that can be used with the help of main circulating pump trolley mounted type. This consists of a sturdy and heavy, extruded aluminium, rectangular box in which a flat and long, nylon bristle brush is fitted on bottom side. The box is closed on topside except for a 2" NB hose nipple outlet through which it is connected to suction piping of main pumps using flexible pipe. A strainer is fitted on this line near pump for trapping debris like stones, leaves, hairpins, plastics etc. which otherwise go to pump and likely to damage the impeller. The suction head is also fitted with sturdy nylon guide wheels that facilitate easy movement on the pool floor. Two brackets fitted on either side of suction head are used to tie thick ¾" size nylon ropes for pulling the suction head while cleaning operation. The nylon brush is spring loaded and hence does positive brushing of tiles while loosened dirt is immediately sucked by pump and finally trapped in the filter.

39.10 DIVING SPRING BOARD: This will consist of a laminated diving board supported on a rigid mechanical function which will be grouted on suitable concrete platform on the deck, all as shown on drawing. The design & size to confirm with FINA standards (a) Size - 0.5 Metre width x 5 Metre Length (b) Material - FRP laminated with wooden core.

39.11 Swimming pool items, Filtration plant and accessories shall be provided all as per Sch 'A' and Particular Specifications. In case of omission of provision of any item/specification in the tender documents, which is otherwise required for the entire completion of work, the same shall be provided/adopted all as per approved manufacturer's instructions. The cost of such item(s) shall be deemed to be included in the lump sum cost quoted by the tenderer. Contractor shall not have any claim on account of this and the decision of the Accepting Officer in this regard shall be final and binding.

39.12 TESTING: On completion of work, before commisionig the pool for use, the water in the pool shall be tested for maintaining the required parameters for quality water in terms of IS-3328-1965 for contineous period of 10 days and certificate obtained from any Govt laboratories for the samples of water collected in presence of Engr-in-Charge. The certificate so obtained shall be submitted to GE through Engr-in-Charge duly signed by contractor and Engr-in-Charge.

39.12.1 On successful completion of testing, the plant shall be further tested for its overall performance by an Officer nominated by accepting officer for 16 Hrs and water samples shall be collected and sealed during the working of plants every 4 hourly and got tested from Govt Testing Laboratories to certify that the quality of water is maintained in the pool contineously in terms of IS-3328-1965.

39.12.2 The final test report duly signed by Engr-in-Charge and contractor submitted to accpeting officer with the recommendation of testing officer through Garrison Engineer for acceptance of test. On approval of the test, the swimming pool shall be taken over by GE from contractor. In case the test is failed, the contractor shall make arrangement to rectify the plant and offer retest. All the arrangement or test, sampling bottles for collecting water, laboratories testing fees etc shall be paid by the contractor and no extra payment is admissible on this account. The unit rate quoted for the work shall be deemed to include the cost of testing also.

39.13 TRAINING OF MES PERSONNEL: MES personnel shall be trained for the operation and maintenance of plants including daily testing of water etc for period of 2 weeks before handing over the plants.

39.14 LITERATURE FOR RECORD: During the handing over of swimming pool detailed instruction on operation and aintenance manual of plants and its trouble shooting etc shall be prepared in a printed and bound form alongwith drawing etc and handed over to the department in triplicate for record. Printed and bound 10 books of 100 pages A4 size each for log sheets for recording daily working parameters like water pressure, working hours, PH value, chlorine presence etc and including 10 registers for recording routine maintenance of plant etc shall be handed over to the department while handing over the swimming pool. The cost of these items shall be deemed to be included in the rates quoted for various items.

40. **SEWAGE TREATMENT PLANTS (STP)**

40.1 The scope includes supply and construction, installation, commissioning of Sewage Treatment Plants of various capacities as specified in Schedule 'A' Part-I. STP plant based on MBBR technology along with campus development works on turnkey basis. Including Commissioning & trail run, including all civil, electrical, mechanical, instrumentation and all other allied Works.

40.2 The contractor shall get STP executed through any one of the OEMs Approved by E-in-C's Branch for MBBR Technology i.e (i) M/s Optimus Enviropro Pvt Ltd. (ii) M/s Nitasha Constructions (iii) M/s Sophisticated Industrial Materials Analytics (SIMA) Labs Pvt Ltd. (iv) M/s HydrotechParyavaran (India) Pvt Ltd. (v) M/s Sombansi Enviro Engg Pvt Ltd. (SEEPL) (vi) M/s Ion Exchange (India) Ltd

40.3 **DESIGN:**

40.3.1 Moving Bed Bio-film Reactor (MBBR) has been accepted as standard biological method of treatment of sewage. Salient features of MBBR technology are as under: -

(a) Small cylindrical shaped polyethylene carrier added in aerated or non aerated basin to support bio-film growth. Biomass grows primarily on protected surface on the inside of the carriers. These carriers occupy 25-70% of tank volume. Air agitation or mixers are used to continuously circulate carriers. Perforated plates at the outlet of the tanks keeps biofilm carrier inside the tank.

(b) MBBR can be a single reactor or configured as several reactors-in-series. MBBR provides Five times the Bio-film Surface Area in less than % Reactor Volume as Trickling Filter.

(c) No probiems with odours, snails or red-worms as in air phase fixed films. MBBR is Non clogging system.

(d) Retention of the carrier within the reactor encourages selection and enrichment for organisms that are best adapted to the nutrient conditions that prevail in that reactor at steady state.

(e) The specific surface area of carrier is about 500m2/m3— 1000 m2/m3. The carriers are slightly buoyant and have a specific gravity between 0.94 and 0.96 g/cm3. Life of carrier is around 15-20 years. Retention time in MBBR should be around 2 — 4 hr.

(f) Adequate preliminary treatment including scum (oil & grease) removal is required to prevent the accumulation of inert material in MBBR tank and to prevent plastic bio-film carries' retention screen blinding.

(g) Well designed aeration system is essential to promote the rolling water circulation pattern that uniformly distributes plastic bio-film carriers throughout the MBBR.

(h) Diffused aeration is used for aerobic MBBR tank (Course bubble diffusion) with typical oxygen transfer rates of 2.5 — 3.5 % per meter of water submergence and air flow rate = 6 to 8 m3/m2.h.

(i) Length-to-width ratio (L:W) in the range 0.5:1 to 1.5:1. Ratio more than these results in non uniform distribution of bio carriers.

(j) Bio-film thickness is controlled by air flow or mechanical mixing energy.

(k) Medium-rate MBBRs typically are designed for an OLR in the range 5 to 10 g BODs/m2.d. Higher-rate systems require chemically enhanced liquid—solids separation and/or flotation. OLR = 45-60 g BODs/m2d @25 °C.

(l) MBBR do not require any return activated sludge or backwashing. Quantity of sludge produced is much less in comparison to activated sludge process.

40.3.2 **Sludge Drying:** With MBBR STPs the quantity of sludge produced is much less in comparison to traditional STPs. The sludge from MBBR does not require any further stabilization except dewatering and drying. Any mechanical means of dewatering can be used followed by sludge drying in traditional sludge drying beds. The sludge drying process is affected by weather, sludge characteristics, system design (including depth of bed) and length of time between scraping and lifting of sludge material. High temperature and high wind velocity improve drying, while high relative humidity and precipitation retard drying. The average cycle time for drying may range from a few days to 2 weeks in warmer climates to 3 to 6 weeks or even more in unfavourable ones.

40.3.3 **Tertiary Treatment**: Tertiary treatment is done to bring the quality of effluent from MBBR / STP to the reusable standards. It consists of Pressure sand filter, Adsorption chamber and disinfection. Normally all three are arranged in series.

40.3.4 **Pressure Sand Filter**: The pressure sand filter (PSF) is used as a tertiary treatment unit to trap the trace amounts of solids which escape the clarifier, and can typically handle up to 50 mg/I of solids in an economical manner. This unit is essentially a pressure vessel that is filled with graded media (sand and gravel). The water filtered with PSF is passed on to the next stage in the STP chain i.e. the Activated Carbon Filter.

40.3.5 The Filter vessel is designed as a pressure vessel (it consists of a straight cylindrical shell, with convex dish-shaped ends welded to the top and bottom). The pressure filter is designed for a working pressure of 2 Kg/CM2. In small diameter vessels, it is customary to provide a bolted dish at the top for ease of maintenance. In large filters, a manhole of > 0.6 m dia is provided at the top.

40.3.6 An average design filtration rate of 10 - 12 m3/ m2/hr of filter crosssectional area, is used for designing these filters. .The filter needs backwash when the pressure drop across the filter exceeds 0.5 kg/cm2. However, it is a good practice to backwash once in a shift, irrespective of the actual amount of pressure loss. A five to ten minute backwash will typically rid the filter of all accumulated muck.

40.3.7 **Activated Carbon Filter**: An activated carbon filter, like the Pressure Sand Filter, is a tertiary treatment unit. It receives the water that is already filtered by the Pressure Sand Filter and improves multiple quality parameters of the water: BOD, COD, clarity (turbidity), color and odor.

40.3.8 Activated carbon is typically manufactured from coconut shell or charcoal, the "activation" process creating a highly porous material with a very large surface area. Organic pollutant molecules are physically adsorbed and held fast within the catacomb-like porous structure of the activated carbon. Granular activated carbon is typically used for this purpose.

40.3.9 Unlike in the case of the sand filter, trapped molecules in the carbon cannot be backwashed and got rid of. Hence, activated carbon in the filter has a finite capacity to adsorb and hold the pollutants, after which the carbon is said to be exhausted. The exhausted material is removed from the filter and disposed off: Fresh activated carbon is charged in the filter.

40.3.10 **Disinfection**: The treated water is disinfected to destroy and render harmless disease-causing organisms, such as bacteria,. viruses, etc. The most common methods of disinfection include Chlorination, Ozonation and UV radiation. Of these, Chlorine finds widespread application. In most STPs, the common form of Chlorine used is Sodium Hypochlorite (Hypo) available commercially at 10-12 % strength, being safe, easy to handle and having a reasonable shelf life.

40.3.11 The contractor shall submit in Cover-1, the Name/ Names of OEMs approved by E-in-C's Branch from whom the STP is proposed to be executed. In case of contractor fails to submit name of OEM for STP vendor in Cover-I, Cover-II in respect of the firm shall not be opened. The name of the specialist firm shall be got approved in writing from GE before execution.

PARTICULAR SPECIFICATIONS [Contd...]

40.4 Sewage Characteristics: The contractor shall be responsible to achieve the desired parameters of treated sewage and has to submit the report from the SPCB Authorised or NABL certified laboratory for Raw sewage charecterstics as per site sample and treated sewage charecterstics as per IS limits before seeking the completion of the work: -

40.5 PREPARATION OF THE PLANTS FOR COMMISSIONING

40.5.1 After completion of the installation at the site and before preparation of plant for commissioning, the contractor shall carry out checking and testing of all equipment and installation in accordance with the agreed standards codes of practice of ISI and specific instruction furnished by the equipment supplier as well as the GE.

40.5.2 Checking required to be made on all equipment and installation at site shall comprise (but not be limited to) of the following: -

a) Physical inspecting for removal of any foreign bodies, external defects such as damaged / loose connected bolts etc.

b) Check for grease, insulation / lubricating oil leakage and its proper quality.

c) Check for tightness of all cable, bus bars as well as earth connections in the main earthing network.

d) Check for clearance of live bus bars and conductors from the metal enclosures.

e) Continuity check in case of power and control cables.

f) Checking of all mechanical and electrical interlocks including tripping of breakers using manual operation of relays.

g) Checking of alarm and actuation circuit, manual actuation of relevant relays like Bucholtz relay in case of transformer.

h) Check and calibrate devices requiring field adjustment / calibration like adjustment of settings.

i) Check proper connections to earth network of non current carrying parts of the equipment / installation.

j) Check for liquid level in batteries. Testing of cables and earthing system shall be all as described in the relevant clauses.

40.5.3 On completion of the work contractor shall submit 5 copies of layout of equipment & panels, LT cables and wiring diagram for all equipment as required by the GE for records.

40.6 INSTALLATION, COMMISSIONING AND TESTING OF STP

40.6.1 INSTALLATION: The plant shall be installed in accordance with the modern practice in a workmanship like manner, Special attention shall be paid to the finish and the general appearance. All pipes, gauges and other fittings shall be nearly laid/fixed. The plant shall be new and with all ungalvanised metallic Parts painted for protection against corrosion.

40.6.2 COMMISSIONING AND TESTING: After the plant are physically completed, it shall be commissioned by the Contractor in the presence of Garrison Engineer.

40.6.3 TESTING:

(a) These shall comprise (tests on water tightness of all civil works and on performance of all Electrical and Mechanical Works after the plant is loaded and commissioned. The water tightness of all structures shall be observed over a period of 7 days and results recorded in triplicate on daily basis by the Contractor and Engineer-in-Charge. The performance of Electrical and Mechanical Works such as Pumping Sets, Air compressors, controllers and gauges, etc shall be observed over the initial period of 24 hours and results recorded in triplicate on a 2 hourly basis by the Contractor and Engineer-in-Charge. Simultaneously the physical, chemical and bacteriological characteristics of the treated sewage produced by the plant on the second, fourth and seventh day after commencement of tests shall be got tested by the contractor from a Govt Lab approved as directed by the GE. The tests result shall be produced to the GE in triplicate.

(b) The results of water tightness test and performance tests shall be satisfactory in all respects as laid down in the relevant Indian Standards. The physical, chemical & bacteriological characteristics of each of the three samples of treated sewage shall desired parameters of effluent stated

(c) All arrangements for conducting the test shall be made by the Contractor. Supply of electricity shall however be made by the Department at specified cost to the contractor. The contractor shall be responsible for arrangement of testing equipment and supply of all materials &labour for test & conduct the tests successfully to the satisfaction of Garrison Engineer.

(d) The plants shall be taken over by the GE after satisfactory completion of Tests.

40.7 TRAINING:

(a) The contractor before finally handing over the plants, be responsible for training Department personnel deputed by the GE in proper operation, periodical maintenance and trouble shooting of both the plants.

(b) After the plants are taken over by the GE, the contractor's technical representative shall remain available at both site for a period of Eight weeks to instruct and assist the aforesaid personnel in the actual operation, maintenance and trouble shooting of the plants.

40.8 GUARANTEE The contractor shall guarantee the plant for a period of 24 months. The guarantee period shall commence from the date of satisfactory completion of work & taken over the plants by the GE. During this period of 24 months, the contractor shall be responsible for any defect of damage which, in the opinion of the GE is not due to fair wear and tear. In case of difference of opinion between the GE and the contractor as to whether a particular defect/damage is caused due to fair, wear, and tear or otherwise, the matter shall be referred to the Accepting Officer whose decision shall be final and binding.

40.9 DOCUMENTS TO BE SUBMITTED BY CONTRACTOR: Following documents shall be submitted by the contractor after successfully commissioning of STP for each STP:-

(i) Manufacturer's Technical literature/leaflet in respect of treatment plant including all equipments.

(ii) Instruction Book on the care, operation and periodical –03 copies (daily, weekly, monthly half yearly & yearly) maintenance of the entire treatment plant in English.

(iii) Chart showing important Dos & DO NTS to be observed -01 No by the operating staff in operation & maintenance of the plant in English. This shall be framed with glass cover.

(iv) -do- but in Hindi -01 No

(v) Recommended list of 2 years' normal spares for different -02 Nos Equipments along with Part Nos/Catalogue Nos/Manufacturer's Name.

(vi) Drawing(s) showing plan, elevation and sections of the - 05 copies. Completed buildings/ structures.

(vii) Schematic Layout of the completed plant showing all pipes, -01 No Equipments, etc and their rated capacities. This shall be framed with glass cover.

(viii) Instruction chart with picture showing the emergency first -01 No aid to be given to the victim affected by chlorine gas in HINDI framed with glass cover.

(ix) -do- as above but in TELUGU - 01 No

40.10 MINOR DETAIL Any minor details of construction which have not been detailed in the aforesaid specifications, but which are fairly intended for the completion of work under this tender shall be deemed to have been included in his tender.

40.11 TAKING OVER OF STPs: Installation will be taken over after completion of testing to the entire satisfaction of Engineer-in-Charge and all other details as executed by him together with any other information which the Engineer-in-Charge may require, duly signed by both the parties.

40.12 **MAINTENANCE OF THE SEWAGE TREATMENT PLANTS DURING DEFECT LIABILITY PERIOD**

40.12.1 The treatment plants will be considered commissioned after the issue of completion certificate. The work shall remain from the date of completion under defect liability period as provided under condition 46 of IAFW-2249 for two years. During defect liability period of two years as provided under condition 46 of IAFW-2249, the Contractor shall be responsible for maintenance of Sewage Treatment Plant.

40.12.2 The maintenance of STPs includes maintenance of electrical and mechanical equipments such as Gen set, pumps blowers, diffusers, metering instruments, clarifiers etc maintenances of electrical panels and their accessories, maintenances of sewage/effluent pipe lines and valves starting from collection tank upto treated effluent pipe lines and valves starting from collection tank upto treated effluent storage tank etc to make the system fully operational to the entire satisfaction of Garrison Engineer during defect liability period.

40.12.3 The contractor shall also be responsible for periodical cleaning of screens, removal and disposal of screens materials to a place as directed by Engineer-in-Charge. The place so decided by the Engineer-in-Charge shall be more than 500m beyond the boundary gate.

40.12.4 During defect liability period, the tenderer shall ensure proper performance of the units and any repair/replacement required in the Sewage treatment plant shall be carried out by the contractor without any extra cost to the department. The rate quoted by contractor shall deemed to be inclusive of this aspects.

40.12.5 The contractor shall be responsible for maintaining a furnished office with telephone facilities in the laboratory building for the administration of "operation" and maintenance and operation" of the plant. The Contractor shall submit a programme detailing the testing procedures of the plant and all its components, a training programme for the operators, and a training programme for practical operation and maintenance of the plant, for the approval of the Engineer-in-Charge herein after referred to as "Test Prior to Taking Over".

40.12.6 Comprehensive test shall be carried out six months before the end of the defect liability period, aimed at examining the adequacy of all units involved in the process as well as all equipments, electrical and mechanical installations and pipe line works. Each item shall be tested separately and its adequacy tested in the frame work of the plant as a whole.

40.12.7 Where the "Test Prior to Taking Over" reveals faults, stemming from deficiencies, poor maintenance or other reasons, the contractor shall replace or repair the faulty items at his expense. The Contractor shall repair at his expense all the deficiencies and malfunctions pointed out by the Engineer-in-Charge within 60 days from the date of notice. Should the Contractor not comply with the above the GE shall perform the necessary repairs at the Contractor's expense.

40.12.8 The Contractor shall be required to provide a full training programme for the MES operators or representatives. Practical training and operation shall be an integral part of the "Test Prior to Taking Over".

40.12.9 Prior to Taking over before the end of the defect liability period, the Contractor shall examine the mechanical condition, including strength, noise, vibration, lubrication, corrosion protection and painting of the plant and shall repair any malfunction, abnormality, peeling of paint, replacement of bearings etc as necessary to prove to the Engineer-in-Charge's satisfaction that the plant is in an acceptable state. The GE may carry out any further inspection of the work for purpose of Taking over. On termination of defect liability period, the GE will issue a certificate, certifying therein that all defects have been remedied and that "Tests Prior to Taking Over" have been satisfactorily completed.

40.12.10 QUALIFICATION AND EXPERIENCE

(a) The contractor shall employ Govt ITI qualified in electrical / mechanical trade as operator (FGM) with minimum 2 years experience in relevant field. The helper shall be 10th pass with 2 years experience in relevant field.

(b) The contractor is responsible for submitting original certificates for the verification of qualifications, experience of persons who are proposed to be employed by him to the Engineer- in-Charge.

(c) At least 04 numbers of Departmental personnel shall be given hands on training by the contractor for a period of one month for operation and maintenance of STP, during the O&M period.

40.12.11 The following points shall be borne in mind while carrying out the operation and comprehensive maintenance:-

(a) Quality testing of effluent has to be got done from State PCB APPROVED / NABL CERTIFIED laboratory and results to be kept on record as per interval of 3 months and rate quoted are deemed to be inclusive of any such test charges.

(b) The cost of removal of sludge from drying units and disposal of the same outside MD land as per local civil authorities laid down rules is also deemed to be included in the above quoted rate.

(c) Keeping the STP neat & clean at all time and the work assigned by JE (CIVIL)/ AGE (CIVIL) from time to time. The fenced area or a distance of 3 metres shall be kept clear of all bushes and grass. The lighting in the rooms shall be fully functional and the same shall be maintained at no extra cost.

(d) Safeguard the STP which are being operated and ensure no entry of unauthorized persons into the installation.

(e) The Contractor shall follow the maintenance schedule for maintenance and operation of the STP as given by the OEM and shall be liable for abiding by the schedule. All operation and maintenance procedures shall be carried out through appropriate relevant standards, regulations and labour laws.

(f) Engineer of OEM (engaged by the contractor for the SITC work), must visit the plant once in every 6 months and submit the certificate to GE that plant is operated and maintained by the contractor as per his O&M Manual and plant is working satisfactorily. In case of failure, it will be considered as the breach of contract and department will take necessary action against OEM and Contractor and also report the matter to the approving/enlisting authority for necessary action.

(g) The contractor shall ensure that the premises around the buildings & RCC structures are kept clean and tidy complete all as directed by Enginee-in-Charge.

(h) All the stationeries required during currency of the contract like registers, log books etc are covered under the scope of work. The rate quoted shall be deemed to include the cost of stationeries.

40.13 GENERAL REQUIREMENTS TO BE ADHERED TO BY THE TENDERER

(a) The contractor will be responsible for safety of his personnel including government property in the installation.

(b) The operating staff shall have thorough knowledge of safety precautions during emergency cases and also shall be well conversant with water supply/electricity acts/rules as applicable.

(c) Necessary notice boards containing instructions for precautions to be followed in case of emergency/risks/accidents shall be displayed at locations as required under law and as directed by Engineer-in-Charge.

(d) First aid box/first aid chart required as per statute shall be maintained at installations.

(e) The operating personnel shall be provided with protective clothing and shall wear them while on duty. In case of any accident / injury fatal or partial disability the contractor shall be solely responsible for settling all claims / compensation. Department will have the right to recover any sum indicated / claimed by labour commissioner / court directive. GE however will ensure that the contractor has provided all adequate and required means to the workmen. The contractor may get his personnel insured at his own discretion.

(f) No compensation will be payable to contractor consequent on accident/loss of life of his employees caused due to his negligence.

(g) The installation shall be operated on all days irrespective of holidays and Sundays. Contractor shall be required to employ reserve operators if performance of contract consequent on labour regulation statute on working of personnel on national holidays etc and also on any day when operator(s) is/are absent from duty. Nothing extra will be payable on the account.

(h) The contractor shall maintain required registers as directed by Engineer-inCharge which shall be signed by contractor's representative/Engineer-in-charge.

(j) The tools required for the manning and operation shall be brought by the contractor.

(k) Major repairs to STP are covered under defects liability. BOQ rates deemed to include for minor repairs and rectification to installation to be necessitated due to negligence or wrong operation of the installation on the part of the operator. The decision of the GE whether the repair/rectification is necessitated due to negligence on the part of operator or not shall be final and binding.

(l) On completion of each month, a completion certificate is to be issued by the Engineer-in- Charge for purpose of interim payment to contractor supported by attendance register duly signed by contractor and Engineer-in-Charge.

(m) Any material / repairs required for efficient operation shall be brought to the notice of JE / Engineer-in-Charge for immediate supply of spares / repairs through other agencies.

(n) In the event of non-functioning of STP or any loss or damage caused to any item of the STP, any other structures in respect of the above work during the currency of the contract the same shall be made good by the contractor at no extra cost to the government. If the contractor fails to do so, the government reserves the right to make recoveries from the contractor for the loss or damage at double the prevailing market rates as decided by the Garrison Engineer whose decision shall be final and binding.

(o) The contractor shall comply with all the provisions laid down in Contract Labour Act such as payment of minimum fair wages.

(p) The operation personnel shall limit their movement to the particular installation and shall not trespass to the surrounding areas.

(q) Shift duty roster will be prepared in advance by the contractor of the Sewage Treatment Plant and will be produced for the approval of Engineer-in-Charge before it is implemented. Three copies of the approved duty roster will be submitted in the office of Engineer-in-Charge and copy will be displayed at the installation. Any change in duties thereafter will only permissible in consultation with the Engineer-in-Charge.

(r) Routine maintenance Schedule shall be carried out by the contractor and the same shall be recorded in the proper proforma and duly countersigned by the representative of the Department i.e. Engineer-in-Charge/ JE (CIVIL) charge.

(s) Daily log sheet will be for all the modules of the Sewage Treatment Plant as described under BOQ as advised by JE (CIVIL) / Engineer-in-Charge.

40.14 All consumables/chemicals like Sodium Hypo Chlorite, Alum powder, Dewatering Poly Electrolyte and Aerobic type bio culture powder for development of bacteria during the defects liability period shall be ncluded in the quoted rate nothing shall be paid on this account.

40.15 The contractor shall obtain signature of Junior Engineer of the GE at MES office in token of satisfactory operation of STPs. The contractor shall be available for 24 hours call back services for attending all types of complaints. However, the contractor shall engage additional manpower as per the job requirement without any extra cost and in case of repairs/emergencies. Operator shall promptly attend to each STPs for manning and operation. In case of absent from duty, the GE may at his absolute discretion impose penalty on the contractor a sum of **TWICE the quoted rate/previlling minimum wages** which ever is higher for each shift. The decision of the GE as to whether a particular lift has been operated/manned or not on a particular day will be final and binding.

40.16 The contractor shall not pay lower than the previlling minimum wages to the outsourced personal and payment shall be made direct to Aadhar linked bank account of the staff.

40.17 The contractor shall provide uniform to all the outsouced staff as approved by the GE.

40.18 The contractor shall also be responsible for periodical cleaning of screens removal and disposal of screens material & Salvage materials/sludge obtained after treatment to a place outside defence land.

40.19 The contractor shall be get the testing of treated sewage from approved test laboratory (NABL certified or state PCB approved) and keep records duly signed by Engineer-in-Charge as per interval of 3 months to ascertain result of treated sewage all as per requirement given in particular specification here-in-after. Expenditure for the same shall be borne by the contractors and is deemed to be included in quoted rates.

40.20 No T & P will be issued by the department for doing the above work, it shall be arranged and provided by the contractor like PH testing kit, chlorine test kit, turbidity test kit, pipe wrench, screw drivers, sluice valve opening /closing kit, cutting plier, digging tools etc.

40.21 The STP will be operated for 24 hours per day, unless otherwise specified by the Engineer-in-Charge / GE. Necessery recovery will be made for non operation of plants per shift at the proportional rate and the same shall be final and binding.

40.22 Proper and effeicient functioning of the plant must be ensured through regular inspection by qualified Engineer bi-monthly preferably by OEM or by his authorised agency.

40.23 As per Govt policy, adequate amount of insurance of all the the workers shall be made against any accident before commencement of the work without extra cost to the department.

PARTICULAR SPECIFICATIONS [Contd...]

41.0 **MODULAR OT:** Refer relevant items of Schedule 'A' in conjunction with manufracturers instructions.

41.1 Wall & Ceilling with Paint: The inner surface wall / ceiling should be constructed with 1.5 mm thick EGP Sheet backed by 12 mm gypsum board to be fixed by grouting on the walls of OT, constructed with solid bricks with cement plastering. Anti bacterial paint should be seamless, easy to clean, steam cleaned, electrometric should be ideal for high humidity areas, should have vapor permeability which allows substrate moisture to escape, protects against growth of bacteria, mould and yeasts, moisture resistance, freeze / thaw resistance. Anti bacterial paint should not leach out and its anti microbial system should remain active through out the life of the product. Vapors permeable structure should allow damp substrates to dry out without causing blistering. It tolerates harsh cleaning and chemical agents; dry film thickness of finished surface is 300 microns. Filling of all joints and cavities with metallic epoxy filler and sanded flush to provide a joint-less finish and then sprayed with a water based liquid plastic aseptic and self sterilizing wall coating system.

41.2 HERMETICALLY SEALED DOORS: Adjustable parameters: Self adjustment Opening speed Closing speed Hold open time Automatic lock activation delay Malfunction alerts via display Should be composed of a motor with reduction gear, powered by a single phase power supply; magnetic encoder to determine position, speed and moving direction of sliding leaves; electronic control panel with a microprocessor, self-monitoring system and inverter technology with independent adjustment of voltage and frequency with wide toothed drive belt. Mechanical sealing device to direct hermetic leaf down and against wall to seal perimeter of opening. Mechanical fail-safe device - Composed of a spring to mechanically open automatic door in the event of a power failure. Photocell barrier - Safety device composed of an infrared transmitter and a receiver located on both sides of the door. This safety device is monitored by the electronic control board of automatic door operator. If the leaves are in open position or in motion and the infrared beam is obstructed by an object or person, the control panel will reopen the door and hold it open while the infrared beam remains obstructed. Switch - Device should be used to manually activate and open the door. Specifically designed for use in clean rooms. Vision panel - double glaze vision panel, flushed with the door surface to avoid the accumulation of dust and bacteria. Square window size 300 mm x 300 mm. Security floor rail - Aluminium security floor rail with one or two channels, to ensure the correct movement of the door.

41.3 LAMINAR FLOW CEILING SYSTEM: Laminar flow Ceiling system with unidirectional airflow with Hepa filters with an efficiency 99.97% down to 0.3 micron. The holding structure & top plenum are made up of Aluminium Sheet with a thickness of 1.6mm. It should be sealed with gasket conforming to DIN 4799 standards for the air distribution system, 2 layer diffuser with monofilament precision woven polyester of uniform porosity with an open area of sufficient resistance to create laminar from diffusers face and integral lighting provides an illumination level in excess of 15000 Lux in operating area and 10000 Lux other with flicker less digitally controlled step less dimming down to 5%.

41.4 MEDICAL GAS PIPELINE INSIDE OPERATION THEATRE. All pipes shall be drawn half hard temp., solid drawn, seamless, phosphorous deoxidised, non-arsenic and degreased copper pipe conforming to BS 2871-1971 Part 1 (Table X) and chemical compositon as per BS-6017 of 1981 table 2 The supplies of copper pipe (MEXFLOW) would be accompanied with manufacturers test certificate for the physical properties of copper pipes and their Chemical composition. The supply of pipes be further substantiated with inspection certificate from the third party like SGS/Lloyds Register. The Pipeline will be laid as per HTM-2022 or NFPA 99.

41.5 ELECTRICAL DISTRIBUTION BOARD. All high voltage equipment should be installed in a separate enclosure. The remote cabinet should house operating lamp transformers, mains failure relays, electrical distribution equipment and circuit protection equipment for all circuits within the operating theatre. All internal wiring is terminated in connectors with screw and clamp spring connections of Clip- on type mounted, on a DIN rail and labeled with indelible proprietary labels. Individual fuses or miniature circuit breakers protect all internal circuits.

PARTICULAR SPECIFICATIONS [Contd…]

41.6 PERIPHERAL LIGHTS. Clean-room imported surface-mounted and recessed luminaries with 3 T5 lamps 54 W. Framed luminaries cover made of highly-resistant and disinfectant - consistent laminated safety glass. With visual systems against glare of the lamps and of the internal highly secular reflectors, cumulative reflex ion coated, singular adjustable by up to +/- 30°. Lumina ire body white, consists of sheet steel with mechanical and electrical removable carrier equipment. Protection IP 65. With dimmable electronic multi-lamp ballast with 1-10 V interface. Suitable for areas with infrared regulation.

41.7 SURGICAL SCRUB: 3 Bay Surgical Scrub station should be designed for use in Operation theatre complex providing surgeons with a convenient sink for pre op scrub up. Each fixture is fabricated from Stainless Steel grade 304, It should be seamless welded construction polished to a stain finish. The scrub sink is provided with a front access panel, which is easily removed for access to the water control valve, waste connections, stoppers and strainers. Hands free operation includes infrared sensor with built in range of adjustment. Thermostatic mixing valve control for constant water temperature. User defined settings of 1, 3, 5 min are available. This timing is adjustable to meet individual application requirement, provided with infrared sensor thermostatic controlled taps with fail temperature controls. Foot / Knee operated switch offered as an option.

41.8 WRITING BOARD. List board should be made up of ceramic material, having Magnetic properties and it should be flushed to the wall of the operating room.

41.9 X-RAY VIEWING SCREEN Should be designed to provide a high level of control luminance without flicker. The system should comply electrical safety codes for high and low voltage system. The theatre should be equipped with X-Ray viewing screen. It should be designed to provide flicker free luminance for the film viewing purpose. It should be installed flushed with theatre wait for hygienic and ease of cleaning purpose. The X-Ray viewing screen should be designed for the purpose of front access. The X- ray viewing screen should be illuminated by 4 pieces of fluorescent lamps and dimming is controlled by the usage of dimming ballast with the PCB that is mounted inside the box. The diffuser should be able to diffuse the light evenly and to provide enough luminance for film viewing. It is made of high quality opaque acrylic sheet. The film is held firmly by using spring-loaded clips for ease of mounting and demounting. The body is built by electrolyzed steel with powder coated. It works on a PCB button control system.

41.10 MEMBRANE TYPE OPERATION THEATRE ROOM CONTROL PANEL: Membrane type Operation Theatre Control Panel (7 service Tiles) mounted. Flushed in the theatre wall with complete distribution board with all accessories. Following are the controls/display available: - * 1 no Day Time Digital Clock. * 1 no Elapsed Time Digital Clock. * 1 no Hands Free Telephone. * Peripheral light Control * Medical Gas Alarm for 4 gases. * Temperature & Humidity Indicator. * Alarm for Vacuum.

41.11 DIRTY HATCH BOX. A hatch should be provided in each Operation theatre to remove waste materials from the operation theatre to dirty linen area just adjacent to Operation Theatre. Each hatch is equipped with two doors and the doors are electronically interlocked i.e. the hatch is designed in such a way that only one door can be opened at one time. The UV light is so installed that it is kept on while both the doors are closed. This UV light turns off automatically in case of opening of either of the doors. There are indicators on both sides of the OT so that door open / close status can be monitored from both ends

41.12 PENDANT. The ceiling pendant system should be designed to provide convenient positioning thru double arm of medical equipment, medical gas terminal units, electrical and specially services. Pendent with weight carrying capacity of 100Kg. The pendant should have electrical sockets, one monitor shelf and gas outlets for medical gas supply.

PARTICULAR SPECIFICATIONS [Contd…]

41.13 PRESSURE RELIEF DAMPERS. PRD should be provided in each room to prevent cross contamination of air from clean and dirty areas. Suitably sized air pressure relief damper are strategically placed, enabling differential room pressure to be maintained and ensure that when doors are opened between clean and dirty areas. Counter-weight balancing system is provided in PRD to maintain positive pressure inside operation room. Air pressure stabilizers have unique capability of controlling differential pressure to close tolerance. The PRD remains closed at pressure below the set pressure and can open fully at pressure only fractionally above the threshold pressure. The body is epoxy coated as per standard BS colors. First class electrolyzed steel plate is used for body and with high grade SS304 Stainless Steel for blades.

41.15 ANTISTATIC FLOORING. It should be seamless, static, conductive flooring, resistance to mechanical stress and dynamic loads and having EDS / EMI (conductive) protection characteristics, 2 mm thick, washable with perfectly curved flash coverings, resistant to mechanical stress and dynamic load and washable sliding leaves.

41.16 DOUBLE COMBINATION OT CEILING LIGHT WITH LED TECHNOLOGY Imported European CE & US FDA marked Should have the following Features:

(a) Two Major Dome/light head Single Colour Pure White LEDs Reflector based LED Technology Arrangement of LED in such a way that Shadow Free / Deep cavity illumination is achieved.

(b) Special design to maximize the field of illumination and optimized illumination depth should have good laminar flow properties Easy and less time consuming service access of electronics on the light head dome surface Aluminium Housing for better heat management ESG safety glass for simple and fast disinfection process 360 deg rotation of domes/lightheads / arms for unlimited positioning of light heads MIS Lightning Feature on domes.

42. MEDICAL GASES: Designing, Planning, Supplying, Installing, Testing & Commissioning of the MGPS in the entire Hospital building in wards, OT, emergency etc. as per following:

42.1 Oxygen Manifold Supply System: The Oxygen manifold extendable type size 2 x 8 for bulk oxygen cylinders, Manifold should be suitable to withstand a working pressure of 140 Kg / cm2 and should be Tested after Installation at 140 Kg/cm2 oxygen cylinder pressure. Manifold should also have high pressure copper annealed tail pipes with one end having Brass adaptor suitable for oxygen cylinders and other end suitable for Manifold Non-Return Valves. Manifold should also have 16 brass non-return valves for individual oxygen cylinder. Manifold middle frame of 2 x 8 size should be made with circumferential mild steel flat duly powder coated with black colour& along with chain for individual bulk O2 cylinder.

42.2 Emergency Oxygen Manifold Cylinder System: It should provide cylinders' emergency system with high flow Pressure Regulators, pig tail pipes, manifold of 8 cylinders with Top & middle frame for Oxygen.

42.3 Nitrous Oxide Manifold Supply System: The Nitrous Oxide Manifold extendable type size 2 + 2 for bulk N2O Cylinders. Manifold should be suitable to withstand a working pressure of 140 Kg / cm2 and should be Tested after Installation at 140 Kg/cm2 Nitrous Oxide Manifold cylinder pressure. Manifold should also have high pressure copper annealed tail pipes with one end having Brass adaptor suitable for N2O cylinders and other end suitable for Manifold Non-Return Valves. Manifold should also have 4 brass non-return valves for individual N2O cylinder. Manifold middle frame of 2 x 4 size should be made with circumferential mild steel flat duly powder coated & along with chain for individual bulk N2O cylinder.

42.4 Emergency Nitrous Oxide Manifold Cylinder System **(**2Cylinders**):** It should provide cylinders' emergency system with high flow Pressure Regulators, pig tail pipes, manifold of 2 cylinders with Top & middle frame for N2O. Fully Automatic Digital Gas Control Panel as specified.

PARTICULAR SPECIFICATIONS [Contd…]

42.4.1 The panel should be enclosed in a metal cabinet with a hinged front cover. The panel cover should be fitted with a lock to prevent unauthorized access and can be swung open for maintenance. Should have fully automatic changeover operation and requiring no manual action. Gas changeover system should be electro-pneumatically operated, in the event of electrical Tenderer failure gas supply should not be interrupted. A visual indication of the state of the manifold should be provided by 3 gauges within the control panel which are clearly visible through the transparent cover. These gauges are provided to indicate the pressure of the right and left-hand banks, and the supply pressure from the control panel to the distribution system. The panel should be supplied with sensing facilities to provide visual signals and other ancillary services. In addition, the panel should be fitted with audio alarm indication for changeover of empty cylinder bank to filled cylinder bank and vice versa.

The automatic gas manifold control includes:

--- Two supply pressure gauges

--- One delivery pressure gauge

--- Pressure reduction in primary side by two stage incorporating two regulators

--- Line pressure regulators with bypass valve to facilitate easy maintenance

--- One line pressure relief valve

--- Instruction for changing the cylinders clearly identified on the front of the control cabinet

--- Rated capacity (Delivery) to suit hospital's requirement

42.5 **Copper Piping:** Copper pipes (material): Copper Pipes used should be solid drawn, seamless, deoxidized, non-arsenical, half hard, tempered and degreased, Manufactured as per EN : 13348 : 2001 standard, and chemical composition as per CU DHP to 1190-1 and CW 024 A to EN 1412. Pipe sizes should be used as per latest BS EN 13348 guidelines.

42.5.1 Pipeline Installation: Before erection, all copper pipes, valves, fittings like bends, tees, reducers etc. should be cleaned for dirt, and Should be degreased. Proper pipe cutters, and bending machine should be used during installation of copper pipes. All copper pipes and fittings like bends, Tees, reducers and straight couplings Should be as per BS 864 and joined by silver brazing method for copper to copper. Inert gas welding technique Should be used by passing Nitrogen gas inside the copper pipes during silver brazing, in order to avoid carbon deposition inside the copper pipes. Copper pipes of the diameter up to 42mm OD Should be installed on the wall with the help of plastic saddles at the required span, as per HTM-2022 of U.K. and metallic white powder coated clamps Should be used for pipe sizes above 54mm OD. Wherever the pipes cross brick walls, it should be covered with plastic pipes. All pipes should be installed without springing or forcing. All pipes should be protected against mechanical injury in a manner satisfactory to authorities having jurisdiction.

42.5.2 Test: After erection, all the pipes should be cleaned or purged with the help of dry nitrogen gas, & Should be tested with dry nitrogen at a pressure of 10 Bar for 48 hours.

42.5.3 Painting: All installed pipes should be painted with two coats of synthetic enamel paint &colour codification as per IS-2379 of 1963.

PARTICULAR SPECIFICATIONS [Contd...]

42.6 **Master Alarm Panel:** Each Master Alarm will be modular in design and be fitted with any number of master alarm modules. The master alarms will be capable to monitor from 10 to 30 points in a standard box or 10 to 50 points in a large box. A master alarm module will monitor up to 10 alarm points. Each point represents an alarm condition that the source equipment might have. When an alarm condition exists, a red light flashes and the audible alarm sounds. If several alarm conditions occur simultaneously, the most recent alarm light will flash, while the other alarm lights will remain lit. When an alarm condition is created, an audible alarm will be actuated. A dry contact module will be available to interface with a building management system.

42.6.1 The annunciator panel will be equipped with a "TEST" and a "SILENCE/RESET" button. The "TEST" button tests if all display and audible alarm are in working order. The alarm 'SILENCE/RESET" button is to quiet the audible alarm after it has sounded and to reset the alarm after alarm conditions has been cleared. The annunciator's audible alarm is rated for 80 decibels at 3 feet away. The parameters for each gas can be programmed with three buttons on the back of the annunciator module.

42.6.2 The repeat interval for the audible alarm will also be programmable to an interval beween 1 to 99 minutes. Alarm will comply with the requirement of FCC part 15 (47 CFR Part 15). This requires that no harmful electromagnetic energy is being emitted from the alarm system that may affect other facility equipment in the area of installation. In turn, the alarm system is not affected by electromagnetic energy that may be emitted by other equipment in the area. Incorporated in each alarm is a Lon Works interface node to facilitate communication to the building management information center. Lonworks is a trademark of Echelon Corporation registered in the United States and other Countries.

42.6.3 The box material is 16-gauge steel and equipped with mounting brackets that are adjustable up to a drywall thickness of 1-1/4" (32 mm). The Equipment will confirm to an ISO 13485 facility. Features x Complies with NFPA 99 & FCC Part 15. x High visibility LED readouts x Circuitry allows for Normally Open or Normally Closed. x Adjustable audible alarm repeat (from 1 to 99 minutes) x Can be interfaced with LonWorks. x Knockout for conduit installation. UL listed

42.6.4 **Area Gas Alarm:** The medical gas central alarms should be capable of monitoring a maximum of 6 medical gas services by means of pressure sensors which detect deviations from the normal operating limits of either pressure or medical vacuum. The area alarm should have a digital display of pressures. The medical gas area alarm Should fully satisfy the international standard. Each gas service should be displayed by coloured LED's to show 'Normal' (green), 'Low' and 'High Pressure' (red) conditions. Medical vacuum systems Should be displayed in the 'Normal' (green) and 'Low Vacuum' (red) conditions only. Failure indicators Should be displayed by flashing lights and normal indications Should be steady. An audible warning should sound simultaneously with any failure indication and a mute Facility should be provided. Following a mute selection, the audible Should resound after approximately 15 minutes, or should operate simultaneously should a further alarm condition occur. A maintenance 'Mute' switch Should be provided internally to the panel for use during maintenance which results in prolonged pipeline or plant shutdown. This facility should automatically reset when the gas service returns to normal. The alarm panel should have a 'test' facility to prove the integrity of the internal circuits, LED's and audible warning. The alarm panel Should incorporate a volt free normally closed relay to allow for interconnection to either a medical gas central alarm system or an event recording circuit of a building management system. The alarm should be microprocessor based with individual microprocessor on each module. Should provide interface to Gas Delivery Management System. The following configuration should be used: x 2 Gas Services (O2 &Vac) x 3 Gas Services (O2, Vac, Air 4) x 4 Gas Services (O2, Vac, Air4, Air7)x 5/6 Gas Services (O2, Vac, N2O, Air 4, Air 7, AGSS)

42.7 **Area Valve Service Unit:** It should be wall mounted, Aluminum box with lockable front glass panel having ball type valves with PTFE seat, Brass body with Nickel plating valves having quarter turn handle opening. Sizes suitable for 12mm OD copper pipe to 22 mm OD copper pipes should have screItd ends should have brass adopter suitable for copper pipe these valves should be manufactured by an ISO 9001 certified company. The following configuration should be used: x 2 Gas Services (O2 &Vac) x 3 Gas Services (O2, Vac, Air 4) x 4 Gas Services (O2, Vac, Air4, Air7) x 5/6 Gas Services (O2, Vac, N2O, Air 4, Air 7, AGSS

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42.8 **Line Isolation Valve:** The valve should have a bronze body, and a blowout proof stem. The valve ball should be bronze chrome plated, and the seats and packing should be Teflon (PTFE). Each valve in valve box should have a pressure rating of 600 psig, meet NFPA standard or HTM 2022 and be hydrostatically tested. Type "K" copper pipe extensions that are cleaned for medical gas service should be fitted into each side of the valve. A gauge port should be drilled into one of the pipe extensions for the purpose of inserting a gauge. The gauges should have a 2" (50 mm) dial, be ASME B40.1 Grade B. The valve assembly should be plugged or capped to prevent contamination.

42.9 **Gas Outlets Points /Terminal Units with probe points**: Imported for O2, N2O, C. Air (4 & 7bar) Vacuum & AGSS: The outlets should be UL Listed/CE Marked as per Medical Device, NFPA complaint, with the notified body number specified. Cleaned for medical gas service and be pressure tested. Each outlet should have less than 3 psi (21KPa) pressure drop through the outlet @ 120 1/min.and 50 psig (345KPa) inlet pressure. For outlets providing positive pressure gas, the outlet should be equipped with a primary and secondary check valve should be rated for 200 psi allowing the primary check valve to be removed for services without isolating the entire zone. The wall outlets should have a gas specific back body with steel mounting plate, which allows outlets to be ganged together with a center line spacing of 5" (127mm). Each back body should be equipped with a 6-1/2" (165mm) length type "K" copper pipe stub which is brazed to the outlet body. The outside diameter of the copper pipe stub should be 1/2" (12.7mm). The inlet pipe can be swiveled 360 degrees for ease of installation. Outlet bodies should be gas specific by means of a gas assembly only with the specific matching gas back body, preventing interchangeability of gas services.

42.9.1 The latch-valve assembly, which by means of color coding and wording, should identify the specific medical gas service provided by the outlet and should accept only PB type gas specific adapters. For aesthetic appeal each outlet should include a one-piece ivory trim plate. The wall outlet can accommodate various finished wall thickness from 3/8" (10mm) to 1-1/4" (32mm). Equipment should be manufactured in an ISO 13485 registered.

42.10 Oxygen Flow meter with Humidifier Bottle: Back Pressure Compensated flow meter should be of accurate gas flow measurement with control within a range of 0 – 15 LPM. (calibration within ±10%). It should meet strict precision and durability standard. The flow meter body should be made of brass chrome plated materials. The flow tube and shroud components should be made of clear, impact resistant polycarbonate. The flow tube should have large and expanded 0-5 lpm range for improved readability at low flows. The flow tube and shroud components should be made of good quality plastic. It Should be supplied with plastic transparent reusable humidifier bottle.

42.11 **Theatre Suction unit:** It should be trolley mounted. The unit should include one regulator having gauge and mounted on the trolley stand. The unit should consist of two reusable 2000ml shatter resistant bottle, each made ofpolycarbonate material and fully autoclavable at 121degree Centigrade A vacuum regulator with instant ON/OFF switch and a three-way selector switch with facility to operate either left, right or both All the above items should be mounted on a trolley having free moving castor wheels. Should be supplied with suitable connector probe to match with Vacuum outlets.

42.12 **Ward Vacuum Unit:** The vacuum unit should include vacuum regulator along with 0 - 760mm of Hg vacuum gauge of 2 " size dial, 600 ml capacity reusable plastic collection bottle with overflow safety trap with plastic slide wall mountedtype. Should be of light weight and compact Should have a 600 ml. reusable collection jar, made of unbreakable poly carbonate /poly sulfone material and fully autoclavable at 121 degree centigrade. Should have wall bracket for mounting the jar assembly on the wall. The vacuum regulator with instant ON / OFF switch should be infinitely adjustable and with vacuum gauge which will indicate suction supplied by the regulator. Safety trap must be provided inside the jar to safeguard the regulator from overflowing. Should be supplied with suitable connector probe to match with Vacuum outlets.

42.13 Vacuum System: It will provide two vacuum pumps, air cooled type, Model V X 255 (Ingersoll Rand make), each pump having piston displacement of 60 Cfm. Free Air delivery to suction approx. 90% of P.D., maximum working pressure 29" of Hg or 730mm of Hg, single stage - twin cylinder, fitted with M.S. channel frame complete with V-Belt drive, belt guard etc.

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42.14 Compressed Air System: The unit should have Duplex stationary air cooled silenced (Reciprocating) Oil-Free Air Compressor with critical maintenance free technology each having 57.18 scfm capacity.

42.15 Compressed Air Filtration System: One set of Double – stage filter should be provided as follows: The filters should be made of die cast aluminum housing with epoxy powder paint on the outside and anodizedsurface treatment inside to prevent corrosion and ensure extra-long life. The filters should have maximum contaminant removal efficiency with minimum pressure drop. Total 2 stages of filters should be used (stage 1 & 2 should installed before the desiccant dryer and balance two stages after it as mentioned below :

Stage – 1 : Coalescing filters for general purpose protection, removing liquid water and oil aerosol to 0.1mgcum.(0.1 ppm) and particles down to 1 micron. Particulate filters for dust protection, removing particles down to 1 micron

Stage –2 : high efficiency coalescing filters, removing liquid water and oil aerosol to 0.01 mg/cu.m (0.01 ppm) and particles down to 0.01 micron

42.16 **Anesthesia Gas Scavanging System**: The unit furnished should be a standard catalog item of the supplier regularly engaged in the business of providing packaged systems for hospitals and laboratories and would meet and exceed the requirements of HTM-2022, C11, BS 6834:1997 and BS EN 737.2. Anaesthetic Gas Scavenging System is fully automatic in operation and supplied as a complete factory tested package, which can be easily tailored to meet specific customer requirement. The System offers high quality reliable air cooled, oil free side channel exhausters as standard. Vacuum control valve fitted to automatically regulate vacuum within the pipeline System available as standard in all voltage and frequent options to sui international electrical standards, which ensures trouble free installation and reliable operation.

42.16.1 The vacuum system should be guaranteed in writing by the manufacturerfor a period of 36 months from the date of start-up or 24 months from the date of shipment (whichever comes first) against defects in design, materials, or construction. The service of a factory trained representative should be made available at the job site to check installation, start-up and instruct operating personnel in the proper operation and maintenance.

42.16.2 It shall have Very quite operation which allows installation in noise sensitive areas. Available floor standing or wall mounted. Supplied in package form with minimum space requirements. Includes inlet and exhaust silencer & High quality paint finish, in a choice of BS and RAL colours. Supplied with integral control panels with all necessary starters and indicators. Provided complete with all necessary interconnecting wiring and pipe work. Every machine is fully tested prior to dispatch, Condensation traps with isolation valves fitted to pump exhausts & Remote control starter panels.

42.17 High Pressure Tube: Tubing should be colour coded throughout their length. All hoses shall incorporate in antistatic inner core.

42.18 Low Pressure Rubber Tube: Duct / 3 Channel Bed Head Panel / Bed Head Unit of 1800mm:

42.18.1 To ensure safe and easy access to services and equipment for the medical staff in critical care environment at the point of care, Bed Head Panels are made from high quality extrusion and are designed to provide plenty of capacity, which means they can accommodate all the electrics, gases, data and other media for critical care areas. It shall be supplied in compliance with the 93/42/CE regulation and Quality standards ISO 13485. The three duct /3 channel Bed head panel is made from modular profiles which shall be constructed from extruded aluminum alloy 6063 Temper T6. The Bed Head must have a DIN Rail throughout the length of the Bed head Panel.

42.18.2 The Rail should have strength to be capable to support various accessories available at the hospital such as monitors, IV stand etc. The rail section shall be fixed directly to the wall to ensure the load on the rail is well supported. The Bed head panel shall have 3 separate ducts to ensure that services (Electric 220V, Low Voltage / Data, Medical Gases) are properly isolated from each other.

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42.18.3 Duct for Medical Gas Terminals and associated pipeline. BS EN 13348 Medical Grade pipe should be used. Each gas outlet of same gas should be brazed together and a single pipe for each gas type should either come out from back of the bed head unit OR side of bed head panel. The pipe should be properly labelled to avoid any cross connection at site. Duct for Electrical Services (220V); all electrical switch sockets shall be prewired with at least 2.5mm copper wire.

42.18.4 All electrical wires must terminate in a single connector for connecting it to external power supply. Duct for Low Voltage / Data; Data or low voltage services shall be accommodated in a separate duct. RJ 45/ RJ 11 connection to be provided. Provision for Nurse Call system by providing cut out on the top plate to be provided. Inbuilt lighting shall be in a separate section and NOT in any of the 3 service ducts. Each Duct shall have a top profile which shall be removable to allow access to the service sections.

42.18.5 All profiles except Top profile shall be Anodized aluminum finish with 10 Electrical Sockets antibacterial. 1 Data Socket. 1 Telephone Socket and Provision for 6 Gas Outlet Points.

43 **LAUNDRY:** Refer relevant items of Schedule 'A' in conjunction with manufracturers instructions.

43.1 Barrier WASHER EXTRACTOR (CE certified)2 x18 Kg Description: The washer should be two door (Loading & Unloading), model having front loading and unloading of the washed garments shall be done from the other side (Unloading door) soft mount type with suspended construction allowing a 300G force extraction to save energy during the drying process. The machine should be robust frame made of hot dip galvanized steel, casing and panels made of galvanized and coated steel plate, External Doors with Horizontal hinges, door opening upwards The Barrier Washer ensures that any wash program is performed in full before it allows unloading on the clean side. No fast forward No Error No power failure No emergency stop is allowed. If any of the above happen, the machine only opens on the dirty side to ensure that linen has been properly washed and disinfected before unloading it on the clean side.

43.1.1 It should have following features:

x AS – Automatic Savings and Power Balance

x RPM not less than 860 RPM x G-Force Not less than 300 G force

x Loading Capacity (18 Kg x 2 nos.)

x Fully automatic microprocessor control

x Barrier washer extractor with two doors.

x Automatic Inner drum positioning in loading and unloading position with safe ergonomic door lock. Automatic opening of inner drum door by pneumatic jack helps in power and time savings

x Drum mounted on both sides with V Belt drive with air cushion suspension for minimum vibration and smooth operation.

x Variable frequency drive

x 4 compartment detergent dispensers for automatic dosing

x Outer Drum and Inner Cylinder must be of SSǦ 304 Stainless steel

x All wet materials and components must be of SSǦ 304 Stainless steel

x Machine should control the hygiene process and system to restrict bypass of wash programs.

x Motor rating max 2.3 KW or as per OEM.

x Water consumption –Cold-12.3ltrs/KG Hot-3.2ltrs/KG or as per OEM.

43.2 DRYING TUMBLER: Capacity – 20KG ELECTRIC/LPG/Natural Gas heated Heavy duty, Front Loading, Cool down Feature, Auto-timed, Auto-reversible, Dual Motor drive, Open Pocket & Front display, the dryer should be with temperature control system. For long service life, the drum suspension should have sealed self-lubrication bearings.

x Control – Microprocessor with adjustable parameters such as temperature, program and cool down time. And also the feature to control the moisture control in the dryer.

x Temperature Controller - Auto digital control.

x Time Controller- Auto digital control for drying and cooling.

x Software -for the minimization of the cost and maximization of the uptime of the equipment and would ensure the following (running hours, idle time, consumption figures, machine usage, total consumption, cost calculation etc.) - process validation (print of receipt) - maintenance intervals (actions are logged) - error alerts (recommend actions).

x Door opening it should be large for easy loading and unloading.

x Inner Drum– Should be made of Stainless steel AISI-304 The drum should be fitted with 4 lifters. The diameter of the perforation holes should be 8 mm for better perforation and fast drying with 2 loads per hour.

x Residual moisture control feature for the continuous measurement for the garments in the cycle to prevent over drying and thus saving energy and time.

x Safety features: The tumble dryer should be equipped with overheating protection and a temperature sensor that turns off the heat if the airflow is clogged.

x Installation: The tumble dryer should be having design for quick and simple installation by using the adjustable levelling feet. Only one external connection for electricity, gas, steam and exhaust should be required.

x Door Lock: The dryer should have a safety function or feature, which means the dryer should stop in case the door is opened during operation.

x Transmission: The transmission should have pulley and belt drive. There should be no x Gear boxes , clutches or gear reducers. The transmission should have a mechanical device for tightening and loosening the drive belt.

x Door - Made of die pressed Stainless steel 304 quality, Toughened glass window , SS door latch/handle and interlock for safety.

x Door Opening - 580 mm Ø (Minimum) x Basket Volume- 360Ltrs. (Minimum)

x Suction Blower- Heavy Duty Centrifugal Suction Blower and dynamically balanced

x Lint Screen - Self cleaning lint screen, facility of cleaning should be through front door x Electric Load – 1.0 Kw x Heating: LPG/ Natural Gas x Electric supply– 220-240V, 3Ø, AC, 50hz.

43.3 VACUUM FINISHING TABLE (CE certified) - 2 Nos. It should have following features:

o Table Top Size 1500mm X 900mm

o Table top padded with heat resistant material like Silicon etc.

o Powerful suction o Vacuum unit operated by Pedal

o Heavy Duty Motor of 0.4 KW for centrifugal blower

o MOC – Mild steel plate of 18 gauge and powder coated paint with antirust primer coated

43.4 STEAM BOILER WITH 2 IRONS: Steam Boiler with 2 outlets and including 2 steam irons. the boiler must have safety features: `Dual Thermostat in series at a differential temperature setting of 3 degrees C Pressure Switch, Audio (buzzer) Visual Alarm (lamp) for any safety activated Safety valve, Low water indicator, Pressure Gauge, Water level gauge Inbuilt electrical switches are covered for shock protection of wet hands Superior metallurgy of Electrical Elements for Energy Efficiency and Long Life.

43.5 Boiler Specifications - On caster wheels - Stainless Steel Boiler - Stainless Steel Water Tank - 4kW boiler - Automatic pump for water refill -Includes 2 irons, 800W each, with cable holder rods and iron rest mats 400V 3N 50Hz -Steam Irons 2 numbers with 800 W heating element each Pump 0.45 kW 3 bar pressure.

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43.6 FLATWORK IRONER Roller Heated, Gas Heated: Suitable for rapid ironing of linen like Bed sheets, Pillow cover or flat sheet etc Roller Diameter-325mm-2065 mm length, Front feed and Front Return Type, Variable Speed Control, Powder coated outer body Auto timed and Auto temperature control.

43.6.1 Roller - Made of Stainless Steel-304. Machined with perforations throughout the length and periphery for moisture suction. Roller should run on self aligning ball bearings.

43.6.2 No. of Rollers- 1 (One). Roller Diameter -325mm and Length - 2065mm x Control: Electronic Control Panel. Safety –Finger Guard Protection and Start and stop of the machine with emergency switch. Automatic stopping of the machine for Finger guard. Padding- pressure roll with a padding & tightener springs. Electric Load Should not exceed – 0.5 Kw. Electric supply- 415V, 3AC, 50hz ,40AMPERE. Heating - LPG/PNG 25KW x Ironing Speed in meter per minute- 0.5-5.5.

43.7 WET LINEN TROLLEY: Capacity 50 Kg : The base frame of the trolley shall be in Stainless Steel construction with all welded joints ground & smooth finished out of heavy duty Stainless Steel tubes and bars. The trolley shall be fitted with at least 3 Nos. Stainless Steel shelves (2Ğ shelves removable). The base frame shall be supported on 4 Nos. castor wheels min. 75 mm size of swivelling type.

43.8 MOBILE TABLE: Capacity 50 Kg : The rolling table shall be specially designed for carrying rolling and folding of linen in the laundry. The frame of the table shall be fabricated out of Stainless Steel tubes and bars supported on 4 Nos. castors min. 75 mm size swiveling type. The table top shall be of polished Stainless steel with smoothly. The under shelf of the trolley shall be made of Stainless steel. Dimension-2Mtr/700mm o Height of the table top should be 1.2 mtr.

43.9 INDUSTRIAL WEIGHING MACHINE of Capacity 100 Kg: The weighing machine shall be heavy duty platform type with dial type weight indication. The platform for placement of buckets/goods for weighing shall be with steel casting with adjusting lever mechanism and knob for adjustment of error in machine.

43.10 All of the above Laundry equipments must be CE certified The above listed are the minimum requirement for in house laundry. In addition to the above equipment's, if need arises for any other equipments or if the contractor feels necessary to include any other equipment then he may do so without any financial implications to the department.

44. **CCTV:** Refer relevant items of Schedule 'A' in conjunction with manufracturers instructions.

44.1 GENERAL: Provide a complete video surveillance and management system, including engineering, components, installation and commissioning.

44.2 SUBMITTALS:

(a) Manufacturer's Product Data: Submit manufacturer's data sheets indicating systems and components proposed with property details like physical, mechanical, electrical, thermal along with instruction/Installation manuals & Operational maintenance Manuals.

(b) Shop Drawings: Submit complete shop drawings including connection diagrams for interfacing equipment, list of connected equipment, and locations for major equipment components.

(c) Product /Material certifications from relevant authorities, manufacturers, testing labs etc as and where required as per the tender specifications.

(d) List of recommended & mandatory spares and consumables.

(e) Manufacturer's Authorization Letter: This document certifies that company's personnel are competent in the field of sales, installation, commissioning and maintenance of OEM's Products and Systems and will ensure that their staffs are continually updated on training on new products and technology as they are introduced by OEM.

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44.4 QUALITY ASSURANCE:

(a) Original Equipment Manufacturer: Minimum ten years experience in manufacturing and maintaining Video & Security management systems. O.E.M. company should be registered & should have service centre in INDIA. Manufacturer shall provide technical assistance and support on the product & solution.

(b) Installer: Minimum two years experience installing similar systems in India, and acceptable to the manufacturer of the video management system.

(c) Power Requirements: Components shall have the following electrical specifications: 100-240 VAC (50 Hz).

44.5 DELIVERY, STORAGE, AND HANDLINGA. Deliver materials in manufacturer's labeled packages. Store and handle in accordance with manufacturer's requirements, in a facility with environmental conditions within recommended limits.

44.6 PRODUCTS OBJECTIVE: To achieve an Enterprise Level Surveillance & Security System. The vendor shall supply and commission an IP based CCTV system with the objective to provide high degree of surveillance system for the entire site. The purpose is to monitor & supervise the entire area for security purpose, as well as record and inform officials on unwanted, untoward incidents. The hardware required for the system including servers, workstations, monitors, networking components, cables, connectors, conduits, power supplies etc. will be in vendor's scope. It will be the responsibility of the vendor/Contractor to make the entire system fully functional as per the specifications. Vendor/Contractor shall consider any equipment/devices required to make the system functional if not mentioned herewith. Further, the CCTV system shall be seamlessly integrated with other security systems such as the Access Control Systems & Intrusion Alarm System. Also, All the systems should be from a single vendor.

44.7 SCOPE OF WORK The scope of work under this tender shall consist of design, supply, installation, testing, training & handing over of all materials, equipment, hardware, software applications and necessary workmanship to commission said system with all the required components strictly as per the enclosed tender specifications, design details. The scope also includes the supply, Installation & commissioning of any material or equipment including civil works that are not specifically mentioned in the specification.

44.8 SYSTEM ARCHITECTURE: Video Management System (VMS) shall be a fully digital IP-based video surveillance system that brings together in one system a network video recorder (NVR) with unlimited storage capacity. It shall provide an option for integration onto the Access Control System and Intrusion Detection System. As a software-based enterpriselevel video and data management system, VMS shall provide a single GUI that monitors, records, and offers functionality to deliver the timely, accurate information required for effectively responding to any challenge. VMS shall be a fully scalable enterpriseclass media management system. This advanced network-based system architecture enables simultaneous live monitoring from multiple stations and is easily configurable for storage both on and off site. The software can be configured to store and to view images captured by one camera or thousands of cameras and monitor connections across an unrestricted number of servers. VMS can be designed to effectively integrate with access control, intrusion detection system and video equipment including NVRs, keyboards, and cameras to leverage and protect investments in legacy infrastructure and equipment.

44.9 SYSTEM COMPONENTS

A. VMS-Client Application shall provide live video view, various video playback support, historical video search and playback, PTZ Controls, alarm management, EMap integration and front end control features to an operator. Client Application shall also able to manage & control all devices depending on the user access privileges. System should support virtually unlimited VMS Clients.

B. VMS Database Server contain a web based data management center includes user management, facility management system logs etc. and event & control service which receives and controls events and commands of various formats via different communication modes, integrating video, access & intrusion (alarm) devices. The Primary Database Server shall able to support either upto 500 cameras/server or a combination of 300 cameras with 200 access readers and 200 intrusion alarm zones per server or any such combination of various front end devices. However, the system should be capable to expand virtually upto unlimited number of cameras, access & intrusion points by incorporating multiple servers to make a complete enterprise security systems.

C. Network Video Recorder (NVR) shall able to receive and store videos from various front end devices and forward to various decoders, clients applications connected to the enterprise security system; ensuring a smooth transmission when transmitting mass videos in various bandwidth levels. Each NVR server shall able to support upto 340mbps data throughput which can take upto 128 cameras recording @ D1 resolution with 40 channels playback at real time simultaneously. Each NVR shall be provided with a storage chassis which should able to expand upto 32TB and can be further expanded upto 96TB by incorporating the additional storage chassis. S

44.10 SYSTEM COMPONENT DESCRIPTION & INTEGRATION System shall support integration of various system components as detailed below as a minimum to create an enterprise level Security Management System.

A. Recorders: Video Management System (VMS) shall support integration with digital and network video recorders (NVRs). VMS shall have the ability to access and manage necessary functions of the recording devices through the VMS client interface, such as live video, recorded video, playback, camera configuration, PTZ control and other associated functions. The system shall support 128 Channel NVR at 25 fps @ D1 resolutions as a minimum.

B. Cameras: VMS shall be able to support Dome, Bullet and PTZ cameras for its functionality.

C. VMS shall have the capability to integrate with Access control and Intrusion systems in future.

44.11 OPERATIONAL REQUIREMENTS

A. VMS shall provide a single graphical user interface (GUI) to monitor, control and administer digital video surveillance equipment from multiple systems and platforms; Access Control & Intrusion Detection System.

B. All the Alarms from all the interfaces i.e CCTV; Access Control & Intrusion Detection shall be reported into a single GUI.

C. VMS shall be configured to store and view images captured by one camera or numerous cameras and monitor connections across an unrestricted number of servers.

D. All the Software & hardware equipments for CCTV, Access Control & Intrusion Detection Systems shall be of same make/manufacturer.

44.12 VMS SOFTWARE FEATURES: The VMS application software shall have following major features:

A. Scalability: System shall be scalable to enterprise level system so that increase in the number of cameras; number of servers & number of Clients shall not affect the currently running system operations & functionality.

1. Architecture: Multi-location: System shall work on an enterprise class environment over the TCP/IP network. The system shall be designed on central site connected with multiple remote sites along with the following required conditions / aspects:

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B. System shall be capable of local recording, local monitoring and video management at each local site. The system ideally shall not transmit any video through remote VMS Database Server (to optimize the WAN bandwidth) for any local access to videos (LIVE and recorded). System shall be capable of Video monitoring (LIVE / Recorded), system & user management through a master central location.

x The system shall be designed & proposed in a way that in the event of connection failure between central VMS Database Server & local location, system shall continue to work & deliver the key functions at local site i.e. local monitoring and local recording.

C. Open Standard Support: VMS Software shall be ONVIF compliantso thatit can integrate with multiple digital IP cameras, multiple digital and network video recording devices, multiple video matrix switchers and matrix keyboards.

D. System Integration: System shall have Integration capabilities with electronic access control system, Intrusion detection systems. Integration capabilities of the system shall be measured on below mentioned aspects as a minimum:

VMS shall support integration with Access Control & Intrusion Detection System. It shall support real time linkage of digital video clips to their associated alarms from the access control & intrusion alarm system. System Administrators shall configure video segments by specifying pre- and post- alarm time marks, then link those defined video segments to specific alarms. The software shall provide at least 10 minutes of tagged pre and post activity recording per event. In an event of an alarm generated by Access Controller or Intrusion Detection System the software shall ensure that the operator is automatically provided with the CCTV video from the designated camera to view the alarm location as soon as the alarm is received, allowing the operator to visually assess the event and also providing continuous recording. The software shall also automatically focus the nearest PTZ cameras to view to the point of alarm. In an event of a card being shown to a card reader (where there is camera located near the door), the system shall capture a video clip containing at least 2 minutes before the card swipe, during card swipe event & 2 minutes after card swipe and bundle them together & tag them along with the card event database.

When the card event is retrieved then it should be possible to play the associated video clip of that particular Event/Alarm. VMS shall support defining multiple rule logics which can be assigned to any alarm to run automatically when those alarms received in the system. There shall not be any limitation in defining such rule logic. Example of such rule is "in case there is an alarm received from a zone of Intrusion Detection System, then specific Camera assigned to that Zones shall automatically Pop up on the VMS- Client GUI and start recording based on the Pre & Post record time defined during the configuration and defined set of Access Controlled doorsshall go into Locked/Unlocked state as defined.

VMS shall support operation from Central consol but not limited as defined below:- Intrusion Alarm integration operation: x Arm, disarm, bypass status shall be displayed on VMS-Client machine. x Zones can be sorted by status. x Arm, disarm, bypass operation can be implemented to all the zones. Access Control Integration Operation: x User name, card No., card type, privilege and reader No. can be gained upon swiping card. x Door control can be fulfilled manually or automatically assigned in rule defined in the system. x Above information shall be able to be logged in system database.

E. Service Stability: VMS shall integrate with sandbox framework to ensure crash of server will not result in service crash. It will also try to restart a crashed server to increase system accessibility and stability.

F. Compression Techniques: System shall use various compression techniques simultaneously to utilize storage and network bandwidth effectively. Video compression techniques shall including H.264, MPEG-4 and M-JPEG as minimum.

G. Multi Operations: Managing pentaplex user operations of attached recording devices simultaneously, including live viewing, recording, playback, and handling the exchange of data between the server and a remote workstation.

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H. Live View: Live viewing of up to 64 cameras on a single VMS-Client up to D1 resolution. VMS-Client application shall have capability to connect to 4 monitors & 16 cameras can be viewed on one Monitor.

I. Alarm Management: System shall receive alarms & eventsfrom multiple video, access and alarm devices. It shall provide capability of Alarm & event viewing, management and interlocking. Alarm interlock logic shall reside in VMS Server which will trigger device to execute preset operations on receiving of an alarm.

J. Reports: Log Report shall be used to search the device alarm events, device operations, user login, and web operation. It shall also be used to set queries to get results quickly. Log reports shall be exported in XML, CSV, TIFF, PDF, Web Archive and Excel file formats.

K. Search: System shall manage investigation, post-recording motion detection, motion detection-based recording, Alarm (from any of integrated solution CCTV, Access Control and Intrusion Detection) Based recording and search tools with advanced search capabilities of the recording devices.

L. User Rights: System shall provide multi-level user access rightsfor viewing and managing access to the recorder functions. The user level shall range from 0 to 255; the bigger the number, the higher the control priority is.

M. Recording Modes: System shall support recording modes of continuous, scheduled, manual, event and alarm-based recording.

N. Network: System shall support for both multicast and unicast network topologies and communication protocols.

O. Rule engine: This capability shall allow for custom scripts and to provide both customization and third party integration. Rules Engine Service shall provide functions such as rules analysis, state monitoring and rules management. By way of logical programming for various devices and event alarms in graphical editing interface, Rules Engine Service shall perform automatic execution of rules when emergency occurs. The visual dynamic user interface shall make it easy to acknowledge alarm circumstances and allows prompt response in case on emergency.

P. Client Application: VMS shall provide at least 20 Client licenses as inbuilt. System shall provide unified VMS-Client login to users. User shall be able to login from any PC loaded with VMS-Client application. User shall have the option of two modes of user logins: i. Online login: User shall be able to login when at least one VMS service online. ii. Offline login: User shall be able to login when there is no VMS service online after user at least success one-time online login.

Q. Hardware: System shall utilize off-the-shelf computer workstations, servers, networking and storage equipment. No proprietary hardware shall be acceptable

44.13 **Vedio Management System (VMS) :** OPERATOR FEATURES: VMS shall provide the following operator functions:

A. Configuration: The operator (with Administrator privileges) shall have the option to configure the system. It shall support live updates of all configurations. The configurations shall provide the option to add/edit/delete recorders, cameras, switchers, keyboards, users and roles, sites, recording rule, rule engine service etc. Configuration of video recording trigger service and device recovery service parameter shall be basic feature of VMS.

B. Event & Control Service Configuration: EC service integrates with sandbox framework to ensure crash of specified device adapter will not result in service crash. EC service will also try to restart a crashed adapter to increase system accessibility and stability Option to configure Event & Control Service. The following configurations shall be possible: i. Supported devices. ii. Alarm filter mechanism. iii. Judgment mechanism for control priority iv. Mechanism for cascading connections of Event & Control services.

C. Data Dynamic Synchronization: The configuration data in VMS shall be able to synchronous to all connected VMS-Clients and NVR services.

D. Log Report: The operator shall be able to view following log reports: a. Device alarm log report. b. Device operation log report. c. User login log report. d. Web operation log report.

E. Disaster Recovery, Redundancy and Backup Service: Disaster Recovery and Backup Service shall provide the following operator functions:

a. This backup system shall supervise and backup the center contents dynamically. Once there is an accident, the system can switch to the backup system automatically, which replaces the original center and continues the work. Disaster Recovery and Backup Service can backup for Event Control Service, Video Trigger Service and Rule Engine Service.

b. Redundant Recording: VMS shall support failover or redundant capabilities of the Recording device(s) as a minimum. N+1 redundancy for recording device(s) shall ensure system availability in the event of main recording device failure or network failure of the main recording device.

44.13.1 VMS-CLIENT FEATURES: VMS-Client Application shall have below mentioned features:

A. Live View: Main video viewing screen capable of showing 1, 4, 9, 16 and other customized split layout of live or recorded video. Standard presets may be customized to the user preferences.

B. Scenarios: Current view can be saved as scenario and allowing the user to restore this view at any later point in time. These scenarios shall be modified, overwrite or deleted as and when required.

C. Drag and Drop: VMS-Client application shall provide drag and drop functionality. Particular video device can be dragged onto main video viewing screen to view live video.

D. Favorites: VMS-Client application shall have feature to save favorites, where user can create a device/scenario folder and drag devices/scenarios into it so that these can be quickly accessed.

E. Patrol: VMS-Client application shall provide user the capability of configuring and running video patrol sequences to automatically play videos of multiple channels in specified windows by turns. A patrol shall include several scenarios and a scenario includes several video channels.

F. PTZ Control: Support both analog and digital PTZ through GUI and the keyboard. PTZ control shall be used for adjusting PTZ movement and setting the focus, aperture and preset bit of the camera.

G. Snapshot: Capable of capturing snapshot of live video and allowing user to export snapshot. Snapshot tool shall be available in video window itself. Only the authorized users shall have snapshot functionality.

H. Video Export: VMS-Client shall have capability of download and export recorded video from recorders. Exported video clip shall be in OEM's native format to ensure data integrity. Download link to the player shall be provided with video exported.

I. Playback: VMS-Client shall be able to playback recorded video from recorders. Different playback modes shall be there as 8x, 16x, 32x, 64x, frame by frame and backward playback.

J. Instant Playback: Allow the user to view and save 30sec ago instant playback for any playing live video. It shall be used for monitoring emergent situation. This function shall be enabled by default, if required, user may disable this function.

K. Recording: Allows the user to initiate recording through GUI. Recording can be initiated remotely on NVR and locally on VMS-Client PC.

L. Alarm Management: Capability of complete alarm management for the alarms coming from recorders, switchers, intrusion detection systems and access control systems. Alarm Management shall be based on below mentioned aspects:

i. User shall get the pop-up message for response plan upon receiving the alarm so that same response plan can be followed by each operator.

ii. E-mail notification can be sent out which shall include alarm information and User editable information along with individual alarm. One or multi receiver addresses and SMTP can be assigned for E-Mail notification. M. E-Maps: VMS-Client shall have capability to upload GIS Map which shall support .shp, AutoCAD, bmp, jpg, png format file. These maps can be interlinked with 8 levels.

M. Devices including cameras, access control readers and intrusion detectors shall be planted on maps. E-map application shall have below mentioned functionalities:

i. Video verification can be displayed within 1 second after alarm is triggered.

ii. Multi video verification (at least four) can be triggered by same alarm input.

iii. Alarm can come from any kind of event notification which system can recognize.

N. Surrounding Camera View: VMS-Client application shall have facility of surrounding camera view. It shall support setting presets in surrounding cameras. i. In a surround view, video from a specific device shall be playing in the centre and the other surround videos will be from surrounding video devices. Once the object moves to some other camera's FOV, operator can pull that camera in the center and surrounding videos from the associated surrounding camera plays in the surround views. Every video device can be configured one surround view with related 12 surrounding cameras. There shall not be any limit in defining such surround views. ii. Surround video can be called through keyboard and VMS-Client operation. iii. Surround video can be configured through web or VMS- Client.

O. Alternate Camera View: For continuous monitoring, system shall have alternative view functionality. Every camera can be assigned an alternative view camera. If one camera is unavailable, operator can achieve alternative camera to get same/similar scene. i. Alternative view camera can be called through keyboard and VMS- Client operation. ii. Alternative view camera can be assigned through web configuration or through NVR-Client.

P. Operations: Option to perform various operations through context menu on a particular video (live/recorded/patrol). These operations shall include: Full screen, point and drag, enable square select, digital zoom, start recording, stop recording, take snapshot, show surrounding cameras, trigger alternative view.

Q. Timeline Control: Ability to manage timeline control of the recording device, which provides camera recording statistics. Timeline control shall have following features: time slider, time search, time jump, play controls. Timeline control shall also include dedicated buttons for step reverse and step forward and keyboard shortcuts for playback operations.

R. Keyboard Functionality: VMS-Client shall be controllable by a keyboard controller connected to the VMS server and shall have following major features: Selecting layout, ending monitor commands, switching operations, PTZ control operations. PTZ control latency shall be less than 500ms

S. Search: The search facility shall include search based on date and time, device type, trigger type, alarm, operator, location and site. The search facility shall be able to search records in specified recorder.

T. Device and Service Status: VMS-Client shall be capable to show the running status of Event & Control services, Rule Engine service and VMS site in bottom status bar. It shall also monitor connected devices status.

U. Server Usage: VMS-Client shall provide facility to view CPU, Memory and Network usage information.

PARTICULAR SPECIFICATIONS [Contd…]

44.14 NVR CAPABILITIES: NVR shall have below mentioned capabilities:

A. Video Streaming: NVR shall relay the real-time streaming to the VMS-Client.

B. Recording: NVR shall store the real-time streaming for a certain period of time when it receives the storage command from Trigger Service. Each individual camera can be set a different preset recording frame rate. Camera recording frame rate will be changed to full frame rate upon motion detection or other alarm information (according to configuration).Frame rate change interval (from alarm received to recording frame rate change) shall be less than 1 second.

C. Video playback and download: NVR shall allow the user to playback and download video records from NVR-Client. It shall also allow the user to configure the storage locations.

D. Pre-alarm Recording: NVR shall be capable to cache the real-time streaming for a certain time (no longer than 10 minutes). When there is an event or alarm triggering recording, prerecording can help trace the situation before the event or alarm occurs.

E. Re-Linking: NVR shall re-link to disconnected front-end devices. The following two conditions can result in re-linking: i. If the NVR fails to link with the front-end device for the first time, it will try to re-link with the front-end devices repeatedly; the maximum interval is 30 seconds for each try. ii. When the NVR succeeds in linking with the front-end devices and is recording or relaying the streaming, if the bit rate from the device remains as "0", it will start the re-linking operation.

F. Overwriting: NVR shall be capable to cycle overwrite video records. NVR supports the cycle overwrite in the following two situations: i. Delete the videos older than N days regularly. If the disk can store the videos for N days, at which point the NVR deletes video files older than N days according to the required video storage space after a certain capacity is filled. ii. Delete the oldest videos when the disk capacity is full.

G. Device Status Monitoring: NVR allows the user to monitor the running status of NVR via GUI. The following health statuses need to be monitored: system overload (CPU, Network), storage getting full, hard disk error, data accumulation to an unstable level, temperature too high, power supply failure and fan failure. i. Health status abnormal shall be able to be reported out to VMS- Client as alarm information. ii. User shall be able to configure which alarm to be received The following status shall be provided: a. Total connected device number b. Working device number c. Receive BPS (KB/S) d. Relay device number e. Relay BPS (KB/S) f. Storage device g. Storage BPS (KB/S) h. Historical Relay number i. Historical Relay BPS (KB/S) j. Storage locations k. All space (MB) l. Remain space (MB)

H. Remote Upgrade: NVR shall be able to be upgraded without sending device back to factory. It shall be remotely upgraded from VMS-Client.

44.15 Cameras: The proposed system shall be able to support the below mentioned types of cameras and the specifications specified for each.

A. Dome Cameras The dome camera should have the following:
- 1/4" CMOS Image sensor
- Minimum illumination of 0.1Lux
- Enhanced function with BLC and alarm trigger for intelligent video motion detection
- Shall support two-way audio • Shall have option for local storage SDHC Card (Class 6 or above).
- Shall support H.264, MPEG-4, MJPEG simultaneous Triple-Encoding
- Power over Ethernet (PoE) and AC24V/DC12V Support
- Should have a varifocal lens of 2.8 mm to 10.5 mm range
- Shall be able to operate in the temperature range of -10°C to 50°C
- Shall have the FCC and CE certifications
- The camera should be ONVIF compliant

PARTICULAR SPECIFICATIONS [Contd…]

B. Vandal Dome Cameras The Vandal Dome cameras shall have the following:
• 1/4" CMOS Image sensor
• Minimum illumination of 0.1 lux
• Enhanced function with BLC and alarm trigger for intelligent video motion detection
• Should support H.264, MPEG-4, MJPEG simultaneous Triple-Encoding
• Power over Ethernet (PoE) and AC24V/DC12V Support
• The camera to have IP66 Rating, weather and vandal proof casing
• The camera should support two-way audio
• Should support local storage SDHC Card (Class 6 or above).
• Should have a varifocal lens of 2.8~10.5mm
• The camera should have CE and FCC certification
• Shall be able to operate in the temperature range of -10 ~ +50°C

C. High Speed Dome Camera The High speed dome cameras shall have the following:

• The camera shall have 36x optical zoom and 12x digital zoom up to 432x zoom
• Should support 4CIF, 25 fps supporting 8 users simultaneous access
• Weatherproof with IP66 rated enclosure, heater and fan built in
• Camera shall have high speed of pan up to 300°/sec and tilt up to 120°/sec
• High performance memory with 128 presets and 3 self-leaning auto tracks
• High speed preset at 360 °/sec with high accuracy with +/-0.1°
• The camera Built-in web browse for easy configuration
• Minimum illumination of 0.01 lux
• Focal length of 3.4mm-122.4mm
• Shall support the WDR and BLC functionality
• Comply with CE and FCC Certifications
• The camera shall be able to operate in the temperature range from – 20

D. Box Camera Two different models of box camera to be offered. One box camera to have the following:

• 1/4" CMOS Image sensor
• Minimum illumination of 0.1Lux
• Enhanced function with BLC and alarm trigger for intelligent video motion detection
• Shall support two-way audio
• Shall have option for local storage
• Shall support H.264, MPEG-4, MJPEG simultaneous Triple-Encoding
• Power over Ethernet (PoE) and AC24V/DC12V Support • Shall be able to operate in the temperature range of -10°C to 50°C
• Shall have the FCC and CE certifications
• The camera should be ONVIF compliant
The other box camera to have the following:
• 1/ 2.7" Mega-Pixel CMOS sensor
• Minimum illumination of 0.5 Lux
• Support High Definition mode (1280*720) with real-time frame rate
• Enhanced function with True Day/Night switch
• Support BLC and alarm trigger for intelligent video motion detection
• Shall support two-way audio
• Shall have option for local storage SDHC Card (Class 6 or above).
• Shall support H.264, MPEG-4, MJPEG simultaneous Triple-Encoding
• Power over Ethernet (PoE) and AC24V/DC12V Support
• Shall be able to operate in the temperature range of -10°C to 50°C
• Shall have the FCC and CE certifications
• The camera should be ONVIF compliant

PARTICULAR SPECIFICATIONS [Contd…]

44.16 EXECUTION

44.16.1 AMINATION A. Examine site conditions prior to installation. Notify Architect and Department in writing if unsuitable conditions are encountered. Do not start installation until site conditions are acceptable.

44.16.2 3.2 INSTALLATION A. All the components shall be tested before shipping to the project location

Video Management Software shall be installed, programmed and tested in accordance with manufacturer's installation instructions.

i. Coordinate interfaces with Department's representative where appropriate.

ii. Provide backboxes, racks, connectors, supports, conduit, cable, and wire for a complete and reliable installation. Obtain Department's approval for exact location of all boxes, conduit, and wiring runs prior to installation.

iii. Install conduit, cable, and wire parallel and square with building lines, including raised floors areas. Do not exceed forty percent fill in conduits. Gather wires and tie to create an orderly installation. iv. Coordinate with other trades to provide proper sequencing of installation.

44.16.3 FIELD COMMISSIONING AND CERTIFICATION:

A. Field Commissioning: Video Management Software Testing as recommended by manufacturer, including the following:
i. Conduct complete inspection and testing of equipment, including verification of operation with connected equipment.
ii. Test all the devices and demonstrate operational features to Department's representative and authorities having jurisdiction as applicable.
iii. Correct deficiencies until satisfactory results are obtained. iv. Submit written copies of test results.

44.16.4 WARRANTY

A. OEM Warranty: OEM shall provide standard 36 months' warranty for the offered products & application software.

B. OEM shall provide free of cost patches upgrades for the offered version of the software.

C. AMC: The vendor shall provide AMC for complete Video Surveillance System for a period of 36 months after the OEM product Warranty.

44.17 TRAINING:

(a) The contractor before finally handing over the SYSTEM, be responsible for training Department personnel deputed by the GE in proper operation, periodical maintenance and trouble shooting.

(b) After the SYSTEM are taken over by the GE, the contractor's technical representative shall remain available at both site for a period of Eight weeks to instruct and assist the aforesaid personnel in the actual operation, maintenance and trouble shooting.

44.18 GUARANTEE The contractor shall guarantee the SYSTEM for a period of 24 months. The guarantee period shall commence from the date of satisfactory completion of work & taken over by the GE. During this period of 24 months, the contractor shall be responsible for any defect of damage which, in the opinion of the GE is not due to fair wear and tear. In case of difference of opinion between the GE and the contractor as to whether a particular defect/damage is caused due to fair, wear, and tear or otherwise, the matter shall be referred to the Accepting Officer whose decision shall be final and binding.

45. PA SYSTEM: Refer relevant items of Schedule 'A' in conjunction with manufracturers instructions.

46. TRACK & CURTAIN SYSTEM: Refer relevant items of Schedule 'A' in conjunction with manufracturers instructions.

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50. **SAFETY MEASURES TO BE FOLLOWED IN ALL ON GOING WORKS:**

50.1 Contractor shall at his own expense arrange for all safety provisions as per MES safety code appended as Annexure 'B' IAFW-2249. In addition to adherence of this safety code contractor shall also comply the following safety measures as subject work is to be to be executed in Naval Station Rambilli, which falls under Factory Act.

(a) The contractors' supervisors have to address their labour about safety measures to be adopted while working in the high raised buildings/technical buildings before commencement of work each day.
(b) The contractor shall provide safety belt with Helmet and rope being used by all workers to be as per IS specification.
(c) The contractor shall provide adjustable safety belt as per IS standard to be used forthwith.
(d) Life line and net shall be provided by the contractor while working being undertaken over roof/top and cladding areas.
(e) The contractor shall provide roof ladders and crawling ladders where necessary.
(f) The contractor shall deploy at least one supervisor for each building as directed by GE.
(g) The contractor shall obtain the working permit for the working at height and the electrical work from the concerned shop floor manager through the GE.

50.2 This Safety Clause is not a substitute to Statutory requirements as specified by the Govt. of India or Govt of AP vide various acts/rules and 'prevailing safety regulations or norms of the Naval Station Rambilli, but to further reinforce the existing safety standards which have been to be followed by the contractor.

50.3 Naval Station Rambilli, Visakhapatnam shall not be responsible for any injury/casualty or loss of the life that may take place during the course of contracted work/Service and any Compensation or expenditure towards treatment for such injury/casualty shall be the sole responsibility of the contractor.

50.4 The Contractor is to ensure adequate safeguards for personnel when employed on work where risk to human health/injury is involved. The contractor is to comply with the following conditions regarding 'Labour Welfare and Safety".

(a) The contractor is to ensure that the workers are adequately equipped with safety gear/equipment that is necessitated by the nature of the work involved. The Contractor is to adequately brief the workers in a suitable language easily understood by workers, of the potential hazards and necessity to adhere to Safe Work Practice.

(b) Labourers (both male and female) below 18 years and above 50 years of age are not to be employed by contractor. In addition, they should be free from any pre-existing morbid conditions which are likely to be aggravated by the work conditions in the Naval Station Rambilli. Chronic alcoholics are not to be employed.

(c) All work force employed onsite/on-board ships is to wear separate uniform with firm's logo for clear identification. The workers are to wear suitable visible identification indicating their name and blood group.

(d) The Contractor is liable to provide immediate first aid/hospitalization in case of accident/sudden illness to personnel.

(e) Naval authorities are to be informed by the contractor immediately in the eventuality of any accident taking place.

(f) Compensation to the family on account of injury of any worker employed by the contractor/vendor will be the sole liability of the contractor/vendor.

(g) The contractor shall ensure that the work force employed by the contractor abides by all security regulations imposed by the Naval Unit and does not in any manner compromise security of Naval property/area.

(h) The contractor will render proof of police verification of character and antecedents of the employees proposed to be employed inside Naval Station Rambilli premises.

(j) In case passes are issued to any contractor/firm for working beyond normal working hours on any day, it is the responsibility of the contractor to intimate the Security Officer/Concerned office/Officer of the day and the security staff in case there is a change in the approval, as sought for that day.

(k) Passes are to be surrendered to security officer/concerned office after completion of contract.

(l) An affidavit is to be submitted by the contractor for compliance of minimum wages, EPF and ESI along with acceptance of payment after producing proof of payment to the concerned authorities as per existing Gazette Notification issued from time to time.

Electrical Safety:

(m) In order to avoid burn injuries, shock, fatalities etc. Whilst working on Electrical equipment/undertaking Electrical works/rendering services involving use of Electricity/Electrical appliances (as applicable), strict compliance to safety standards laid by Contracting agency are to be adhered to.

(n) Use of Personal Protective Equipment (PPE) like Rubber gloves and shoes is mandatory when undertaking repairs/work on any electrical machinery. Further, the contractor is to ensure use of properly insulated tools.

(p) Repair/work on electrical equipment is to be undertaken only after a permit/ authorization to do so by the contracting agency.

(q) Switching off of power supplies and tagging to avoid inadvertent switching on must be undertaken under supervision of technical support team of contracting agency.

(r) Additionally, whilst undertaking repairs/works /providing services of non-electrical nature, all precautions are to be taken to avoid inadvertent contact of men and material from energized circuits/electrical overhead lines.

(s) Safety glasses or face shields are worn when exposed to any electrical hazards including work on energized electrical systems.

Personal Protective Equipment (PPE):

(t) Contractors are to ensure provisioning of proper PPE for all workers employed. This should include non-skid shoes/welding shoes, helmets, gloves, masks, welding shield, clothing etc., Construction workers should wear work shoes or boots with slip-resistant and puncture-resistant soles.

(u) Workers should wear Safety Helmet where there is a potential for objects falling from above, bumps to their heads from fixed object, or accidental head contract hazards. The safety helmet used by contractor shall be DARK YELLOW in colour with name of contractor mentioned in front portion. All safety helmets shall have chin strap.

(v) Workers should wear the right gloves for the job (for example, heavy duty rubber gloves for concrete work, welding gloves or welding gloves for welding insulated gloves and sleeves for electrical hazards).

Scaffolding:

(w) It is to be ensured that labourers employed on work on a high structure, where risk of accident exists, are secured to a strong point with a long rope acting as safety belt/life line. Where no suitable strong points exist, one may be specifically constructed/fabricated prior to commencement of work. The scaffold checklist is placed at Annexure-1 for the guidance of contractors. The contractor must submit a signed copy of the scaffold check list to the user department prior starting work on high structure.

(x) Following is to be ensured while working on high structure:

(i) Scaffolding should be set on sound footing.

(ii) Damaged parts that affect the strength of the scaffold are taken out of service.

(iii) Scaffolds are not moved horizontally while workers are on them unless they are designed to be mobile and workers have been trained in the proper procedures.

(iv) Scaffolds are not erected or moved within 10 feet of power lines.

(v) Workers should not be permitted to work on scaffold in bad weather or high winds unless a competent person has determined that it is safe to do so.

(vi) Ladders, boxes, barrels, buckets or other make shift platforms are not to be used to raise work height.

(vii) Extra material is not to be allowed to build up of scaffold platforms.

(viii) Scaffold should not be loaded with more weight than they were designed to support.

Floor and Wall Openings:

(y) Floor openings (12 inches or more) are to be guarded by a secured cover, a guardrail or equivalent on all sided (except at entrances to stairways).

(z) Toe boards are to be installed around the edges of permanent floor openings (Where persons may pass below the opening).

Elevated Surfaces:

(aa) Following is to be ensured while working on Elevated Surfaces.

(i) Signs are to be posted, when appropriate, showing the elevated surface load capacity.

(ii) Surfaces elevated more than 48 inches above the floor or ground should have standard guardrails.

(iii) All elevated surfaces (beneath which people or machinery could be exposed to falling objects) should have standard 4 inch toe boards.

(iv) A permanent means of entry and exit with handrails is to be provided to elevated storage and work surfaces.

(v) Material should be piled, stacked or racked in a way that prevents it from tipping, falling, collapsing, rolling or spreading.

Crane Safety:

(ab) Following is to be ensured during Crane Operation:

(i) Crane should be restricted from operating within 10 feet of any electrical power line.

(ii) Rated load capacities, operating speed and instructions are to be posted and visible to the operator. Cranes should be equipped with a load chart.

(iii) Only properly trained and qualified operators/riggers are to be slowed to work with hosting and rigging equipment. The area below crane boom to be barricaded when lifting is in progress and it shall be ensured that no person shall come under suspended load at any given time. When cranes are used in night, there shall be adequate illumination and the crane operator and rigger shall wear fluorescent and light reflective jackets.

(iv) No crane shall be left unattended with hanging load. On completion of work, the boom/jib of the crane may be brought down and kept in horizontal condition. There should not be any hanging hooks, and hooks are to be secured before the crane leaves the premises of the work site.

(v) No crane including hydraulic crane shall be allowed to move on road with suspended load.

(vi) The contractor need to inspect the area where the crane is being positioned for the operation prior to deployment of crane. In case of load bearing strength of the ground/soil is not sufficient, then the contractor has to use suitable aids for supporting the hydraulic jacks of crane for better stability and safe operation of the crane.

Safety during Welding Operations:

(ac) Welding cables /accessories used by the firms should be fully serviceable, complying with current regulations in force and adequately marked and properly laid out for ease of identification.

(ad) The welder and assistants employed need to be briefed on the procedures of operation of gas cylinders daily to avoid any accident.

(ae) Fire sentries employed should have under gone course on the fighting prior to employment.

(af) Provision of inspection tally with appropriate validity duration for welding operation.

(ag) **Confined Spaces:** Personnel entering confined spaces are to be adequately briefed, equipped with protective clothing masks and be secured with life line with safety number available outside the confined space.

(ah) **Lifting Appliances:** All lifting and hauling appliances like crane sling, chain pulleys, hoists etc being used should have in-date load test certificates certified by the competent authority (as per Factory Act and Rules made there under). All lifting equipment shall be exposed to "Pre-use check" before use every time. Pre-use check must include checking of all critical controls such as brake, limit switches, interlock, warning devices etc. Contractor shall maintain record of pre-use checks at site.

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(aj) Safety training by safety department needs to be conducted for all contractors prior to commencement of work, it shall be the responsibility of the contractor to liaise with safety department to avail the facility of training and have all its employees trained within 10 days of award of contract. The content of the training program would include the following: -

(i) Safety Regulations of the Naval Station Rambilli.

(ii) Use of Personal Protective Equipments in general and any special Personal Protective Equipments specific for a particular job.

(iii) Emergency preparedness plans including evacuation plan.

(iv) Fire Orders of the Naval Station Rambilli and emergency communication procedure.

(ak) The contractor is to nominate at least one qualified safety officer/supervisor for 50 workers and forward his contact details to the Safety department. Safety supervisor of the Contractor shall liaise with user & Safety department for compliance of safety norms and training of contract workers and take regular rounds of all work places to ensure safe working conditions. The duties and responsibilities of the Contractor Safety Officer/Supervisor shall include following:

(i) To assess the hazards associated with jobs in consultation with all concerned and establish safe working procedure including identification of the escape routes.

(ii) To establish a written record of factors that can cause injuries and illnesses.

(iii) To undertake routine/surprise inspections of all work sites and identify unsafe conditions and practices, if any. Check for compliance of the safety practices being followed with approved Health-Safety-and-Environment Plan.

(iv) To investigate promptly the incidents (including near-miss) in order to advise corrective and/or preventive action.

(v) To maintain statistical information for use in analyzing all cases of incidents and events involving contract personnel.

(vi) To provide the means for complying with the reporting requirements for occupational injuries and illnesses.

(vii) To check whether the proposed working arrangements are safe and satisfactory, particularly at the interface between the contractor's planned work and Naval Station Rambilli existing facilities.

(viii) To communicate to the contractor the imposed restrictions that may affect the work/ personnel such as the temporary closure of a corridor or electrical isolation of equipment.

(ix) To review and monitor the contractor's adherence to approved Health-Safety-and-Environment plan and all applicable environmental, health and safety requirements.

(x) To ensure that Consultant, Contractor's Managers, Supervisors and workmen at all levels (who will plan, monitor, oversee and carry out the work) undergo Health, Safety and Environmental training in their respective responsibilities with respect to conducting work safely and with due regard for the protection of the environment.

(x) To identify areas of operations where specialized training is required to deal with potential dangers.

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(xii) To document and to bring to the attention of plan Supervisor and Contractor any non-compliance/violation of the safety norms against approved safety and health plan or safety and health requirements and also raise these issues in the Safety Committee Meetings.

(xiii) To take part in Tool Box Meetings at random and to ensure maintenance of records.

(xiv) To attend weekly (or as called for) meeting with Safety Officer with their weekly safety performance and submit action plan/status of recorded points of last meeting and discuss the safety, health and environment issues at work site of contractor.

(xiii) To get assessed the health of equipment/appliances of contractor before they begin the job. Thorough assessment shall be done for all such equipment/ appliances before first use and at regular interval to ensure that their health is okay and statutory requirements are complied.

(al) **Smoking and Carrying of Matches/Lighters:** Smoking is prohibited inside the Naval Station Rambilli. Carrying of matches, lighter and any other source of ignition inside the Naval Station, unless authorised is prohibited.

(i) Carrying, storing and consuming intoxicants by the workers, supervisors and contractors in the Naval Station is strictly prohibited. Entering the Naval Station in an intoxicated state is a punishable offense.

(am) **Construction of Temporary Shed/Office Building:** No temporary shed/office building/store shall be made by contractor inside the Naval Station Rambilli unless the approval has been obtained by the contractor from competent authority. Such permission shall be registered with the CSFO office. Also, such premises shall be considered as contractor's office. The temporary sheds made by the contractor during execution of work shall be removed after completion of work. Otherwise necessary amount (pertaining to the cost of removal as decided by concerned GE) to be recovered from final bill amount.

(an) **Housekeeping:** The Contractor shall maintain a high level of housekeeping at al times. The work site and contractor's office within the Naval Station Rambilli premises shall be kept clean and tidy so as not to create unsafe condition, health hazard or fire hazard. Cleaning of the work area at the end of the day and upon completion of work is a part of the job. Unnecessary materials, used appliances/material, rags etc, shall not be piled or stored on or around the site unless written approval is obtained from the area in-charge.

(ap) **Handling and Storing Hazardous Materials:** The Contractor shall ensure that the Material Safety Data Sheet (MSDS) is available with any hazardous material brought into Naval Station Rambilli premises by the contractor. Inflammable liquids must be handed in safe cans approved by Naval Station Rambilli and shall be stored in the locations allowed by Naval Station Rambilli. All such containers or cans must be clearly labelled. Only trained and experienced personnel equipped with proper PPE shall handle such material.

(aq) **Work Permit System:** All works in Naval Station Rambilli premises shall be covered under "Work Permit System" such as cold work, hot work, excavation, work at height, radiation, entry into confined space, electrical isolation, energisation etc.

(ar) **Traffic Safety:**

(i) All vehicles (including cranes, forklift, hydra etc.) required to e brought inside the Naval Station Rambilli by contactor are to have appropriate clearance from the Chief Security and Fire Officer (CSFO) office.

(ii) No vehicle shall enter the hot work area or off-limit areas etc without prior approval of the concerned department. All the vehicles entering the Naval Station Rambilli must have valid license and must be in possession of valid RTO certificates.

(iii) All traffic instructions displayed in the Naval Station Rambilli shall be followed by the driver of vehicle. Any deviation from set procedures shall be treated as Safety violation.

(as) **Reporting of Accident/Near miss/Fire/Explosion:**

(i) Contractor shall report all cases of injury (including first aid) and Near miss incident to the user department and the nominated Safety Officer immediately after the incident. He will help the Safety Officer to carry out the investigation and analysis, and also make available their employees for interrogation.

(ii) All incidents of fire/explosion shall be immediately informed to Fire Station Control through telephone or fire alarm point. The person at site will try to extinguish the fire using fire fighting facility at site. All personnel while in Naval Station Rambilli must follow the Fire Orders of the Naval Station Rambilli. Telephone number of Fire Station Control room must be displayed at site.

(at) The management of Naval Station Rambilli reserves its right to suspend the work in the event of the contractor not complying with the safety rules, instructions with regard to safety and health practices for which no claim of any kind will be entertained.

50.5 **Monitoring of Contractor's Safety Performance:** The safety performance of the contractor shall be monitored by the User department/Safety department persons from time to time. Any deviation from safety angle should be corrected immediately. In case of violation of safety system, fine/punishment will be imposed on the contractor. Each completed works/project, by way of a contract, will be reviewed by the y Naval Station Rambilli not only for the quality of work, adherence to schedule, and cost but also for the effectiveness of the contractor's safety program. The overall assessment will be used for future contracts.

50.6 **Infringement for Non Compliance of Safety, Health & Environment Norms:** The contractor has to take full precautions to implement all provisions of Health, Safety & Environment requirement of the Naval Station Rambilli. In case of non compliance of Health, Safety & Environment and procedures, the following penalties shall be imposed on the Contractor by the Naval Station Rambilli and approved by the Accepting Officer and shall be deducted from his running/final bill. The penalty can be recommended by main user department/area in-charge/ inspector from safety department or any officer authorised by the management for the purpose and it to be reviewed and approved by the Accepting Officer. The following penalties are in addition to the cost of recovery for damage if any:

(a) Minor safety violation of applicable health, safety & environment related Rules, Regulations and Norms – Penalty of ` 1000/-

(b) Major safety violation of applicable health, safety & environment related Rules, Regulations and norms – Penalty of ` 3000/-.

(c) If above violation result in any injury to personnel, the additional penalties will be as follows on per person basis:

(i) Any physical injury, a penalty of ` 1,00,000/- per injury in addition to the above penalty for safety violation.

(ii) Fatal Accident, a penalty of `5,00,000/- per fatality in addition to the above penalty for safety violation.

50.7 These penalties do not absolve the contractor from any further disciplinary/civil action. In order to have effective compliance of the above provisions, contractor shall take an insurance policy with a view to cover themselves against the above penalties and the contractor shall submit a copy of the policy to main user department before taking possession/work commencement at site. The Naval Station Rambilli reserves the right to impose Tender holiday/De-registration/Black listing in case of non-compliance of safety regulations by the firm.

Signature of contractor
Date:

DD (Contracts)
for Accepting Officer

PARTICULAR SPECIFICATIONS [Contd...]

51. LIST OF DRAWINGS: The under mentioned drawings shall form part of the tender documents:

Sl No	Description of Drawing	Drawing No.	Sheet No	Date	Date of last Revision
	ARCHITECTURAL DRAWINGS				
1	LIST OF DRAWING	DGNP/WD/C/LD/2050	1/3	25-07-2022	
2	LIST OF DRAWING	DGNP/WD/C/LD/2050	2/3	25-07-2022	
3	LIST OF DRAWING	DGNP/WD/C/LD/2050	3/3	25-07-2022	
	SITE PLAN				
4	WARE HOUSE ROOF PLAN AND AREA DETAILS	DGNP/S/C/621	1/1	25-07-2022	
A	**NAVAL PROVOST AND ACCESSES GATE (G+1)**				
5	GROUND FLOOR PLAN (NAVAL PROVOST)	DGNP/WD/C/AR/2050-A	1/11	25-07-2022	
6	FIRST FLOOR PLAN (NAVAL PROVOST)	DGNP/WD/C/AR/2050-A	2/11	25-07-2022	
7	ROOF PLAN & MUMTY FLOOR PLAN (STAIRCASE) AND OTHER DETAILS(NP)	DGNP/WD/C/AR/2050-A	3/11	25-07-2022	
8	SECTION 1-1' & 2-2' (NAVAL PROVOST)	DGNP/WD/C/AR/2050-A	4/11	25-07-2022	
9	SECTIONS 3-3' (NAVAL PROVOST)	DGNP/WD/C/AR/2050-A	5/11	25-07-2022	
10	ELEVATION-A & C (NAVAL PROVOST)	DGNP/WD/C/AR/2050-A	6/11	25-07-2022	
11	ELEVATION - B & D (NAVAL PROVOST)	DGNP/WD/C/AR/2050-A	7/11	25-07-2022	
12	GROUND FLOOR PLAN (ACCESSES GATE)	DGNP/WD/C/AR/2050-A	8/11	25-07-2022	
13	ROOF PLAN (ACCESSES GATE)	DGNP/WD/C/AR/2050-A	9/11	25-07-2022	
14	ELEVATIONS A,B,C&D AND SECTION- 4-4' &5-5'(ACCESSES GATE)	DGNP/WD/C/AR/2050-A	10/11	25-07-2022	
15	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-A	11/11	25-07-2022	
B	**CAPTAIN SUPERINTENDENT AND REPAIR YARD**				
16	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-B	1/5	25-07-2022	
17	ROOF PLAN & SHAFT DETAILS	DGNP/WD/C/AR/2050-B	2/5	25-07-2022	
18	ELEVATIONS - M,N,P & Q	DGNP/WD/C/AR/2050-B	3/5	25-07-2022	
19	SECTION AA' & BB'	DGNP/WD/C/AR/2050-B	4/5	25-07-2022	
20	SCHEDULE OF FINISHES	DGNP/WD/C/AR/2050-B	5/5	25-07-2022	
C	**ADMIN BUILDING -01 (G+2)**				
21	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-G	1/6	25-07-2022	
22	FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-G	2/6	25-07-2022	
23	SECOND FLOOR PLAN AND SECTION CC'	DGNP/WD/C/AR/2050-G	3/6	25-07-2022	
24	TERRCE FLOOR PLAN, SECTION AA' and BB'	DGNP/WD/C/AR/2050-G	4/6	25-07-2022	
25	SECTION AA', BB' and CC' ELEVATIONS FRONT and REAR	DGNP/WD/C/AR/2050-G	5/6	25-07-2022	
26	SCHEDULE OF FINISHES	DGNP/WD/C/AR/2050-G	6a/6	25-07-2022	
27	SCHEDULE OF FINISHES	DGNP/WD/C/AR/2050-G	6b/6	25-07-2022	
28	SCHEDULE OF FINISHES	DGNP/WD/C/AR/2050-G	6c/6	25-07-2022	

PARTICULAR SPECIFICATIONS [Contd...]

Sl No	Description of Drawing	Drawing No.	Sheet No	Date	Date of last Revision
D	**ADMIN BUILDING -02 (G+1)**				
29	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-H	1/5	25-07-2022	
30	FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-H	2/5	25-07-2022	
31	TERRACE FLOOR PLAN, PART PLAN OF INDOC RM,SECTION AA' AND BB'	DGNP/WD/C/AR/2050-H	3/5	25-07-2022	
32	ELEVATIONS FRONT AND REAR, SECTION AA', BB' AND CC'	DGNP/WD/C/AR/2050-H	4/5	25-07-2022	
33	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-H	5a/5	25-07-2022	
34	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-H	5b/5	25-07-2022	
E	**PORT CONTROL TOWER (G+2)**				
35	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-Q	1/6	25-07-2022	
36	FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-Q	2/6	25-07-2022	
37	SECOND FLOOR PLAN	DGNP/WD/C/AR/2050-Q	3/6	25-07-2022	
38	ROOF PLAN	DGNP/WD/C/AR/2050-Q	4/6	25-07-2022	
39	SECTION AA' & BB' AND FRONT, REAR,LEFT & RIGHT SIDE ELEVATIONS	DGNP/WD/C/AR/2050-Q	5/6	25-07-2022	
40	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-Q	6/6	25-07-2022	
F	**STATION HEALTH OFFICE**				
41	GROUND FLOOR PLAN & PART SITE PLAN	DGNP/WD/C/AR/2050-P	1/5	25-07-2022	
42	ROOF PLAN	DGNP/WD/C/AR/2050-P	2/5	25-07-2022	
43	ELEVATIONS A, B, C & D	DGNP/WD/C/AR/2050-P	3/5	25-07-2022	
44	SECTION 1-1', 2-2', 3-3' & 4-4'	DGNP/WD/C/AR/2050-P	4/5	25-07-2022	
45	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-P	5/5	25-07-2022	
G	**SWIMMING POOL (G+1)**				
46	SITE PLAN	DGNP/WD/C/AR/2050-J	1/10	25-07-2022	
47	PLAN AT LEVEL +900	DGNP/WD/C/AR/2050-J	2/10	25-07-2022	
48	PLAN AT LEVEL +3000	DGNP/WD/C/AR/2050-J	3/10	25-07-2022	
49	ROOF PLAN	DGNP/WD/C/AR/2050-J	4/10	25-07-2022	
50	ELEVATION - A, B, C & D, SECTION -FF' & GG'	DGNP/WD/C/AR/2050-J	5/10	25-07-2022	
51	PUMP ROOM ELEVATIONS - P,Q,R&S	DGNP/WD/C/AR/2050-J	6/10	25-07-2022	
52	SWIMMING POOL GALLERY ELEVATIONS A, B, C & D, SECTION EE'	DGNP/WD/C/AR/2050-J	7/10	25-07-2022	
53	SECTION AA', BB', CC' & DD'	DGNP/WD/C/AR/2050-J	8/10	25-07-2022	
54	TYPICAL DETAILS	DGNP/WD/C/AR/2050-J	9/10	25-07-2022	
55	SWIMMING POOL DIVING STAND DETAIL SECTION AA'	DGNP/WD/C/AR/2050-J	10/10	25-07-2022	
56	COLUMN AND WALL LAYOUT PLAN-TOILET BLOCK	DGNP/WD/C/AR/SF/2050-J	11/12	25-07-2022	
57	SCHEDULE OF FINISHES	DGNP/WD/C/AR/2050-J	12/12	25-07-2022	

PARTICULAR SPECIFICATIONS [Contd...]

Sl No	Description of Drawing	Drawing No.	Sheet No	Date	Date of last Revision
H	**GRAND STAND**				
58	PART SITE PLAN	DGNP/WD/C/AR/2050-L	1/10	25-07-2022	
59	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-L	2/10	25-07-2022	
60	UPPER FLOOR & ROOF PLAN	DGNP/WD/C/AR/2050-L	3/10	25-07-2022	
61	ELEVATION 1 & 2	DGNP/WD/C/AR/2050-L	4/10	25-07-2022	
62	ELEVATION 3 & 4 AND KEY PLAN	DGNP/WD/C/AR/2050-L	5/10	25-07-2022	
63	SECTION AA' & BB'	DGNP/WD/C/AR/2050-L	6/10	25-07-2022	
64	PLAN OF TOILET BLOCK 1&2	DGNP/WD/C/AR/2050-L	7/10	25-07-2022	
65	ELEVATIONS 5,6,7&8 (TOILET BLOCK)	DGNP/WD/C/AR/2050-L	8/10	25-07-2022	
66	SECTION CC' & DD' (TOILET BLOCK)	DGNP/WD/C/AR/2050-L	9/10	25-07-2022	
67	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-L	10/10	25-07-2022	
I	**GYMNASIUM (G+1)**				
68	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-K	1/8	25-07-2022	
69	FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-K	2/8	25-07-2022	
70	ROOF PLAN & SHAFT DETAILS	DGNP/WD/C/AR/2050-K	3/8	25-07-2022	
71	FRONT & REAR SIDE ELEVATIONS	DGNP/WD/C/AR/2050-K	4/8	25-07-2022	
72	LEFT & RIGHT SIDE ELEVATIONS	DGNP/WD/C/AR/2050-K	5/8	25-07-2022	
73	SECTION AA' & BB'	DGNP/WD/C/AR/2050-K	6/8	25-07-2022	
74	SECTION CC' & DD'	DGNP/WD/C/AR/2050-K	7/8	25-07-2022	
75	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-K	8/8	25-07-2022	
J	**K- SUB MARINE REPAIR YARD (G+3)**				
76	GROUND & FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-C	1/16	25-07-2022	
77	SECOND & THIRD FLOOR PLAN	DGNP/WD/C/AR/2050-C	2/16	25-07-2022	
78	ROOF FLOOR & MUMTY ROOF PLAN	DGNP/WD/C/AR/2050-C	3/16	25-07-2022	
79	ELEVATION - E & G	DGNP/WD/C/AR/2050-C	4/16	25-07-2022	
80	ELEVATION - F & H	DGNP/WD/C/AR/2050-C	5/16	25-07-2022	
81	SECTION AA' & BB'	DGNP/WD/C/AR/2050-C	6/16	25-07-2022	
82	SECTION CC' & DD', SHAFT DT-1 & DT-2, DETAILS OF STEPS & PLINTH PROTECTION DETAILS	DGNP/WD/C/AR/2050-C	7/16	25-07-2022	
83	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-C	8/16	25-07-2022	
84	ROOF PLAN	DGNP/WD/C/AR/2050-C	9/16	25-07-2022	
85	ELEVATION-A & B	DGNP/WD/C/AR/2050-C	10/16	25-07-2022	
86	ELEVATION-C & D	DGNP/WD/C/AR/2050-C	11/16	25-07-2022	
87	SECTION XX' & YY'	DGNP/WD/C/AR/2050-C	12/16	25-07-2022	
88	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-C	13/16	25-07-2022	
89	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-C	14/16	25-07-2022	
90	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-C	15/16	25-07-2022	
91	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-C	16/16	25-07-2022	

PARTICULAR SPECIFICATIONS [Contd...]

Sl No	Description of Drawing	Drawing No.	Sheet No	Date	Date of last Revision
K	**WARE HOUSE**				
92	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-T	1/8	25-07-2022	
93	MEZZANINE FLOOR PLAN	DGNP/WD/C/AR/2050-T	2/8	25-07-2022	
94	ROOF PLAN	DGNP/WD/C/AR/2050-T	3/8	25-07-2022	
95	SECTION -EE', FF', ELWEVATION P&Q	DGNP/WD/C/AR/2050-T	4/8	25-07-2022	
96	SECTION AA', BB'	DGNP/WD/C/AR/2050-T	5/8	25-07-2022	
97	SECTION CC', DD'	DGNP/WD/C/AR/2050-T	6/8	25-07-2022	
98	ELEVATION R AND S	DGNP/WD/C/AR/2050-T	7/8	25-07-2022	
99	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-T	8/8	25-07-2022	
L	**MEDICAL INSPECTION ROOM**				
100	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-D	1/7	25-07-2022	
101	ROOF PLAN AND DETAILS	DGNP/WD/C/AR/2050-D	2/7	25-07-2022	
102	ELEVATION -A, B ,C & D	DGNP/WD/C/AR/2050-D	3/7	25-07-2022	
103	SECTIONS XX, YY, & ZZ AND OTHER DETAILS	DGNP/WD/C/AR/2050-D	4/7	25-07-2022	
104	MISALLIANCES DETAILS-1	DGNP/WD/C/AR/2050-D	5/7	25-07-2022	
105	MISALLIANCES DETAILS-2	DGNP/WD/C/AR/2050-D	6/7	25-07-2022	
106	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-D	7/7	25-07-2022	
M	**HOSPITAL BLOCK (G+1)**				
107	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-U	1/22	25-07-2022	
108	FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-U	2/22	25-07-2022	
109	ROOF PLAN	DGNP/WD/C/AR/2050-U	3/22	25-07-2022	
110	ELEVATION - M,N,P, & Q	DGNP/WD/C/AR/2050-U	4/22	25-07-2022	
111	SECTION - AA' & BB'	DGNP/WD/C/AR/2050-U	5/22	25-07-2022	
112	RAMP DETAILS	DGNP/WD/C/AR/2050-U	6/22	25-07-2022	
113	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	7/22	25-07-2022	
114	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	8/22	25-07-2022	
115	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	9/22	25-07-2022	
116	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	10/22	25-07-2022	
117	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	11/22	25-07-2022	
118	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	12/22	25-07-2022	
119	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	13/22	25-07-2022	
120	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	14/22	25-07-2022	
121	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	15/22	25-07-2022	
122	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	16/22	25-07-2022	
123	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	17/22	25-07-2022	
124	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	18/22	25-07-2022	
125	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	19/22	25-07-2022	

PARTICULAR SPECIFICATIONS [Contd...]

Sl No	Description of Drawing	Drawing No.	Sheet No	Date	Date of last Revision
126	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	20/22	25-07-2022	
127	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	21/22	25-07-2022	
128	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-U	22/22	25-07-2022	
N	**NURSING OFFICER HOSTEL (G+3)**				
129	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-N	1/14	25-07-2022	
130	FIRST/SECOND FLOOR PLAN	DGNP/WD/C/AR/2050-N	2/14	25-07-2022	
131	THIRD FLOOR PLAN	DGNP/WD/C/AR/2050-N	3/14	25-07-2022	
132	ROOF PLAN & OTHER DETAILS	DGNP/WD/C/AR/2050-N	4/14	25-07-2022	
133	FRONT ELEVATION	DGNP/WD/C/AR/2050-N	5/14	25-07-2022	
134	REAR ELEVATION	DGNP/WD/C/AR/2050-N	6/14	25-07-2022	
135	LEFT & RIGHT SIDE ELEVATIONS	DGNP/WD/C/AR/2050-N	7/14	25-07-2022	
136	SECTIONS A-A'	DGNP/WD/C/AR/2050-N	8/14	25-07-2022	
137	SECTION B-B' & C-C'	DGNP/WD/C/AR/2050-N	9/14	25-07-2022	
138	DETAILS OF STAIRCASE & OTHER DETAILS	DGNP/WD/C/AR/2050-N	10/14	25-07-2022	
139	MUMTY PLAN & MUMTY ROOF PLAN(STAIRCASE)	DGNP/WD/C/AR/2050-N	11/14	25-07-2022	
140	MISALLIANCES DETAILS	DGNP/WD/C/AR/2050-N	12/14	25-07-2022	
141	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-N	13/14	25-07-2022	
142	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-N	14/14	25-07-2022	
O	**COMMANDER OF YARD CRAFT**				
143	GROUND & FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-M	1/6	25-07-2022	
144	TERRACE FLOOR PLAN AND RAMP SECTION	DGNP/WD/C/AR/2050-M	2/6	25-07-2022	
145	FRONT,REAR,LEFT & RIGHT SIDE ELEVATION	DGNP/WD/C/AR/2050-M	3/6	25-07-2022	
146	SECTION AA', BB' & XX'	DGNP/WD/C/AR/2050-M	4/6	25-07-2022	
147	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-M	5/6	25-07-2022	
148	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-M	6/6	25-07-2022	
P	**SECONDARY SCHOOL (G+2)**				
149	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-E	1/8	25-07-2022	
150	FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-E	2/8	25-07-2022	
151	SECOND FLOOR PLAN	DGNP/WD/C/AR/2050-E	3/8	25-07-2022	
152	ROOF PLAN, MUMTY PLAN & MUMTY ROOF PLAN AND SHAFT DETAILS	DGNP/WD/C/AR/2050-E	4/8	25-07-2022	
153	FRONT & SIDE ELEVATION	DGNP/WD/C/AR/2050-E	5/8	25-07-2022	
154	SECTION AA',XX'&YY'	DGNP/WD/C/AR/2050-E	6/8	25-07-2022	
155	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-E	7/8	25-07-2022	
156	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-E	8/8	25-07-2022	

PARTICULAR SPECIFICATIONS [Contd...]

Sl No	Description of Drawing	Drawing No.	Sheet No	Date	Date of last Revision
Q	**NAVAL KG SCHOOL(G+1)**				
157	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-F	1/6	25-07-2022	
158	FIRST FLOOR PLAN & RAMP DETAILS	DGNP/WD/C/AR/2050-F	2/6	25-07-2022	
159	ROOF PLAN, MUMTY PLAN & MUMTY ROOF PLAN AND SHAFT DETAILS	DGNP/WD/C/AR/2050-F	3/6	25-07-2022	
160	ELEVATION 1 & 2	DGNP/WD/C/AR/2050-F	4/6	25-07-2022	
161	SECTIONS - AA', BB', CC', XX'&YY'	DGNP/WD/C/AR/2050-F	5/6	25-07-2022	
162	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-F	6/6	25-07-2022	
R	**AUDITORIUM (G+1)**				
163	PART SITE PLAN	DGNP/WD/C/AR/2050-R	1/9	25-07-2022	
164	COLUMN DEMARCATION PLAN	DGNP/WD/C/AR/2050-R	2/9	25-07-2022	
165	GROUND FLOOR PLAN	DGNP/WD/C/AR/2050-R	3/9	25-07-2022	
166	FIRST FLOOR PLAN	DGNP/WD/C/AR/2050-R	4/9	25-07-2022	
167	TRUSS PLAN	DGNP/WD/C/AR/2050-R	5/9	25-07-2022	
168	ELEVATION A, B, C & D	DGNP/WD/C/AR/2050-R	6/9	25-07-2022	
169	SECTIONS AA' HEIGHT SECTION	DGNP/WD/C/AR/2050-R	7/9	25-07-2022	
170	SECTIONS BB' & TOILET SECTION	DGNP/WD/C/AR/2050-R	8/9	25-07-2022	
171	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-R	9/9	25-07-2022	
S	**BUS STOP**				
172	BUS STOP PLAN, TOP PLAN, FRONT ELEVATION & SECTION PP'	DGNP/WD/C/AR/2050-S	1/2	25-07-2022	
173	BUS STOP DETAILS - A & B	DGNP/WD/C/AR/2050-S	2/2	25-07-2022	
T	**MORTUARY**				
174	PLAN, ROOF PLAN ELEVATIONS - A&C	DGNP/WD/C/AR/2050-X	1/3	25-07-2022	
175	ELEVATION B & D	DGNP/WD/C/AR/2050-X	2/3	25-07-2022	
176	SECTION XX'&YY'	DGNP/WD/C/AR/2050-X	3/3	25-07-2022	
177	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-V	4/4	25-07-2022	
U	**BIO MEDICAL**				
178	PLAN, ROOF PLAN, SECTION XX'&YY'	DGNP/WD/C/AR/2050-W	1/2	25-07-2022	
179	FRONT,REAR,LEFT & RIGHT SIDE ELEVATIONS	DGNP/WD/C/AR/2050-W	2/2	25-07-2022	
180	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-V	4/4	25-07-2022	
V	**GARAGE, GAS MANIFOLD AND OXYGEN GENERATION PLANT**				
181	PLAN & ROOF PLAN	DGNP/WD/C/AR/2050-V	1/4	25-07-2022	
182	FRONT,REAR,LEFT & RIGHT SIDE ELEVATIONS	DGNP/WD/C/AR/2050-V	2/4	25-07-2022	
183	SECTION XX',YY' & ZZ	DGNP/WD/C/AR/2050-V	3/4	25-07-2022	
184	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-V	4/4	25-07-2022	

PARTICULAR SPECIFICATIONS [Contd...]

Sl No	Description of Drawing	Drawing No.	Sheet No	Date	Date of last Revision
W	**ENGINEERING SERVICES(G+2)**				
185	GROUND FLOOR & FIRST FLOOR PLANS	DGNP/WD/C/AR/2050-Y	1/5	25-07-2022	
186	SECOND FLOOR PLAN & ROOF PLAN	DGNP/WD/C/AR/2050-Y	2/5	25-07-2022	
187	ELEVATIONS	DGNP/WD/C/AR/2050-Y	3/5	25-07-2022	
188	SECTION	DGNP/WD/C/AR/2050-Y	4/5	25-07-2022	
189	SCHEDULE OF FINISHES	DGNP/WD/C/AR/SF/2050-Y	5/5	25-07-2022	
	UG SUMP 75000 LTS CAPACITY				
190	PLAN, ELEVATION AND SECTION AA'	DGNP/WD/C/AR/2050-Z	1/1	25-07-2022	

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.

Signature of contractor
Date:

(T Venkata Ratnam)
AAD (Contracts)
for Accepting Officer

PARTICULAR SPECIFICATIONS [Contd...]

52. **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.

52.1 If any item makes as specified in PS / Schedule "A" neither available nor manufacturing in the market then IS marked makes with prior approval of GE can be taken before execution and the same shall be intimated.

Ser No.	Materials	Make/Name Of Firms
1	Factory Made Chowkats, Panelled / Skeleton Shutters [Wooden]	M/s. Timber Technic, Phase-V Industrial Development Area Jeedimetla, Hyderabad – 500 235 / M/s. Wood India Products, Calcutta / M/s. Standard Doors, Jeedimetla, Hyderabad / M/s. Electrical & General Wood Industries K-6, Industrial Development Area, Uppal, Hyderabad – 500 035 / M/s. Sri Ram Wood Products [P] Ltd, 31-34-145/1, Bangaramma Metta, Visakhapatnam / M/s. MP Wood Products, 124, Labriya Bheru, Dhar Road, Indore / M/s. Berar Timber Industries Pvt Ltd, National High Way No. 8, Village Saran, Valsad, Gujarat – 396 001 / M/s. Goyal Bros, Goyal House, Ramkund, Raipur – 492 001 / M/s. Betul Wood Products Pvt Ltd, Industrial Estate Betul – 460 022 / M/s. Goyal Industrial Corpn, 8343, D.B Gupta Marg, New Delhi – 110 005 / M/s. Doorking Industries, 27, G.N Block Sector-V, Industrial Estate, Salt Lake, Calcutta – 700 091 / M/s. Wood Treatment Specialist, Chennai / M/s. Wood Design [P] Ltd, Bangalore / M/s. Kitply Flush Doors And Furniture Co, Chennai
2	PVC / UPVC Door, Window & Chowkhat	Kumar Arch Tech Pvt. Ltd / Sintex India Ltd. / Polywood / Rajshri Plastiwood Ltd. /Poly Windows Pune / Accucell / Duraplast extrusion
3	Moulded Panel Doors	Jain / Goyal / Rajshri Plastiwood Ltd. / Sintex
4	Solid Panel Foam Doors [Solid / Glazed Panel]	Fenesta / Kesar / LG Hausys
5	FRP Door Shutters	Fibreways Technology / Krafto Door / Sintex India Ltd
6	Natural Fibre Thermo Composite Door / Window Shutter & Frames	Durosam [AB Composite Pvt. Ltd.] / ELCONS
7	Wooden Panel / Flush Doors & Windows	MP Wood Products / Doorking Kolkata / Ambika Timber Works / Premier Wood Craft [P] Ltd. / Jain Doors Pvt. Ltd.
8	Automatic Door & Glass Fittings	Toshi / Hardwin / Hettich
9	Aluminium Door & Window Fittings	Bharat / Classic / Alans / Argent / Hettich
10	Extruded Polished / Matt Finish Brass Builders Hardware	Harrison / Godrej / Crown

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
11	MS Stove Enameled Builders Hardware	Mowjee / Crown / Everlite / Harrison / Godrej
12	Floor Springs / Door Closers / Accessories	Hardwin / Godrej / Doorset
13	PVC False Ceiling	Kumar Arch Tech Pvt. Ltd. / Accura / Saint Gobain / Modiguard
14	Gupsum board / Calcium Silicate Board / Calsidicor Tiles in False Ceiling / Wall Lining	Armstrong / India Gypsum / Lafarge / Gypstone / Saint Gobain / Everest
15	Mineral Fibre False Ceiling	Armstrong Gyroe [Saint Gobain] / Twiga Insulation / UP Twiga Fibre Glass Ltd. / Llyod Insulation
16	Metal False Ceiling	Armstrong / Unifloors / Nittobo
17	Cement Fibre Board Ceiling	Everest / Lafarge / Armstrong
18	Anodised Aluminium Partition System with Solid / Glazed Panel	Jindal / Hindalco / Indalco
19	Frameless Glass Partition System / Wall Paneling	Saint Gobain Glass / IAG / Kesarbrand by M/s Kesar safety glass
20	PVC Partition and Wall Paneling	Kumar Arch Tech Pvt. Ltd / Rajashri Plastiwood Ltd., / Duro plast / Sintex India Ltd. / Commander
21	PVC Kitchen [Cupboards, Cabinets & Wardrobes]	Kumar Arch Tech Pvt. Ltd / M/s Rajshri Plastiwood / Sintex
22	Rigid Foam PVC Sheets from 0.5mm to 40mm thickness	Kumar Arch Tech Pvt. Ltd / Rajashri Plastiwood Ltd. / Sintex / Marino
23	Prelaminated PVC Sheets from 0.5mm to 40mm thickness	Jain Irrigation Systems Ltd / Rajashri Plastiwood Ltd. / Sintex / Hindopan / Marino
24	Prefabricated PVC Hut & Bath Rooms	Kumar Arch Tech Pvt. Ltd / Prestar / Sintex / Marino
25	Galvanised Colour / Powder Coated Steel Windows, Doors, Partition and Structural Glazing	NCL Alltek & Seccolor Ltd. / Armstrong / Nittobo
26	Aluminium Composite Panel	Alstone International / Alumnium Tech Industries / Modern Fittings

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
27	Polycarbonate Sheets	Prestar Infrastructure Pvt. Ltd. / GE / Fibreways Technology
28	CP Bath Fittings	Jaquar & Company Pvt. Ltd. / Marc / Kohler / Cera / Parryware / Grohe / Crabtree / Blue Star & Silver Shine
29	Stainless Steel Towel Rail / Towel Rack/ Towel Ring/ Soap Disc/TPH	Jaquar & Company Pvt. Ltd. / Marc / Kohler / Cera / Parryware
30	Wash Basins / WCs	Jaquar & Company Pvt. Ltd. / Kohler / Roca / Cera [First Quality] / Hindware [Italian Collection] / Parryware [Superfine] / Johnson Pedder
31	SS Wash Basins & WCs	Diamond / Nirali/ M/s Bluestar sanitary Industries Pvt. Ltd / Kohler
32	Designer Bath Suits	Jaquar & Company Pvt. Ltd / Cera / Parryware
33	Stainless Steel Kitchen Sink	Jain Brothers Sanitation Pvt. Ltd. / Cera / Blue Star & Silver Shine / Kohler/ M/s Prayag Polymers (p) Ltd.
34	PTMT Float Valves / Ball Cocks, Cockroach Traps, Glass Shelf, Bath Fittings/ SS Door Hinges & Hardware	Prayag Polymer Pvt. Ltd. / Polytuff / Neelkanth / Shakti
35	SS Plate Rack	Suyog / Prayag/ M/s Bluestar
36	Kitchen Cabinets and Trolleys	Godrej Interio / Zuari / Kitchen Concepts / Dream Kitchens / Kitchen Crafts
37	Concealed Cisterns	Kohler / Grohe / Hindware / Jaquar
38	Normal or Dual-Flow PVC Flushing Cistern	Hindware / Cera / Parryware / Commander
39	Glass Mirror	Prayag / Zircon / Cera / Saint Gobain / Modiguard
40	PVC / Acrylic Toilet Mirror Cabinet	Parryware / Polytuff / Commander / Cera
41	Stainless Steel Towel Rail / Towel Rack / Towel Ring / Soap Dish / Toilet Paper Holder	Kohler / Grohe / Jaquar / Blue Star & Silver Shine / Cera
42	Toilet Seat Cover	Commander / Parryware / Cera / Hindware / Jaquar/ M/s Prayag Polymers (p) Ltd.
43	Shower Panels	Grohe / Kohler / Jaquar / Lauret
44	Bath Suits	Kohler / Grohe / Jaquar

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
45	Glass WHB	Zircon / Sparkle Glass / Seabird
46	Glass Frameless Shower Enclosures / Cubicles	Cera / Hindware / Lauret / Jaquar
47	Acrylic Washable Distemper	Berger [Jadoo] / Nerolac / British Paint / Jotun India Pvt Ltd / Velvet Acrylic Distemper [Crimson Paints Pvt Ltd.]
48	Plastic Emulsion Paint	Berger [Silk] / ICI [Dulux Velvet Touch] / Shalimar Paints / Asian Paint Ltd. / Nerolac Paints Ltd. / Jotun India Pvt Ltd
49	Synthetic Enamel Paint / Acrylic Paint	Shalimar Paints Ltd. [Superlac] / Asian [Apcolite] / Berger [Luxol] / Jenson & Nicholson Paints Ltd [Brolac] / Jotun India Pvt Ltd
50	Cement Based Paint	Snowcem Plus / Berger / Asian Paints [Gutucam] / Jotun India Pvt Ltd / Crimocem Super Cement Paints
51	Exterior Acrylic Emulsion Weather Coat Paint	Apex Ultima [Asian] / Extra Maxium Ultra [Shalimar] / Weather Coat [Berger Paints Ltd.] / Dulax / Royal Acrylic [Crimson Paints Pvt Ltd.] / Jotun India Pvt Ltd
52	French Polish	Berger / Jenson & Nicholson Paints Ltd / Asian / Jotun India Pvt Ltd
53	Thermoplastic Road Marking Paint / Retro-Reflective Paint	Asian Apcomark / STP / Shalimar Paints Ltd. / Berger Paints Ltd. / Jenson & Nicholson Paints Ltd / Jotun India Pvt Ltd
54	Water Based Road Marking Paint	Jotun India Pvt Ltd / Berger / Asian Apcotrak / Shalimar
55	Acid Resistant Paint	Asian / Berger / Jotun India Pvt Ltd
56	Epoxy Paint / Polyurethane Paint	Fosroc / Pidilite / Asian / Berger / Johnson & Nicholson / Jotun India Pvt Ltd
57	Black Bituminous Paint	Asian / Berger / Jotun India Pvt Ltd
58	White Cement / Wall Putty	Birla Laval Plast / Berger / J & N / Shalimar Paints / Asian Paints
59	PMB (Polymer Modified Bitumen)	M/s OOMS Polymer Modified Bitumen Pvt. Ltd. / M/s Hindustan Coalas Ltd.
60	Ply Wood / Prelaminated Ply Wood / Marine Ply Wood / Veneered Decorative Plywood / Structural Plywood / Fire Retardant Plywood	Greenply Industries [Ply & Board Division] / Kitply / Century / National Plywood Industries Pvt. Ltd. / Sylvan Ply / Archid Ply
61	Veneered Plain Particle Board / Prelaminated Particle Board	Greenply Industries [Ply & Board Division] / Kitply / Anchor / Bhutan Board / Novapan / Associate Décor / Archidply
62	Gypsum Board	Lafarge / Gypsum India Ltd / Armstrong / USG / Gyproc

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
63	MDF / HDF Boards	Greenply Industries Ltd [Engineered Panel Division] / Balaji Action Buildwell / Novapan / National / Kitply
64	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	Kajaria Ceramics Ltd / Asian Granito India Ltd / Somany Ceramics Limited / Varmora Granito Pvt Ltd / H & R Johnson India Ltd /
65	Precast Concrete Interlocking Paving Blocks	Anjali Tiles / Ultra Tiles Pvt Ltd / Terra Firma / Ecco Scope / Mehtab Tiles
66	Precast Plain / Chequered Cement Tiles for Flooring	Ultra / Bansal / Nitco / Anjali / Multiwyn
67	Precast Terrazzo Tiles for Flooring	Johnson / Ultra Tiles Pvt Ltd / Nitco
68	Wooden Laminated Floor Tiles / Parquet Tiles	Vista / Pergo / Haro
69	Glazed Mosaic Tiles	Hindustan Tiles / Johnson / Ultra Tiles Pvt Ltd / National Tiles & Industries / Coral / Ceco
70	Heavy Duty Exterior Vitrified Tiles	Johnson [Endura] / Multiwyn / Century / Cristal / Somany [Durastone] / Orient Bell Ltd.
71	Glazed Porcelain Elevation Wall Tiles	Century Porselato / Porselato / Porcelain / Crystal Porcelain
72	Acid Resistant Vitrified Tiles	Johnson [Endura] / Somany [Durastone] / Asian Granito / Kajaria
73	Metallic Floor Hardener for Wear Proof Topping	Ironite / Stillonite / Hardonate
74	Non-Metallic Floor Hardener for Wear Proof Topping	Fosroc / Fibrex / Sika / BASF
75	Epoxy Resin / Polyurethane Based Floor Coating	Sika / Fosroc / BOSTIK India / STP
76	Tile Adhesive	Pidilite Industries Ltd / Somany Ceramics Limited / Kajaria / Latecreat
77	Punched Tape Concertina Coil and Flat Wrap Weld Mesh for Fencing	Global Technocrats Pvt Ltd/ A-1 Fence Products Company Pvt Ltd / Shiva Engg Co.

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
78	Pressed Steel Frames for Doors / Windows / Ventilators	BA Enterprises / Multiwyn Industrial Corporation / Doorwyn Industries / Modern Fabricator / Madhu Industries / Ajanta Ispat / Alusys
79	Anodised / Powder Coated Aluminium Frames	Jindal / Hindalco / Ajit India / Indal
80	Aluminium Doors / Windows [Solid / Glazed Panel]	Jindal / Hindalco / Balco / Modern Fabricator / Alumilite Pvt Ltd. / Ajit India Pvt Ltd
81	Frameless Glass Door	Kesar / Super Aluminium / Haresh Aluminium
82	Metal Rolling Shutters and Rolling Grills / Collapsible Gates	BA Enterprises / Multiwyn Industrial Corporation / Doorwyn Industries / Modern Fabricator
83	Plain Sheet Glass / Float Glass / Frosted Glass	Saint Gobain Glass / Modiguard Float Glass / Asahi India / Hindustan Pilkington Glass / Triveni Float Glass / IAG
84	Toughened Glass / Laminated Glass	Safex / Saint Gobain Glass / Modiguard Float Glass / Kesar / Asahi India / Atul Tuf / Hindustan Pilkington Glass / Triveni Float Glass
85	Solar Control & Thermal Insulation Glass	SGG EVO / Evolite / Envision
86	Wired Glass	Saint Gobain Glass / Modiguard Float Glass / Triveni / Safex / Atul Tuf / Hindustan Pilkington Glass / Kesar
87	Black Painted Glass Tiles	Kesar / Marvel / Dreamwalls Color Glass / Paladio / Italia / Mridul / Mehtab Tiles
88	Tinted / Coloured Glass	Saint Gobain / Modiguard / Hindustan Pilkington glass
89	Glass Top Shelves	Kesar / Ozone / Sparkle Glass
90	Cat Eyes / Studs [Metal / Plastic] /Rumble Strips /Speed Breakers	3M / Dark Eye / Green lite
91	Delineators / Road Barriers	3M / Dark Eye / Green lite
92	Road Signage	3M / Dark Eye / Green lite
93	HDPE / LDPE Water Tanks (Three layered)	Sintex / Polycon / Oriplast / Jindal
94	UPVC / PPR / HDPE Pipe	Jain Irrigation / Kisan / Prince / Supreme / Oriplast / Finolex / Diplast
95	RCC Pipes [NP2 / NP3]	Indian Hume Pipes / Everest / Himalaya / Thuluvananikal Pipes
96	CI / DI Centrifugally Cast [Spun] Pipes & Fittings	Neco Centri / BIC / Electro Steel Casting Ltd. / AIC / PIC / Jai Balaji Industries / Srikalahasti Pipes Ltd.

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
97	PVC Soil / Waste / Rain Water [SWR] Pipes and Fittings	Jain Irrigation / Kisan / Supreme / Prince / Anant / Oriplast
98	CPVC / UPVC Pipes and Fittings	Astral / Ashirwad Flowguard / Kisan / Reliance / Supreme / Prince/ M/s Prayag Polymers (p) Ltd
99	HDPE Pipes and Fittings [Water]	Kisan / Jain Irrigation / Supreme / Prince / Oriplast / Ajay Flow
100	Brass Ball [Float] Valve	Leader / Kirloskar / Zoloto
101	CI Manhole Covers	AIC / PIC / Singhal Iron Foundary
102	PGI Sheet	Tata / Jindal / SAIL
103	Galvalume / Zincalume Sheet for Roof and Wall	Tata Bluescope / Bhushan / Jindal
104	PVC Insulated Cable up to 1100 Volts Copper / Aluminium Conductor, Sheathed / Unsheathed as per IS – 694	Havells / Finolex / Nicco / KEI / Polycab / RR Kabel Ltd / Asian (RPG) / Universal / Goldmedal
105	PVC / XLPE Insulated PVC Sheathed Heavy Duty Armoured / Unarmoured Cables up to 1100 Volts, Aluminium / Copper Conductors, Solid / Stranded as per IS – 1554, Part–I & IS – 7098, Part–I.	Havells / Gloster Cables / KEI Industries Ltd / Polycab / Asian (RPG) / Finolex / Universal / Goldmedal
106	HT XLPE Cables	Havells / Asian [RPG] / CCI / Polycab / Finolex/ Gloster Cables / KEI Industries Ltd / Universal
107	Other Category of Cables / ABC Cable	Ravin Cables Ltd / M/s Dynamic Cables Ltd. / KEI
108	CI Pipes	Electrosteel / Kesoram / Tisco
109	DI Pipe, ISI Marked of bore 80 to 1000mm [Except DN 125 & 750mm] of Class K7, K8, & K9 Conforming to IS – 8329] and Fittings	Jindal / Electrosteel Casting Ltd. / Tata Metaliks / Tata Kabuto / SAW Pipes
110	ERW MS Pipes / GI Pipes / Fittings	Tata / Jindal / Zenith

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
111	PVC Pipes & Fittings	Ori-Plast / Supreme / Prince / Finolex / Kisan Mouldings Ltd.
112	UPVC / CPVC / RWP Pipes	Ori-Plast / Supreme / Prince / Finolex
113	UPVC Casing for Bore Wells	Kisan Mouldings Limited Skipper / Finolex / Supreme
114	UPVC / PPR / HDPE Pipes and Fittings	Kisan Mouldings Limited / Jain Irrigation Sustem / Finolex
115	PVC SWR Pipes	Kisan Mouldings Limited / Supreme / Prince / Reliance
116	PPR Pipes & Fittings	Savoir-Fair Manufacturing Co. Pvt Ltd / Reliance/ Finolex / Supreme/ M/s Vectus Industries Ltd M/s SHK Polymers Industries / M/s Kanha Plastics Pvt Ltd
117	Composite Pipes / ASTM / Plumbing Pipes / Submersible Pipes / Micro Irrigation Pipes / Casing Pipes / Underground Drainage Pipes / Hot & Cold Water Distribution System	Kisan Mouldings Limited / Jain Irrigation Systems Ltd / Savoir-Fair Manufacturing Co. Pvt Ltd.
118	Conduit Steel ERW	Tata / Jindal / Kalinga / BEC
119	Conduit PVC pipe	Presto Plast / Finolex / Indo American Electricals Ltd / Kalinga Gold / Richa Cables Pvt. Ltd. / Goldmedal
120	PVC Casing Capping	Presto Plast / Finolex / Kalinga / Payal
121	Flame Proof Fittings	Bajaj / Crompton Greaves / Sudhir
122	Fluorescent Tube Light / CFL Fittings	Philips / Crompton Greaves / Havells / Surya Roshni Ltd / Bajaj / Wipro / C & S Electric Ltd
123	FTL / CFL / PLS / HPSV / HPMV / Metal Halide Fittings / Lamps [Outdoor Lighting]	Philips / Crompton Greaves / Havells / Surya Roshni Ltd / Bajaj / Wipro / C & S Electric Ltd
124	LED Light Fittings External / Internal	Philips / Havells / Wipro / GE / Bajaj / Crompton Greaves
125	Switch Fuse / Changeover Switch	L & T / Legrand / ABB / Siemens / GE / Schneider / Havells /C&S / Goldmedal
126	MCBs / RCCB / RCBO & DB for MCBs / Isolator	Legrand / L & T [Hager] / Siemens / ABB / C&S/ Schneider / GE / Havells / Goldmedal
127	MCCB / ACB	Legrand / L & T / Siemens / ABB / C & S / Schneider / GE / Havells

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
128	Switches / Switch Socket / Bell Push / Ceiling Rose / Regulator Piano Type / Buzzer / Bell	Havells / Anchor / Legrand / Schneider / Goldmedal
129	Modular Type Switches /Sockets / Regulator	Anchor [Woods] / Legrand / RR Kabel Ltd. / MK Honey Wall / Schneider / C & S Electric / Havells / Goldmedal
130	Power Transformers 33 / 11 KV	BHEL / ABB / Siemens / Andrew Yule / Alstom / Schneider / Bharat Bijlee
131	Transformers 11 KV, Distribution Type Step Down / Up <400 KVA	Voltamp /Crompton Greaves / ABB / Esennar Transformers (P) Ltd / Kanyaka Parameswari Engineering Ltd (KPEL)
132	Transformers 11 KV, Distribution Type Step Down / Up ≥400 KVA	BHEL / ABB / Siemens / Alstom / Schneider / Crompton Greaves / Bharat Bijlee / Kanyaka Parameswari Engineering Ltd (KPEL)
133	Packaged / Unified Substation	BHEL / ABB / Siemens / Andrew Yule / Schneider / Crompton Greaves
134	VCB & SF6 [11 KV & 33 KV] & Ring Main Units	BHEL / ABB / Areva T & D / Siemens / Andrew Yule / Schneider
135	Current & Potential Transformers [LT & HT]	AE / English Electric / Crompton Greaves / Areva T & D / Schneider
136	Electronic Energy Meter [Tamper Proof with Optical Port]	Siemens / L & T / Havells / HPL / Schneider
137	Electrical Instrumentation / Measuring Instruments Digital / Analog / Energy Meters / Volt Meter / Ammeter	Havells / HPL / L & T / AE / Schneider
138	Water Heater [Geyser]	Bajaj / Usha / Crompton Greaves / Jaquar / Racold
139	Energy Saver	Mega Energy Solutions / HPL / Schneider
140	Exhaust Fan / Ceiling Fan / Air Circulator / Wall Mounting Fan	Crompton Greaves / Almonard / Bajaj / Orient / Havells
141	Capacitor Bank / APFC Panel	ABB / C&S / Siemens [EPCOS] / L & T/ Schneider / M/s BCH Electric Limited
142	Thermoplastic Street Light Junction Box / DB	Hensel / Sintex / C & S

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
143	Nature Switch / Street Light Timer	Legrand / L & T / Bajaj / Schneider / BCH
144	LT Switch Board Panel [Indoor Wall Mounted Prewired]	Schneider / L & T / ABB / Havells / C & S
145	LT Control Panel / Feeder Pillar Box	L & T / Milestone / Advance / Unilec / C & S / Schneider
146	Steel Tubular Poles	Jindal Steel / National Tubing Co / Bombay Tubes & Store / Calcutta Poles & Tubes
147	Cable Joint LT & HT, Hot & Cold Shrinkable	M-Seal 3M / Denson / Raychem
148	Air Break Switches / HT Isolators / Gang Switches	Pactil / BHEL / Jaipuria Brothers
149	DSC / Pin Type Porcelain Insulators	BHEL / Jaipuria Brothers / Pactil / Southern Insulators
150	Diesel Generating Set Engines	Kirloskar Green / Cummins / Ashok Leyland / Greaves Cotton
151	Alternator	Alstom / Crompton Greaves / Kirloskar Electric / Siemens / Bharat Bijlee
152	Lightning Arrester [Station Class]	Oblum / Obo / Elpro / BHEL / Alstom / Jaipuria Brothers
153	ACSR Conductor	Indian Aluminium Ltd / Alind / Bharat Conductors
154	Single Phase Preventor / Contactors / Thermal Overload Relay	ABB / L & T / Siemens / C & S / Schneider / BCH
155	Battery Maintenance Free	Exide / AMCO / Nicco / Amaron / Tata
156	Battery Chargers	Escorp / Su-Kam / Microtek
157	Servo Control LT Voltage Stabiliser	Voltamp / APLAB / Andrew Yule / Brentford / AE / Vintec [Volina]
158	HT Voltage Stabiliser [11 KV]	Andrew Yule / Brentford / APLAB
159	Indicator Lamp / Selector Switch	L & T / Siemens / GE / RR Micro / Schneider / BCH
160	Sluice Valve / Reflux Valve / Air Release Valve / Foot Valve / Non-Return Valve / Gate Valve / Butterfly Valve	Kirloskar / Leader / Zoloto / Audco / Venus / Upadhaya

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
161	DOL / Star-Delta/Soft Starter	BCH / Siemens / L & T / ABB / Schneider / C&S /BCH
162	Submersible Cable	Finolex / Havells / RR Kabel / Polycab
163	Centrifugal Pumps	Crompton Greaves / Kirloskar / KSB / Wilo Mather & Platt Pump Pvt
164	Submersible Pumps	Crompton Greaves / Colama / KSB / Kirloskar / Wilo Mather & Platt Pump Pvt
165	Bleaching Dozer	Ion Exchange / RMCO / Avon / Aquapura / Maic India
166	Chloronome Plant / Chlorinator	Auqa / Pearl Filters / Jesco / Advance – 2000
167	PVC Overhead Tank [ISI Mark] (3 layered)	Sintex / Polywell / Polycon
168	Electric Motors	Crompton Greaves / Siemens / ABB / Kirloskar Electric / Havells
169	Monoblock Pumps/Diesel Engine driven Pumps	Crompton Greaves / Kirloskar / KSB / Wilo Mather & Platt Pump Pvt Ltd
170	Chiller Units / Compressors, Scroll / Screw Type	Blue Star / Voltas / York / Kirloskar / Carrier / Daikin / Trane
171	Condenser & Chiller Pumps	Crompton Greaves / Kirloskar / ABB
172	Cooling Towers	Paharpur / Mihir / Delta
173	Cooling Coil / AHU	Blue Star / Voltas / Zeco / Llyod
174	Filters	Blue Star / Airtech / Thermodyne
175	Balancing Valves	Leader / Audco / C & R / Advance
176	Refrigerant Controls	Sporlan / ALCO / Honeywell / Danfoss / Jhonson Control
177	Strainer	Rapid Control / Emberland / Sant
178	Insulation Crosslink Polyethylene with Adhesive	Torcellen / Paramount / Thermoflex
179	Thermometers / Pressure Gauges	Hguru / Taylor / Fiebig
180	Thermostat / Humidistat	Honeywell / Jhonson Control / Danfoss / Siemens
181	Actuators	Siemens / Rapid Control / Honeywell
182	Heaters	Daspass / Racold / Bajaj
183	Thermostatic Expansion Valve	Siemens / Honeywell / Danfoss

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
184	Grills / Diffusers / Fire Dampers	Caryaire / Mapro / Conaire
185	Split Type AC / Package Type AC / Window Type AC	Blue Star / Hitachi / Daikin / Carrier / Voltas
186	Fire Pump / Jockey Pump / Booster Pump	Crompton Greaves / Kirloskar / KSB / Wilo Mather & Platt Pump Pvt
187	Fire Hose Real	Minimax / Firex / Safex
188	Stand Post Type Hydrant	Minimax / Firex / Safex
189	RRL Hose Pipe	Dunlop / Cosmos / Jayshree
190	Sprinkler Head	Minimax / Tyco / Ceasefire / Safex
191	Pressure Switch	Siemens / Honeywell / Danfoss / Schneider / Rapid Control
192	Fire Extinguisher [All Types]	Minimax / Firex / Newage / Cease Fire
193	Single Head Landing Valves Three / Four Way Brigade Inlet Hose Reel Drum and Shut-Off Nozzle	Minimax / Safex / Superex
194	20mm dia Rubber Pipe	Jyothi / Dunlop / Minimax
195	Hooter	Safex / Honeywell / Mnimax
196	APP Modified Polymeric Membrane	Stp Limited / Sika India Pvt Ltd / Fosroc Chemicals / IWL India Pvt Ltd / Asian Paints / Torchtar Memberance & Bitumen Products / Tiki tar Danosa (I) Pvt Ltd / Shivan Tar Products
197	EOT Cranes / HOT Cranes	Tyojam / Anupam / Mukund / Jessop / WMI / Dinesh Enterprises.
198	LLDPE Septic tanks	Sintex/Suprem
199	Lift	Kone India/ Schindler India Pvt Ltd. / Kinetic Hyundai Elevator & Movement Technologies Ltd / Hitachi Lifts India Pvt Ltd / Mistubishi Elevator India Private Limited / Otis Elevator Company India Ltd / Fujitech India PVt Ltd /Thyseenkrupp Elevators India Pvt Ltd
200	Motor Actuated Butterfly Valve	Kirloskar / Emtork / Hasel / Hofener / Ritetork / Inter Valve / Weir Bdk
201	PLC PANELS	Siemens / Schneider / ABB / Rockwell
202	Solar Water System	Tata – BP Solar System / BHEL / Jain Solar / Best & Crompton Noval Energy Delhi
203	Water Meter	Capstan / Dashmesh / Kaycee / Capital / Kirloskar

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
204	High Mast Light & Pole	Bajaj / Phillips / Crompton / Crompton Greaves
205	Ammeter / Voltmeter / Frequency Meter	IMP / Automatic Electric /L&T / Havells / MECO
206	Precast Cable Covers	Mehtab / Lucky Cement Blocks/ Sukhi Enterprises
207	Hydraulic Door Closer	Everite / Universal / Prabhat Door King / Perfect Hydraulic / Dyana
208	Mortice Locks	Harrison / Godrej & Boyce Co Ltd / KICH / RP Lock Co
209	Steel Rolling Shutters / Collapsible	Shree Lakshmi Engg Works / M/s Prakash & Co. / M/s Senthil Rolling Shutters / M/s Swastik Rolling Shutters / M/s Jayaraj Industries
210	Indicating Lamps	L&T / Siemens / AE / Bhartia Industries
211	Refrigerator / Water Cooler / Deep freezer	Blue Star / Hitachi / Voltas
212	Aviation Obstruction light	Havells / Bajaj / CG/ Phillips
213	UPS	Tata – Liebert / Aplab / Luminous / Sukam
214	Type tested panels	Schneider / ABB/ Siemens / BCH / C&S
215	Cable Tray	Legrand/Sumip/C&S/Hind Runway System/Patny System / Obo
216	Track & Curtain System	Vista Levolor / MAC / Aerolux /
217	Water Proofing Compound	Pidilite Industries Ltd Taloja / FOSROC / Dr Fixit / Asianpaints
218	PA rack for Amplifiers	Walrack / Ritta / Ahuja
219	Filters	Blue Star / Airtech / Thermodyne
220	Chloronome Plant / Chlorinator	Auqa / Pearl Filters / Jesco / Advance – 2000
221	Bleaching Dozer	Ion Exchange / RMCO / Avon / Aquapura / Maic India
222	UPVC / PPR / HDPE Pipe for Sewage	Jain Irrigation / Kisan / Prince / Supreme / Oriplast / Finolex / Diplast
223	RCC Pipes [NP2/NP3]	Any ISI Marked
224	Road Furniture	3M / Dark Eye / Apolo
225	Wooden flooring	Vista / Pergo / Haro
226	Glazed Mosaic Tiles	Hindustan Tiles / Johnson / Ultra Tiles Pvt Ltd / National Tiles & Industries / Coral / Ceco

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
227	Metallic Floor Hardener for Wear Proof Topping	Ironite / Stillonite / Hardonate
228	Non-Metallic Floor Hardener for Wear Proof Topping	Fosroc / Fibrex / Sika / BASF
229	Epoxy Resin / Polyurethane Based Floor Coating / Synthic floor / Rubber floor	Sika / Fosroc / BASF / Pidilite Industries
230	Tile Adhesive	Pidilite Industries Ltd / Somany Ceramics Limited / Kajaria / Latecrete
231	Admixtures	Sika / Fosroc / BASF / Pidilite Industries / Asianpaints
232	Wall Panel Backed for OT	TATA/SAIL/ Jindal Steel
233	Pendent	AKTIV/JK ENGINEERS/GM MEDICAL
234	Sliding Doors	Metaflex, Ownic, Mediline
235	Medical Gas pipeline	Copper Pipe- Max-flow/ Rajko/ Metalco/MANDEV Copper Fittings- Conex Banninger (IBP Conex)/ Muller/ Yorkshire/Mehta tube
236	Filling of all jonts and cavities with epoxy filler	SKK /Berger/Asian paints (Royale health shield)
237	Pressure Relief Damper	GM MEDICAL/ JK ENGINEERS/TROX
238	Operation Theatre Control Panel	AKTIV/JK/MPS
239	3 Bay Scrub station / Dirty hatch box / X- Ray viewing screen	ALCON MEDITECH/JK/MPS
240	Laminar Planair Ceiling	JK/MPS/AKTIV TECHNOLOGIES
241	OT CEILING LIGHT	Simeon/ Dragger/ Maquet/STERIS
242	OT Electrical wiring	Finolex / Havells / Skytone
243	MEDICAL GAS PIPELINE SYSTEM	Oxicare engineers / Global mediLife solution / Hi- tech med gas solutions / Aktiv / Sreekrishna / WTK /
244	IP CCTV Cameras / PTZ Keyboard	SONY / BOSCH /AXIS / TYCO/ PELCO/ PANASONIC
245	Work Station / NVR Server	SONY / BOSCH /AXIS / TYCO/ PELCO / PANASONIC/HP/DELL
246	CCTV Storage HDD	Dell / IBM / HP / NetApp/ EMC/ AXIS
247	LED Monitor	Panasonic / Samsung / Sony / LG/HP/Dell

PARTICULAR SPECIFICATIONS [Contd...]

Ser No.	Materials	Make/Name Of Firms
248	PTZ Digital Joystick	Sony / Bosch /Tyco / Pelco/ AXIS
249	Network, POE Switches	Cisco / Allied Telesis / HP / Huawei / Juniper
250	VMS (Video Management Software)	Nice / Milestone / Genetec
251	Racks	President / Rittal / Valrack
252	CAT 6 Cable & Accessories	Schneider Electric-Digilink / CommScopeSystimax / Panduit-Pannet/ Legrand
253	OFC cable and Accessories	Belden / D Link / Tyco/ Molex/Siemon/Systemacs
254	DWC Pipe	REX / Duraline/Tirupati
255	MDF	Krone/Delton/Poweride
256	EPBAX System	Cisco/Avaya/Tadiran
257	Telephone Handsets	Siemens/Panasonic/GE
258	All other items	ISI Marked as approved by GE

Signature of contractor
Date:

(T Venkata Ratnam)
DD (Contracts)
for Accepting Officer

41. **MATERIALS AND TESTS:**

41.1. 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.

41.2. The materials listed hereinafter shall be tested as per the frequency indicated therein.

41.3 Level of testing shown in legend as A, B & C are defined as under:

41.4. **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.

[d] 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.

[e] 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.

41.5. **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

41.6. **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.

41.7. 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.

41.8. 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.

41.9. 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".

41.10. **LIST OF SUGGESTED ESSENTIAL EQUIPMENT:**

Ser No	Name of Equipment
1	Cube Mould [150 +/ – 0.2mm] – 12 Nos
2	Tamping Bar [16mm dia, 600 mm long]
3	Balance 12 Kg [LC 1 gm]
4	Balance 220 gm [LC 0.001 gm] digital
5	Weights
6	Compression Testing machines with three gauge [capacity 2000KN]
7	Slump Test Apparatus
8	Standard Test Sieve [80 to 4.75mm] Square hole, perforated plate
9	Standard Test Sieve [3.35mm to 75 micron] fine mesh, wire cloth.
10	Soft brush & Camel hair brush
11	Lid & Pan
12	Hot air oven [Thermostatically controlled]

PARTICULAR SPECIFICATIONS [Contd…]

13	Thickness Gauge
14	Measuring Cylinders [graduated]
15	Steel Tape [LC 1 mm], Steel scale [Lc.5 mm]
16	Plywood sheet [2 No.] 3mm thick
17	Dish [180mm, 180mm, 40mm] of glass or porcelain of glazed stoneware
18	Distilled water
19	Moulds for casting concrete beams for testing flexural strength.
20	Relevant IS Codes
21	Concrete Hammer
22	Hand Penetro Meter
23	Vicat Apparatus
24	Vernier Caliper
25	Micrometer
26	Indian Standard Sand
27	Cube Moulds For Cement Testing
28	Stop Watch
29	Cement Cube Vibrator
30	Thermometer up to 300^{0}C
31	Sieve Shaker for Coarse Aggregate Test Sieve
32	Sieve Shaker for Fine Aggregate Test Sieve
33	Thermometer for Hot Bitumen
34	Thermometer for Recording Day Temp
35	Humidity Recorder Meter
36	Timber Moisture Content Meter.
37	Field Procter Density Test Equipment
38	Cement Testing Machine for Initial / Final Setting / Consistency.
39	Working Platform.

PARTICULAR SPECIFICATIONS [Contd...]

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.

Ser No	Materials	Test	Method of Testing	Frequency of Tests			Level of Test	Rate per Test	Remarks
1.	Brick	Compressive Strength	IS – 3495 [Part – II]	As per IS – 5454 as given under:			A	180.00	Checks for visual and Dimensional characteristics shall also be carried out as per IS - 5454
		Water Absorption	IS – 3495 [Part – II]	Lot Size	Sample Size	Permissible Nos of defective bricks	A	150.00	
				1001 to 10000	5	0			
		Efflorescence	IS – 3495 [Part – I]	10001 to 35000	10	0	A	180.00	
				35001 to 50000	15	1			
2.	Coarse Aggregate	Sieve Analysis	IS – 2386 [Part – I]	One test for every 15 Cu.m of aggregates or part thereof brought to site.			A	120.00	
		Flakiness Index	IS – 2386 [Part – I]	One test for every 15 Cu.m of aggregates or part thereof brought to site.			A	90.00	
		Estimation of Deleterious Materials	IS – 2386 [Part – I]	One test for every 100 Cu.m of aggregate or part thereof			A	120.00	
		Organic Impurities	IS – 2386 [Part – I]	One test per source of supply			C	120.00	

PARTICULAR SPECIFICATIONS [Contd…]

		Moisture Content	IS – 2386 [Part – II]	Regularly as Required	A	120.00	
		Specific Gravity	IS – 2386 [Part – II]	One test for each source of supply	B	120.00	
3.	Fine Aggregate	Sieve Analysis	IS – 2386 [Part – I]	One test for every 15 cum of FA or part thereof when brought to site	A	180.00	
		Test For Clay, Silt and Impurities	IS – 2386 [Part – I]	One test for every 15 cum of FA or part thereof when brought to site	A	90.00	
		Specific Gravity	IS – 2386 [Part – II]	One for each source of supply	B	180.00	
		Test For Organic Impurities	IS – 2386 [Part – II]	One test for each source of supply	C	180.00	
		Moisture Content	IS – 2386 [Part – II]	Regularly as required subject to 2 tests/ per day when being used.	A	180.00	
4.	Cement	Setting Time	IS – 4031 – 63 Reaffirmed 1980	Once for each consignment or as and when Required	B	180.00	
		Soundness	IS – 4031 – 63 Reaffirmed 1980	Once for each consignment or as and when Required	B	120.00	
		Compressive Strength	IS – 4031 – 63 Reaffirmed 1980	Once for each consignment or as and when Required	B	360.00	
		Fineness	IS – 4031 – 63 Reaffirmed 1980	Once for each consignment or as and when Required.	B	120.00	
5.	Structural Concrete [M – 15 Grade & above]	Slump Test Or Compacting Factor Test Or Vee–Bee Time	IS – 1119	The Min frequency of sampling of concrete of each grade shall be as under:	A	180.00	Random sample shall be carried out to cover mixing units. As per IS –
		Compressive Strength	IS – 516	Quantity of Concrete in the work / No of samples	A	120.00	

PARTICULAR SPECIFICATIONS [Contd…]

				[Cu.m]				456 – 2000 Clause. 14 for frequency of sampling.
				1 – 5	1			
				6 – 15	2			
				16 – 30	3			
				31 – 50	4			
				51 and above	4+1 for each Additional 50 Cu.m or part thereof			
6.	Cement Flooring Tiles / Terrazzo Tiles	Water Absorption	IS – 1237 [Appendix "D"]	6 Tiles out of 18		B	180.00	Samples: 18 Tiles from each source of supply selected at Random.
		Wet Transverse Strength	IS – 1237 [Appendix "E"]	6 Tiles out of 18		B	144.00	
		Resistance To Wear	IS – 1237 [Appendix "F"]	6 Tiles out of 18		C	540.00	
7.	Timber	Specific Gravity& Weight	IS – 1708 – 1960	Minimum 3 samples from a lot of 4 Cum or 250 pieces of seasoned timber		B	120.00	
		Moisture Content	IS – 1708 – 1960			A	120.00	
8.	Water For Construction Purpose	Test For Acidity	IS – 456 & IS – 3015	Once at the stage of approval of source of water		B	240.00	Also refer clause 4.3 of IS – 456 and its subsequent sub clauses regarding suitability of water
		Test For Alkalinity	IS – 456 & IS – 3015			B	240.00	
		Test For Solid Content	IS – 456 & IS – 3015			C	300.00	

PARTICULAR SPECIFICATIONS [Contd…]

MATERIAL TESTS AND THEIR RECOVERY RATES OF TESTING CHARGES [Continued]

<table>
<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>
<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 rowspan="10">10.</td><td rowspan="10">Timber Panelled & Glazed Door/ Window Shutters [Including Factory Made Shutter]</td><td rowspan="2">Dimensions, Sizes Workmanship & Finish</td><td rowspan="2">IS – 1003
[Part – I]</td><td>Frequency of sampling from each lot shall be as under:
Lot size | Sample Size
26 to 50 | 5
51 to 100 | 8
101 to 150 | 13
151 to 300 | 20
301 to 500 | 32
501 to 1000 | 50
1001 and above | 80</td><td rowspan="2">A</td><td rowspan="2">180.00</td><td rowspan="10"></td></tr>
<tr><td>Strength Test</td><td rowspan="4">IS – 1003
[Part – I]</td><td rowspan="4">From each lot 5% of the factory made shutter shall be Manufacture tested for strength tests.</td></tr>
<tr><td>Slamming</td></tr>
<tr><td>Impact Indentation</td></tr>
<tr><td>Shock Resistance</td></tr>
<tr><td>Edge Loading</td></tr>
</table>

PARTICULAR SPECIFICATIONS [Contd…]

11.	Ply Wood [IS–303]	Moisture Content	IS – 1734 – 1983 [Part – I]	Six test pieces cut from each of the boards selected as per table – I shall be subjected to tests.	C	240.00	Sampling shall be as per IS – 7835 Table – 2
12.	Veneered Wood Particle Board [Medium Density] IS – 3097	Density	IS – 635 [Part – I]	Three test specimen from each sample [Size 150mm x 75mm]	A	60.00	Sampling shall be done as per IS – 3487 Clause 2 with moisture meter.
		Moisture Content	IS – 2360 [Part – 3]	Three test specimen from each sample [Size 150mm x 75mm]	A & B	60.00	
		Water Absorption	IS – 2360 [Part – 16]	Three test specimen from each sample [Size 300mm x 300mm]	A	60.00	
		Swelling Due To Surface Absorption	IS – 2360 [Part – 17]	Three test specimen from each sample [Size 125mm x 100mm]	A	60.00	
		Swelling In Water	IS – 2360 [Part – 17]	Three test specimen from each sample [Size 200mm x 100mm]	A	60.00	
		Modules Of Rupture	IS – 2360 [Part – IV]	Three test specimens as per IS – 2380– 1977	B	90.00	
		Screw Withdrawal Strength	IS – 2360 [Part – IV]	Three test specimens as per IS – 2385	C	120.00	
13	PCC Hollow Blocks for Walling	Compressive Strength	IS – 2156 [Appendix "B"]	8 Blocks out of 14	A	60.00	Sample: 14 blocks from consignment of every 5000 blocks or part thereof.
		Water Absorption	IS – 2156 [Appendix "E"]	3 Blocks out of 14	B	120.00	
		Density	IS – 2156 [Appendix "A"]	3 Blocks out of 14	B	90.00	
	PCC Solid Block for Walling	Comprehensive Strength	IS – 2185	12 Blocks out of 18	A	60.00	Sample: 18 blocks from consignment of every 1000 blocks or part thereof. These blocks to be checked for dimension
		Water Absorption	IS – 2185	3 Blocks out of 18	B	120.00	
		Density	IS – 2185	3 Blocks out of 18	B	120.00	

PARTICULAR SPECIFICATIONS [Contd…]

							and weight
14	Ceramic Tiles / Glazed Tiles	Water Absorption Test	–	6 Tiles out of 18	B	180.00	Samples: 18 tiles from each source of supply selected at random
15	Burnt Clay Roofing Tiles [Hand Made] As per IS – 2690 Part – II Length 150 to 250 mm, width 100 to 200 mm and thickness 35 to 50 mm	Water Absorption	IS – 3495 [Part – II]	6 Tiles out of 12	B	216.00	Sample: 12 tiles from each source of supply selected at random.
		Compressive Strength	IS – 3495 [Part – I]		A	180.00	
16	Mangalore Pattern roofing tiles	Water Absorption	IS – 654 Appendix "A"	6 Tiles out of 32	B	180.00	Sample: 32tiles from each consignment of 3000 tils or part thereof. These tiles shall be checked for dimensions and weight.
		Breaking Load	IS – 654 Appendix "C"		B	120.00	

Signature of contractor
Date:

(T Venkata Ratnam)
AAD (Contracts)
for Accepting Officer

PARTICULAR SPECIFICATIONS [Contd...]

42. **DIFFERENT STAGES OF YARDSTICK FOR GUIDANCE:**

Stage	Description Of Works To Be Covered
I	Earth Work & Excavation In Foundations Including Rfr, Removal Of Surplus Soil, Pcc [1:4:8] Under Foundation, Att Works, Rcc In Plinth Beams Including Reinforcement, Form Work, Rcc Columns Upto Ffl, Reinforcement Upto Ffl [For Cols] And Earth Filling Under Floors Etc All Upto FFL [Except Sub Base & Flooring]
II	Rcc Works As In Columns, Including Formwork, Reinforcement Upto Slab/Tie Beam Level
III	Brick Masonry Work Including Half Brick Walls, Pcc Cills Etc.
IV	Rcc M40 For Lintels, Chajjas, Drops, Fins, Facias, Gutter Walls, Including Reinforcement Form Work Etc.
V	Rcc M40 For Rcc Beams, Slabs Including Reinforcement Formwork Etc.
VI	All Joinery Works Like Wooden Door / Window / Ventilators Chowkats, Panelled Door Shutters, Window / Ventilators Shutters Including Hardware Items And Steel Rolling Shutters, Ms Grills, Glazing,
VII	Internal Plastering.
VIII	External Plastering.
IX	Water Proofing Treatment To Chajja, Roof Slab Including All Layer Over Rcc Roof Slab
X	Sub Base, PCC Flooring & Other Type Flooring, Including Skirting, Dado, Separately].
XI	Plumbing/Sanitary Fittings, PVC Soil/Rainwater/Waste Pipes, Bends Etc. Pvc Water Tank
XII	Internal Surface Finishes / White Wash In Walls, Ceiling, OBD To Walls, Synthetic Enamel Paint On Wooden And Steel Surface Etc.
XII	Cement Based Paint.
XIV	Misc. Items/Special Items Like False Ceiling, Hard Core For Plinth Protection And PCC [1:3:6] For Plinth Protection And Other Items Not Covered Above.
XV	Site Clearance.

PARTICULAR SPECIFICATIONS [Contd…]

Annexure – "A"

CEMENT SUPPLY & ACCEPTANCE REGISTER

1. C. A. No. & Name of Work :
2. Control No. :
3. Name of Manufacturer/Brand Name/Grade of Cement :
   - [A] Manufacture :
   - [B] Brand :
   - [C] Grade :
4. Quantity of cement & Lot No. / Week No. [In Bags] :
   - [a] Quantity :
   - [b] Lot No./Week No. :
5. Manufacturer's test certificates No. :
6. Random test Details**:**
   - [a] Physical test report from_____ vide their letter No. :
   - [b] Chemical test report form_____ vide their letter No. :
7. Details of Physical & Chemical properties : Refer **Annexure "B"**

Annexure – "B"

	Physical Requirements [As per IS – 4031]										Chemical Requirements [As per IS – 4032]							
	[Sq.m/Gram]	Soundness by Le Chatlier Expansion [%]	Soundness by Auto Clave Expansion	Initial setting time [Minutes]	Final setting time [Minutes]	Compressive Strength 03 Days [Mpa]	Compressive Strength 07 Days [Mpa]	Compressive Strength 28 Days [Mpa]	Temp during testing 0C	Standard Consistency [%]	Lime Saturation Factor [Ratio]	Alumina Iron Ratio [Ratio]	Insoluble Residue [%]	Sulphuric Anhydride [%]	Loss on ignition [%]	Alkalis [%]	Chlorides [%]	Magnesium [%]
As per Relevant IS																		
As per manufacturer's test certificate																		

PARTICULAR SPECIFICATIONS [Contd...]

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 :

Annexure – "C"

IN/OUT CEMENT REGISTER

Ser No	Date	Cement IN		Cement OUT			Quantity Balance [in bags]	Signature		Remarks
		Quantity [in bags]	Control No	Quantity [in bags]	Reasons*	Age of Cement		Contractor	AGE / GE	
[a]	[b]	[c]	[d]	[e]	[f]	[g]	[h]	[j]	[k]	[l]

* **Note:** The following reasons may be mentioned for taking out cement from store:

For testing purpose **:**

For use in work **:**

Rejected cement taken out of site **:**

PARTICULAR SPECIFICATIONS [Contd...]

Annexure – "D"

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 :

Serial No.	Nomenclature and size of steel	IS Reference	Quantity [Tons]		Physical properties					Remarks
					UTS [N/Sq.mm]		Elongation [%]		Bend Test	
			Actual	Conversion	IS Test Sheet	Random Test*	IS Test Sheet	Random Test*		
1	2	3	4	5	6	7	8	9	10	11

* 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 [Contd…]

Annexure – "E"

TEST CERTIFICATE

No. of Test :

Name of Articles[s] :

Samples submitted by :

Reference to the letter No / Date :

Test No.

Serial No	Sample [s]	Carbon [C%]	Sulphur [S%]	Phosphores [P%]	Manganèse [Mn%]	Silicon [Si%]	Chromium [Cr%]	Nickel [Ni%]	Copper [Cu%]	Tin [Sn%]	Lead [Pb%]	Ferrous [Fe%]	Zinc [Za%]	Aluminium [Al%]	Impurities %	Wt of Za	UTS	% Elongation	Proof Stress MPa

Remarks with signature :

Junior Engineer [Civil] :

Engineer – in – Charge :

Contractor :

Accepted/Rejected :

Garrison Engineer :

Remarks of BOO / Inspecting Officer / CE Zone :

PARTICULAR SPECIFICATIONS [Contd...]

Annexure – "F"

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:

Chemical tests on metal [Percentage by Weight]								
Ferrous	C	S	P	Mn	Si	Ni	Cu	Mo
Non Ferrous	Sn	Pb	Cu	Fe	Zn	Others		

Serial No.	Weight / Metre	Weight / Metric	Mechanical / Physical Tests		Elongation	Bend Test	Re-Bend Test	Miscellaneous	Remarks
			Yield / Proof Stress [N/Sq.mm]	Tensile Strength [N/Sq.mm]					

Remarks with signature :

Junior Engineer [Civil] :

Engineer – in – Charge :

Contractor :

Accepted/Rejected :

Garrison Engineer :

Remarks of BOO / Inspecting Officer / CE Zone :

PARTICULAR SPECIFICATIONS [Contd...]

Annexure – "G"

IN / OUT STEEL REGISTER

Ser. No.	Date	Steel IN			Steel OUT			Quantity Balance
		Quantity [Tons]	Section	Control No.	Quantity [Tons]	Section	Reasons*	

***Note:** The following reasons may be mentioned for taking out Steel from storage:

[a] For testing purpose

[b] For use in work

[c] Rejected Steel taken out of site

Annexure – "H"

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 :

Ser. No	Item	Source as per CA	Contractor's plan of sourcing	Refer to testing clause	Agency for testing	Responsibility
1	**2**	**3**	**4**	**5**	**6**	**7**

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 :

PARTICULAR SPECIFICATIONS [Contd…]

17. Certificate that contractor shall maintain a log of all materials received at site as per the following format:

Ser No.	Date	Materials	Quantity Received	Source	Whether as per approved sample or not	Tests carried out by supplier	Tests to be carried out before incorporation
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

18. General remarks by contractor of his plan of action to ensure that quality.

Date: [Signature of Contractor]

PART – II

[To be completed by GE before forwarding for approval by CWE]

1	Verification of Serial No. 2 to 8 of Part – I	:	
2	Verification of Serial No. 9 to 18 of Part – I	:	
3	Confirmation that stage Passing Register laying down the stages and authority responsible for approving the same has been prepared, shown to contractor and kept at site.	:	
4	Confirmation that all sites as require by contract has been handed over to contractor on the date fixed in Work Order No 1	:	
5	Confirmation that arrangements for Government liability in supply of water and electricity have been made and no hold up on this account is expected.	:	

Date: Signature of GE Approved by CWE

LIST OF DRAWINGS

S.NO	DESCRIPTION	DRAWING NO.	SHT.NO	DATE OF ISSUE	DATE OF AMENDMENT
1	LIST OF DRAWING	EPIL/WP07/PCT/STR/010	1/15	27-08-2024	
2	GENERAL NOTES	EPIL/WP07/PCT/STR/010	2/15	27-08-2024	
3	TYPICAL DETAILS OF BEAM ID	EPIL/WP07/PCT/STR/010	3/15	27-08-2024	
4	FOOTING LAYOUT AND REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	4/15	27-08-2024	
5	COLUMN LAYOUT AND REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	5/15	27-08-2024	
6	PLINTH BEAM LAYOUT & REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	6/15	27-08-2024	
7	FIRST FLOOR BEAM & SLAB LAYOUT REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	7/15	27-08-2024	
8	SECOND FLOOR BEAM & SLAB LAYOUT REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	8/15	27-08-2024	
9	ROOF FLOOR BEAM & SLAB LAYOUT REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	9/15	27-08-2024	
10	WATER TANK BOTTOM BEAM, RADAR PLATFORM, LIFT BEAM & SLAB LAYOUT AND REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	10/15	27-08-2024	
11	RAMP, PLATFORM, STAIRCASE AND TYPICAL REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	11/15	27-08-2024	
12	TYPICAL DETAILS OF COLUMNS	EPIL/WP07/PCT/STR/010	12/15	27-08-2024	
13	TYPICAL DETAILS OF BEAMS, SLABS	EPIL/WP07/PCT/STR/010	13/15	27-08-2024	
14	WATER TANK REINFORCEMENT DETAILS	EPIL/WP07/PCT/STR/010	14/15	27-08-2024	
15	DETAILS OF RCC LINTELS & RCC CHAJJAS	EPIL/WP07/PCT/STR/010	15/15	27-08-2024	

NOTES:

SAFETY AND STRUCTURAL STABILITY CERTIFICATE

Certified that the structural designs and drawings have been perused by me keeping in view the relevant IS codes and Sound Engineering practice these structural drawings are good for construction.

For Proof Checking

Dr. S.R. SATISH KUMAR
Professor
Department of Civil Engineering
Indian Institute of Technology Madras
Chennai 600 036, INDIA

SIGNATURE OF DEPARTMENTAL OFFICER

REV NO:	DETAILS	DATE	DRAWN	CHECKED BY	APPROVED BY

CLIENT: DIRECTOR GENERAL OF NAVAL PROJECT VISHAKHAPATNAM (DGNP)

INDIAN NAVY

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

EPC CONTRACTOR:

इंजीनियरिंग प्रोजेक्ट्स (इंडिया) लि
(भारत सरकार का उद्यम)
ENGINEERING PROJECTS (INDIA) LIMITED (EPI)
(A GOVT OF INDIA ENTERPRISES)

PRINCIPAL CONSULTANT:

CENTRE FOR URBANIZATION BUILDING ENVIRONMENT [CUBE]
(An Outfit of IIT Madras & Centre of Excellence of Govt of Tamil Nadu)

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Phone No: 044-61210901, Web: cubeiitm.org
Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 1/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

DRAWING TITLE : LIST OF DRAWINGS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION
☐APPROVAL ☑CONSTRUCTION

DATE OF ISSUE 27-08-2024

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
KP	DM	NK	BM	JJ

RCC GENERAL NOTES

SL No	DESCRIPTION
1	CONTRACTOR TO CHECK AND VERIFY ALL DIMENTIONS BEFORE EXECUTION OF WORK.
2	FIGURED DIMENSIONS SHALL BE FOLLOWED.
3	ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHER WISE SPECIFIED.
4	EXECUTIVES SHALL CHECK ALL DRAWINGS BEFORE TAKING EXECUTION IN HAND.
5	ALL R.C.C SHALL BE M-40 GRADE DESIGN MIX CONCRETE CONFORMING TO IS-456:2000, WITH SEVERE EXPOSURE CONDITION FOR SUPER STRUCTURE AND WITH VERY SEVERE EXPOSURE CONDITION FOR SUB STRUCTURE.
6	ALL REINFORCEMENT BARS SHALL BE CORROSION RESISTANT STEEL OF GRADE FE 500D (TMT CRS) AS PER IS-1786.
7	THE SLUMP(WORKABILITY) OF THE CONCRETE SHALL BE MAINTAINED IN THE RANGE OF 50-100 MM FOR R.C.C WORKS. GOOD DEGREE OF SUPERVISION / QUALITY CONTROL AS PER IS CODE SHALL BE INCORPORATED IN MIX DESIGN AND TO BE MAINTAINED AT SITE AND ACCEPTANCE CRITERIA AS PER IS-456:2000 CLAUSE 16.1,16.3 SHALL BE COMPILED WITH. COVER TO VARIOUS R.C.C MEMBERS SHALL BE MAINTAINED AT SLAB -35mm, BEAM-35mm, COLUMN-40mm, FOOTING -50 mm.
8	100 MM TH PCC 1:4:8 USING 40 MM GRADED AGGREGATE SHALL BE PROVIDED BELOW THE PLINTH BEAMS /PLITH PROTECTION AS MUD MATTING.
9	LAP LENGTH SHALL BE 40 d WHEREVER PROVIDED AND LAPS SHALL BE STAGGERED . (d=dia of the bar)
10	1000 mm WIDE PLINTH PROTECTION IS PROVIDED ALL AROUND THE BUILDING. PLINTH PROTECTION SHALL BE 75MM THICK IN P.C.C 1:3:6 USING 20MM GRADED STONE AGGREGATE, OVER RAMMED EARTH AS SHOWN IN DRAWINGS.
11	WHEREVER TWO TIER REINFORCEMENT IS PROVIDED IN BEAMS, THE SPACER BARS OF THE NEXT HIGHER Ø OF THE MAIN REINFORCEMENT SHALL BE PROVIDED AT 1000mm C/C.
12	DEPTH OF THE BEAM SHALL BE INCLUDING IN SLAB THICKNESS.
13	16 MM Ø CHAIRS TO BE PROVIDED TO SUPPORT TOP REINFORCEMENT IN SLAB NEAR SUPPORTS AND IN RAFT FOOTING @1000 C/C UNLESS OTHERWISE OTHERWISE SPECIFIED.
14	DEVELOPMENT LENGTH (LD) SHALL BE 42 TIMES OF THE BAR Ø.
15	FOR BAR BENDING SCHEDULE REFER SP 34-1987.
16	INCASE OF ANY DIFFERENCE IN DIMENSION AND LEVELS BETWEEN STRUCTURAL DRAWINGS, ARCHITECTURAL DRAWINGS AND SITE CONDITIONS, CONTRACTOR SHOULD SEEK THE CLARIFICATION BEFORE PROCEEDING.
17	EXECUTIVES ARE REQUESTED TO CLOSELY MONITOR SOIL STRATA DURING EXECUTION. MAJOR VARIATIONS IF ANY SHOULD BE REPORTED / REFERRED TO DESIGN SECTION.
18	ALIGNMENT& ORIENTATION OF COLUMN TO BE CHECKED PROPERLY BEFORE EXECUTION OF WORK.
19	ENGINEER-IN-CHARGE TO ENSURE THAT CONSTRUCTION LOADS DO NOT EXCEED LIVE LOAD AND APPROPRIATE ARRANGEMENT TO BE MADE TO DISTRIBUTE CONSTRUCTION LOADS EVENLY.
20	FOUNDATION HAS BEEN DESIGNED CONSIDERING S.B.C AS PER THE SOIL REPORT. BEFORE COMMENCEMENT OF WORK, GE SHALL CROSS CHECK SOIL INVESTIGATION REPORT AND CONFORM THE SAME .
21	LOOSE SOIL IF ANY SHALL BE REMOVED BEFORE LAYING FOUNDATION.
22	NO FUTURE EXPANSON CONSIDERED FOR THE DESIGN .
23	LEVEL OF ALL BEAMS SHALL BE AS PER ARCHITECTURAL DRAWINGS
24	WIND LOAD AS PER IS CODE 875-PART 3 2015
25	ALL WALLS SHOULD BE OF BLOCK MASONRY.
26	OPEN END OF STRRUPS SHALL BE ON OPPOSITE FACES FOR ALTERNATIVE SITRRUPS WHERE d= DIA OF BAR ALL STIRRUPS HAVE 135° HOOKS 
27	THE STRUCTURE IS DESIGNED FOR VISAKHAPATNAM AREA (V_b=50 m/s) AS PER IS 875 PART-3 2015 K_1=1.08, K_2=1.05, K_3=1.36, K_4=1.3, K_d=1.0, K_a=1.0, K_c=0.9 AND P_d FINAL = 6.078 KN/m^2
28	THE DEAD LOAD IS TAKEN AS PER IS 875(PART-1), LIVE LOAD IS TAKEN AS PER CODE IS 875 (PART-2).
29	IN CASE OF ANY VARIATION BETWEEN THE PROVISIONS IN THESE STRUCTURAL DRAWINGS AND THOSE IN THE RELEVANT ARCHITECTURAL DRAWINGS W.R.T THE STRUCTURAL ARRANGEMENTS STRUCTURAL DETAILS THOSE GIVEN IN THESE STRUCTURAL DRAWINGS WILL TAKE PRECEDENCE.
30	PLASTERING IN CM 1:4 ON INSIDE /OUTSIDE SURFACE WALL SHALL BE DECIDED BY GE / ENGINEER -IN CHARGE AND AS PER PROVISION OF CA.
31	LOW LYING AREA SURROUNDING COLUMN/FOOTING/SHALL BE PROPERLY FILLED & COMPACTED WITH PROCTOR DENSITY OF 95%.
32	ALL OPENINGS WILL BE PROVIDED WITH LINTELS AS PER THE LISTED TYPICAL DRAWINGS UNLESS UNTIL BEAMS ARE SPECIALLY INDICATED AT THE SAME LOCATION . HEIGHT OF THE SOFFIT OF THE LINTELS /LINTEL BEAMS/ WILL BE INDICATED IN ARCHITECTURAL DRAWINGS IF SPECIALLY NOT SHOWN IN THESE STRUCTURAL DRAWINGS.
33	EARTHQUAKE CODE = IS 1893(PART1): 2016, R.R.F (RESPONSE REDUCTION FACTOR) =5, IF(IMPORTANCE FACTOR) =1.5, TYPE OF SOIL = TYPE I HARD SOIL , TYPE OF STRUCTURE = ALL OTHER BUILDING
34	FOR SOIL CONDITIONS AND S.B.C REFER "GEOTECHNICAL INVESTIGATION FOR CONSTRUCTION OF PORT CONTROL TOWER UNDER WP7 AT NAOB, VISAKHAPATNAM " BY GEOCONS.
35	FOR LEVELS REFER ARCHITECTURE DRAWINGS.
36	ALL ROOF BEAMS HAVE MINIMUM DEPTH SPECIFIED IN THE BEAM SCHEDULE.

NOTES:

1. ALL DIMENSIONS ARE IN "mm" UNLESS OTHERWISE SPECIFIED.
2. THIS DRAWING SHOULD BE READ WITH ALL OTHER RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWINGS.
3. THIS DRAWING IS A COPYRIGHT AND PROPERTY OF THE ARCHITECT, AND IS NOT TO BE PRODUCED, COPIED, HANDED OVER TO THIRD PARTY OR USED FOR ANY OTHER PURPOSE OTHER THAN FOR WHICH IT IS INTENDED.
4. REFER GENERAL NOTES FOR DETAILED INFORMATION.

SAFETY AND STRUCTURAL STABILITY CERTIFICATE

Certified that the structural designs and drawings have been perused by me keeping in view the relevant IS codes and Sound Engineering practice these structural drawings are good for construction.

For Proof Checking

Dr. S.R. SATISH KUMAR
Professor
Department of Civil Engineering
Indian Institute of Technology Madras
Chennai 600 036, INDIA

SIGNATURE OF DEPARTMENTAL OFFICER

REV NO	DETAILS	DATE	DRAWN	CHECKED BY	APPROVED BY
01	GENERAL NOTES FOR PILES ADDED	22-01-2024	SB	NK	JJ

CLIENT: DIRECTOR GENERAL OF NAVAL PROJECT VISHAKHAPATNAM (DGNP)

INDIAN NAVY

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

EPC CONTRACTOR:

इंजीनियरिंग प्रोजेक्ट्स (इंडिया) लि
(भारत सरकार का उद्यम)
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PRINCIPAL CONSULTANT:

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IIT Madras Research Park, Kanagam Road,
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Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 2/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

DRAWING TITLE : GENERAL NOTES

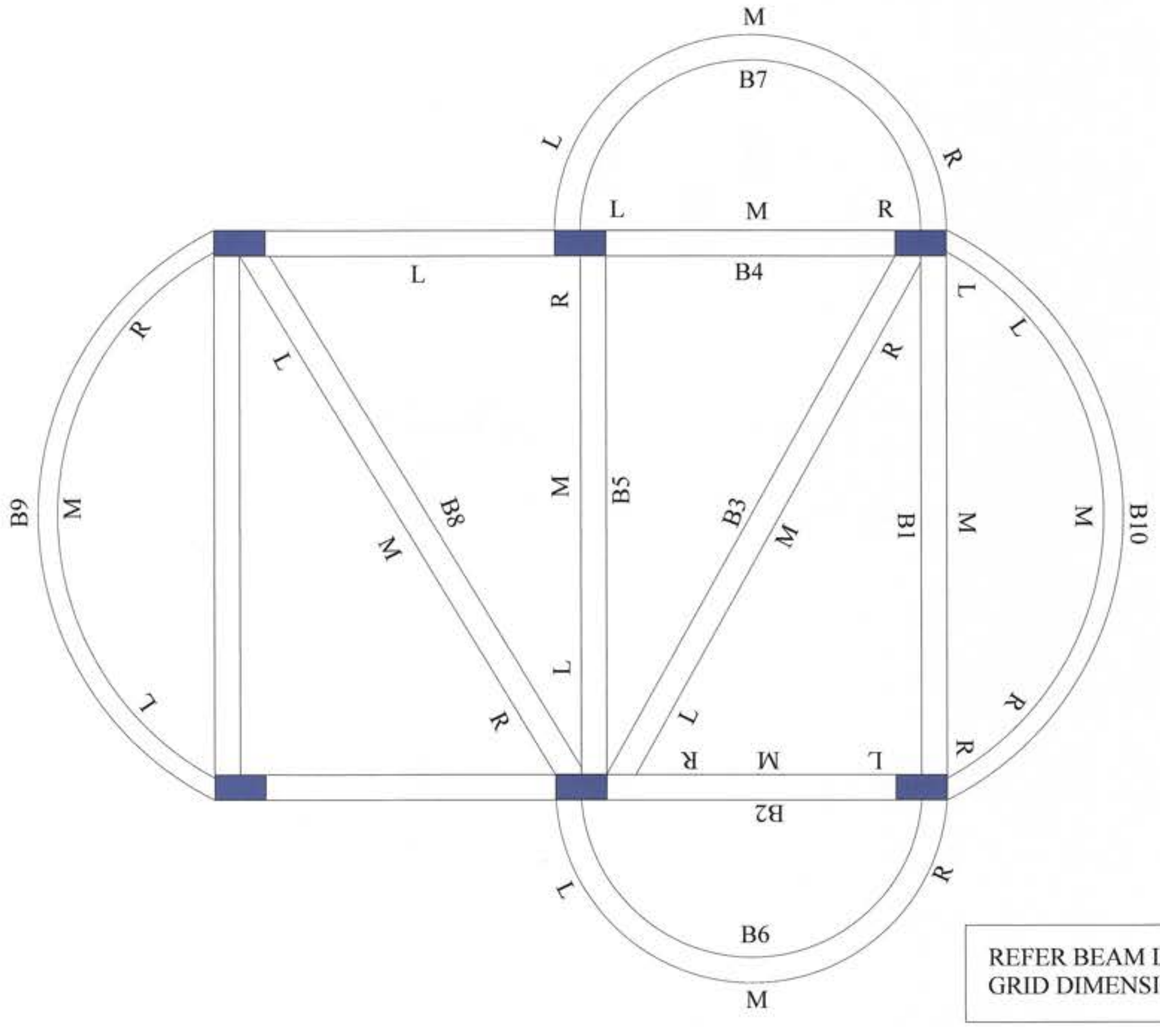
PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION
☐APPROVAL ☑CONSTRUCTION

DATE OF ISSUE 27-08-2024

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



REFER BEAM LAYOUT FOR GRID DIMENSIONS

L - LEFT SPAN
M - MID SPAN
R - RIGHT SPAN

TYPICAL DETAILS OF BEAM

N.T.S

NOTES:

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For Proof Checking

Dr. S.R. SATISH KUMAR
Professor
Department of Civil Engineering
Indian Institute of Technology Madras
Chennai - 600 036, INDIA

SIGNATURE OF DEPARTMENTAL OFFICER

REV NO.	DETAILS	DATE	DRAWN	CHECKED BY	APPROVED BY
01	TOILET DETAILS ADDED	28.06.24	SB	NK	JJ

CLIENT: DIRECTOR GENERAL OF NAVAL PROJECT VISHAKHAPATNAM (DGNP)

INDIAN NAVY

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

EPC CONTRACTOR:

इंजीनियरिंग प्रोजेक्ट्स (इंडिया) लि
(भारत सरकार का उद्यम)
ENGINEERING PROJECTS (INDIA) LIMITED (EPI)
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IIT Madras Research Park, Kanagam Road,
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Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 3/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

DRAWING TITLE : TYPICAL DETAILS OF BEAM ID

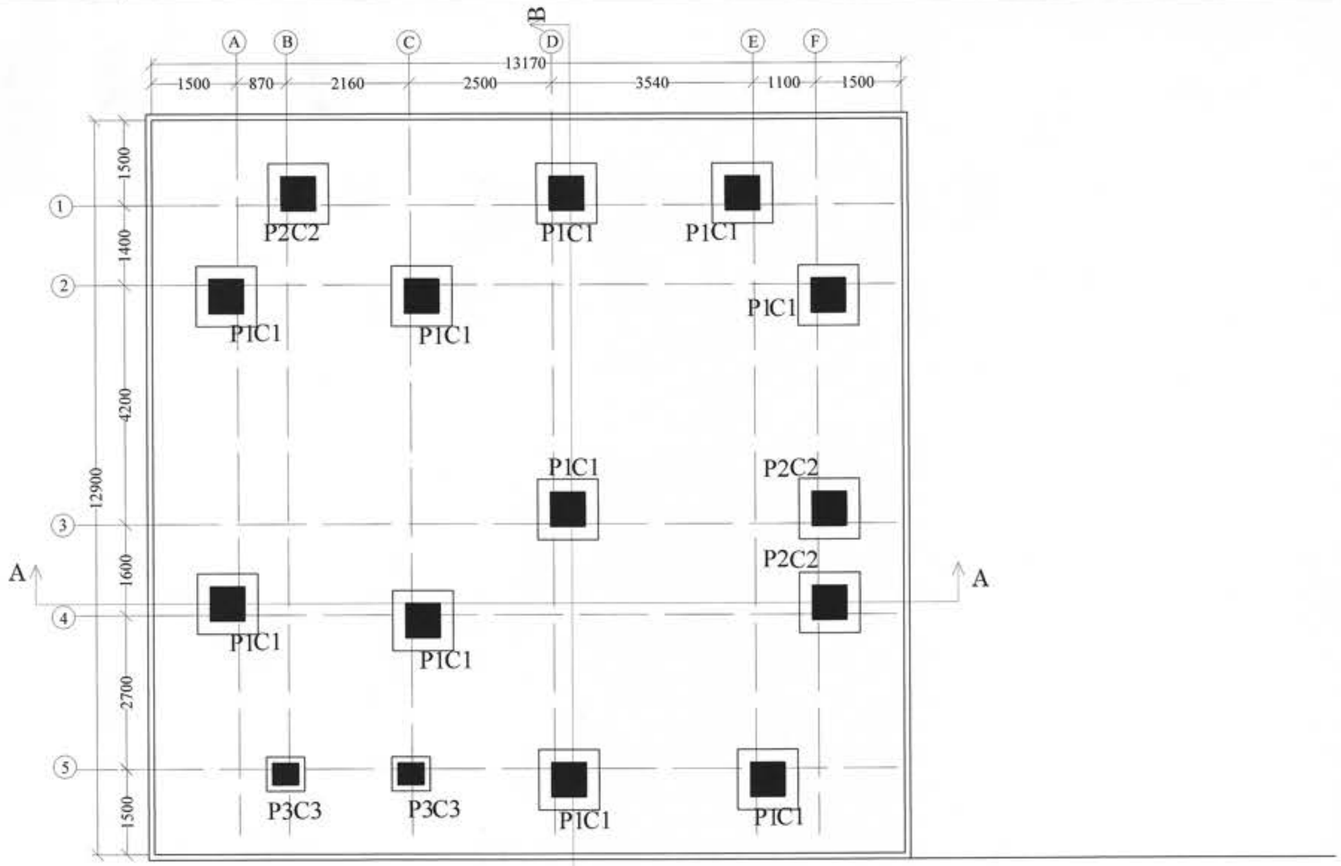
PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

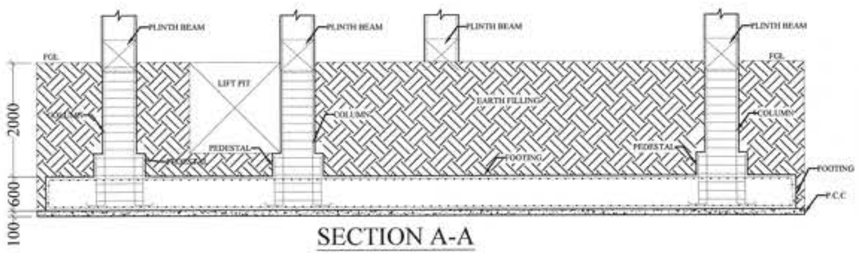
☐PRELIMINARY ☐TENDER ☐INFORMATION
☐APPROVAL ☑CONSTRUCTION

DATE OF ISSUE 27-08-2024

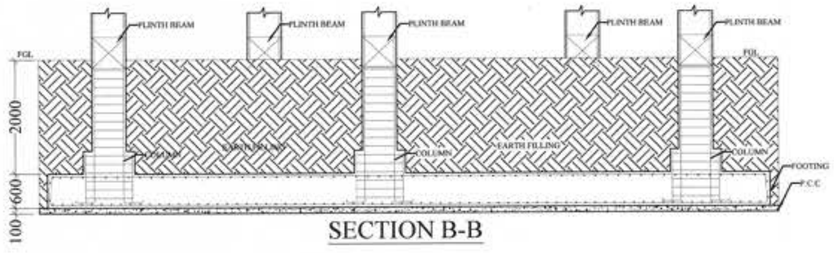
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
KP	DM	NK	BM	JJ



FOUNDATION LAYOUT



SECTION A-A



SECTION B-B

FOOTINGS REINFORCEMENT DETAILS

S.NO	LABLE	DEPTH OF FOUNDATION (D)	FOOTING SIZE	DEPTH OF FOOTING (d)	BOTTOM REINFORCEMENT		TOP REINFORCEMENT		SFR	REMARKS
					ALONG LENGTH	ALONG WIDTH	ALONG LENGTH	ALONG WIDTH		
1.	F1	2600	13170 x 12900	600	T20 @ 150 C/C	T20 @ 150 C/C	T20 @ 150 C/C	T20 @ 150 C/C	2-T16	-

NOTES:
1.ALL DIMENSIONS ARE IN "mm" UNLESS OTHERWISE SPECIFIED
2.THIS DRAWING SHOULD BE READ WITH ALL OTHER RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWINGS

4. REFER GENERAL NOTES FOR DETAILED INFORMATION.

SAFETY AND STRUCTURAL STABILITY CERTIFICATE

Certified that the structural designs and drawings have been perused by me keeping in view the relevant IS codes and Sound Engineering practice these structural drawings are good for construction.

For Proof Checking

Dr. S.R. SATISH KUMAR
Professor
Department of Civil Engineering
Indian Institute of Technology Madras
Chennai - 600 036, INDIA

SIGNATURE OF DEPARTMENTAL OFFICER

REV NO:	DETAILS	DATE	DRAWN	CHECKED BY	APPROVED BY

CLIENT: DIRECTOR GENERAL OF NAVAL PROJECT VISHAKHAPATNAM (DGNP)

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

EPC CONTRACTOR:

इंजीनियरिंग प्रोजेक्ट्स (इंडिया) लि
(भारत सरकार का उद्यम)
ENGINEERING PROJECTS (INDIA) LIMITED (EPI)
(A GOVT OF INDIA ENTERPRISES)

PRINCIPAL CONSULTANT:

CENTRE FOR URBANIZATION BUILDING ENVIRONMENT [CUBE]
(An Outfit of IIT Madras & Centre of Excellence of Govt of Tamil Nadu)

Module No.6C, 6th floor, Phase II Building,
IIT Madras Research Park, Kanagam Road,
Tharamani, Chennai, Tamil Nadu -600113.
Phone No: 044-61210901, Web: cubeiitm.org
Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 4/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

DRAWING TITLE : FOOTING LAYOUT AND REINFORCEMENT DETAILS

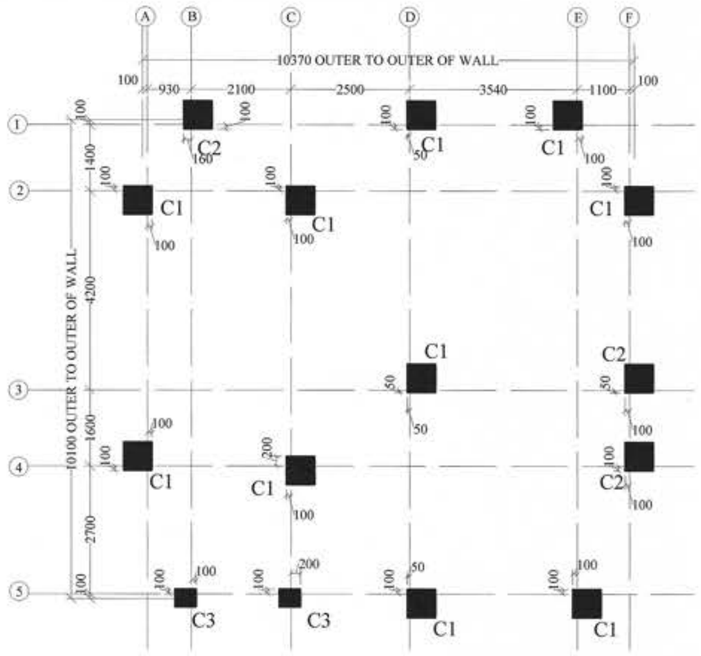
PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION
☐APPROVAL ☑CONSTRUCTION

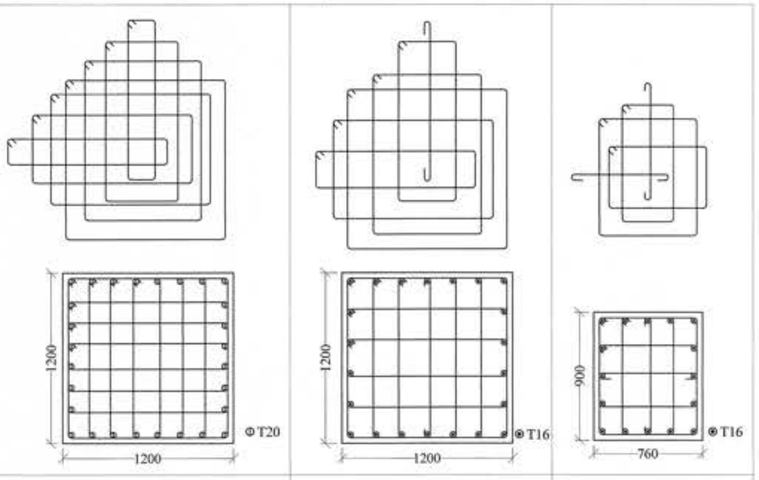
DATE OF ISSUE 27-08-2024

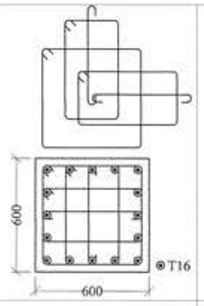
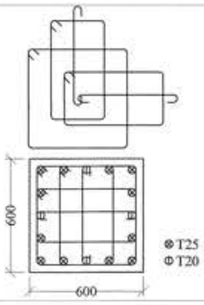
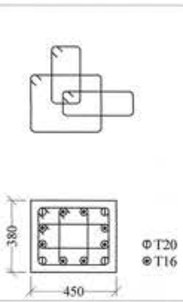
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



COLUMN LAYOUT

PEDESTAL REINFORCEMENT DETAILING LAYOUT

SECTION			
TIES	T10 @ 70 C/C	T10 @ 70 C/C	T10 @ 70 C/C
MAIN REINFORCEMENT	28-T20	22-T16	16-T16
PEDESTAL DEPTH	400	400	400
PEDESTAL SIZE (X x Y mm)	1200 x 1200	1200 x 1200	760 x 900
PEDESTAL	P1 (10)	P2 (3)	P3 (2)

SECTION			
CONFINING ZONE (AT SUPPORTS)	600mm	600mm	600mm
CONFINEMENT ZONE TIES (AT SUPPORT)	T10 @ 70 C/C	T10 @ 100 C/C	T10 @ 90 C/C
NORMAL REINF. (AT MID SPAN)	T8 @ 150 C/C	T8 @ 150 C/C	T8 @ 150 C/C
MAIN REINFORCEMENT	16-T16	12-T25 + 4-T20	4-T20+8-T16
COLUMN SIZE (X x Y mm)	600 x 600	600 x 600	380 x 450
COLUMN	C1 (10)	C2 (3)	C3 (2)

NOTES:
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EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

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Phone No: 044-61210901, Web: cubeiitm.org
Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 SHEET NO : 5/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

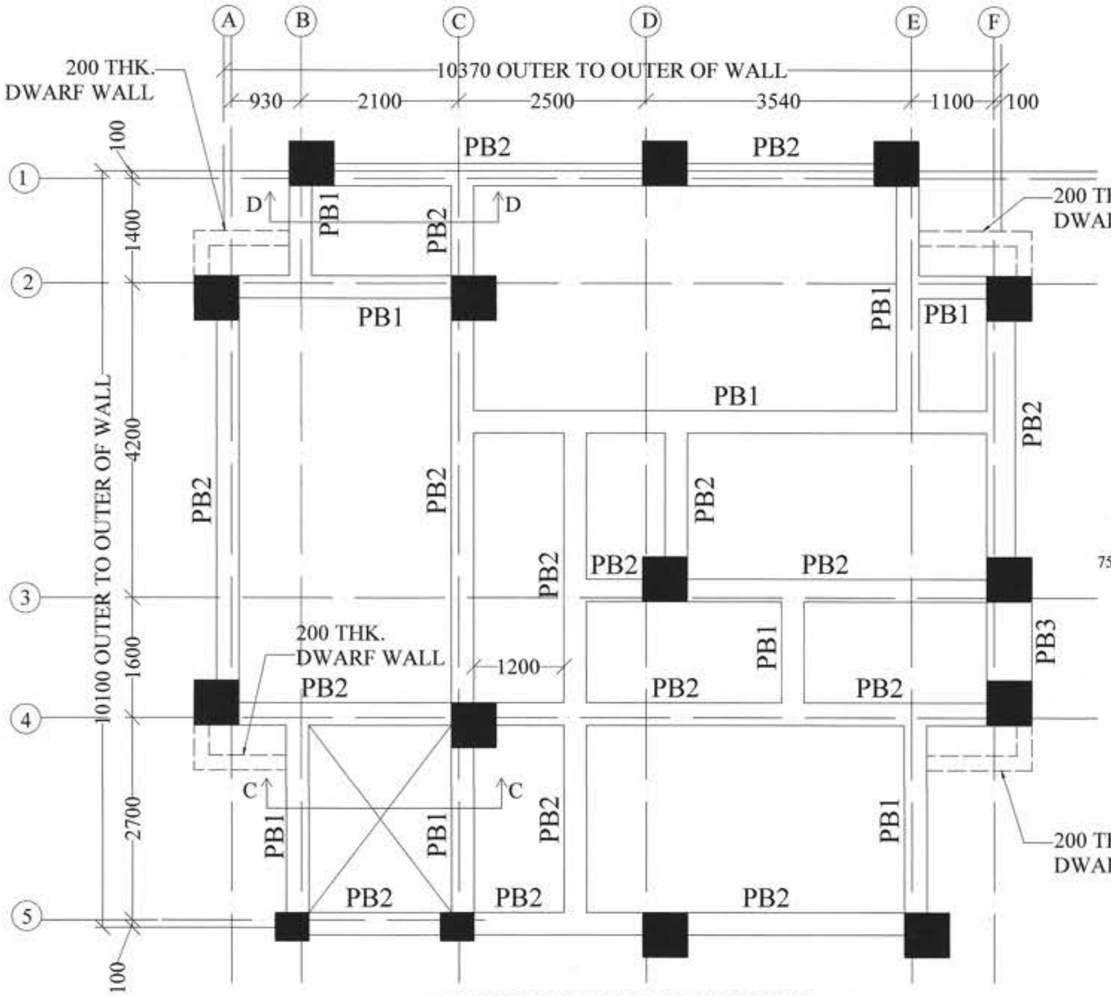
DRAWING TITLE : COLUMN LAYOUT AND REINFORCEMENT DETAILS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

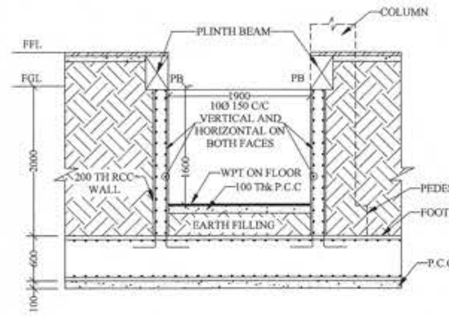
ISSUED FOR: SCALE: SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION ☐APPROVAL ☑CONSTRUCTION DATE OF ISSUE 27-08-2024

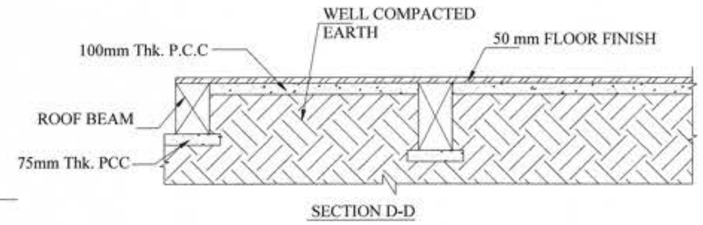
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



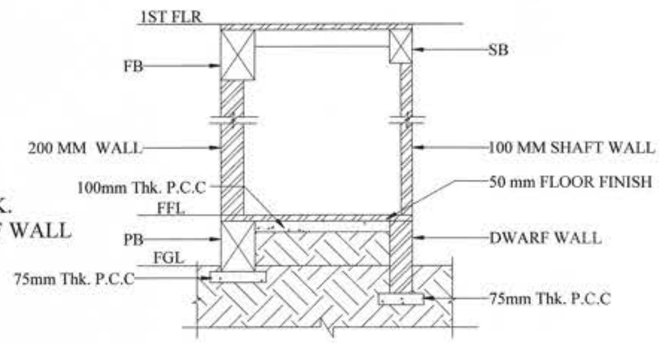
PLINTH BEAM LAYOUT



LIFT PIT DETAILS SECTION C-C



SECTION D-D



TYPICAL DWARF WALL DETAIL AT PLINTH

PLINTH BEAM REINFORCEMENT DETAILS

BEAM NUMBERS	SIZE		BOTTOM REINFORCEMENT		TOP REINFORCEMENT			SHEAR STIRRUPS		REMARKS
	B (mm)	D (mm)	STRAIGHT	EXTRA MID SPAN	STRAIGHT	EXTRA LEFT SUPP	EXTRA RIGHT SUPP	STIRRUPS @ SUPPORTS (ST1)	STIRRUPS @ MIDSPAN (ST2)	
PB1	300	450	4-T16	2-T12	3-T16	2-T16	2-T16	2L-T8@70C/C	2L-T8@100 C/C	---
PB2	300	600	4-T16	---	3-T25	---	---	2L-T10@90C/C	2L-T10@150 C/C	---
PB3	600	600	7-T20	---	4-T20	3-T20	4-T20	4L-T12@70 C/C	4L-T12@70 C/C	---

NOTES:
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SIGNATURE OF DEPARTMENTAL OFFICER

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INDIAN NAVY

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

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Phone No: 044-61210901, Web: cubeiitm.org
Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 6/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

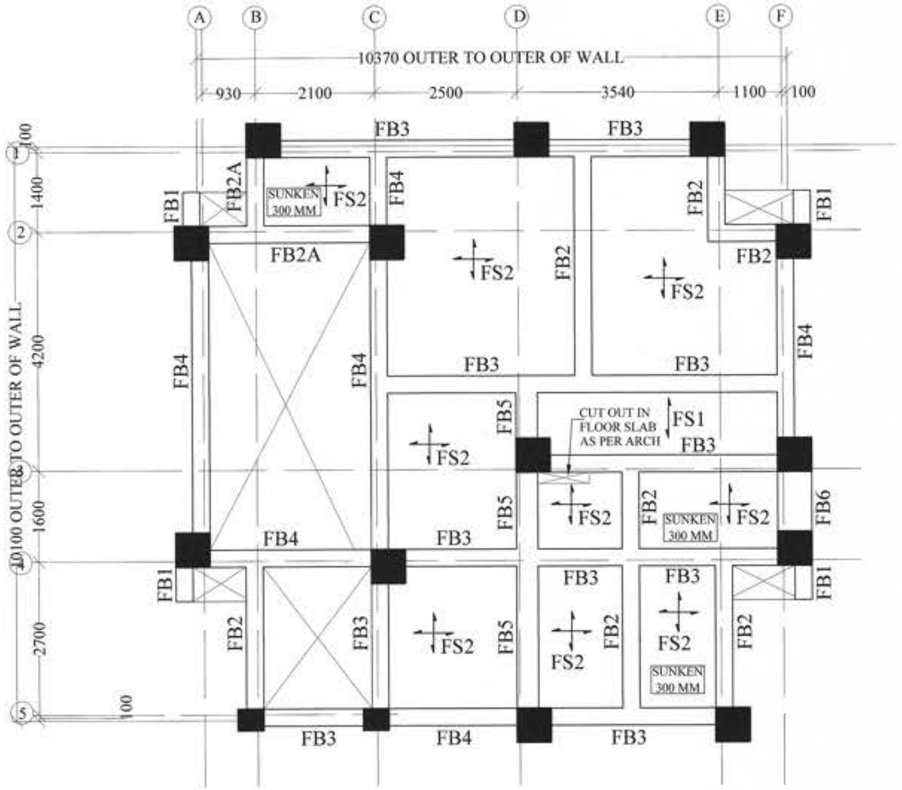
DRAWING TITLE : PLINTH BEAM LAYOUT AND REINFORCEMENT DETAILS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION
☐APPROVAL ☑CONSTRUCTION
DATE OF ISSUE 27-08-2024

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JI



FIRST FLOOR BEAM CUM SLAB LAYOUT

FIRST FLOOR BEAM REINFORCEMENT DETAILS

BEAM NUMBERS	SIZE		BOTTOM REINFORCEMENT		TOP REINFORCEMENT			SHEAR STIRRUPS		REMARKS
	B (mm)	D (mm)	STRAIGHT	EXTRA MID SPAN	STRAIGHT	EXTRA LEFT SUPP	EXTRA RIGHT SUPP	STIRRUPS @ SUPPORTS (ST1)	STIRRUPS @ MIDSPAN (ST2)	
FB1	200	300	2-T12	---	2-T12	---	---	2L-T8@100C/C	2L-T8@150 C/C	---
FB2	300	450	4-T16	---	4-T16	2-T16	2-T16	2L-T10@70C/C	2L-T10@100 C/C	---
FB2A	300	450	4-T20	---	4-T16	2-T20	2-T20	2L-T8@70C/C	2L-T8@150 C/C	---
FB3	300	600	4-T16	---	3-T25	---	---	2L-T10@70C/C	2L-T10@100 C/C	---
FB4	300	600	4-T20	---	3-T25	3-T16	3-T16	2L-T10@70C/C	2L-T10@100 C/C	---
FB5	380	600	5-T20	---	4-T25	2-T20	2-T20	2L-T12@75C/C	2L-T12@90C/C	---
FB6	600	750	5-T25	---	5-T25	---	---	4L-T10@70C/C	4L-T12@70C/C	---

FIRST FLOOR SLAB REINFORCEMENT DETAILS

SLAB NUMBERS	THK	TYPE	BOTTOM REINFORCEMENT		TOP REINFORCEMENT AT SUPPORTS		DISTRIBUTION	REMARKS
			SHORT SPAN	LONG SPAN	SHORT SPAN	LONG SPAN		
FS1	150	1-WAY	T8@150	-	T8@300	-	T8@150	-
FS2	150	2-WAY	T8@150	T8@150	T8@300	T8@300	T8@150	-

NOTES:
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SIGNATURE OF DEPARTMENTAL OFFICER

REV NO:	DETAILS	DATE	DRAWN	CHECKED BY	APPROVED BY

CLIENT: DIRECTOR GENERAL OF NAVAL PROJECT VISHAKHAPATNAM (DGNP)

INDIAN NAVY

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

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Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 SHEET NO : 7/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

DRAWING TITLE : FIRST FLOOR BEAM & SLAB LAYOUT AND REINFORCEMENT DETAILS

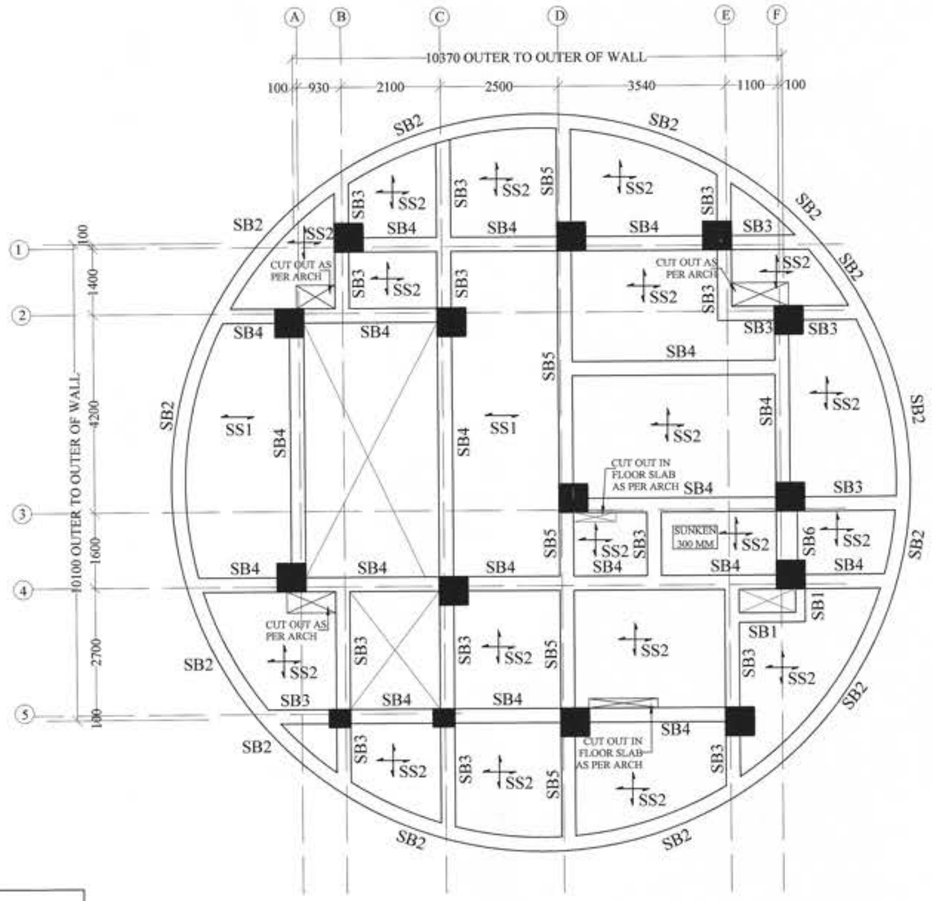
PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: SCALE: SIZE OF SHEET: A1

☐ PRELIMINARY ☐ APPROVAL ☑ TENDER CONSTRUCTION ☐ INFORMATION

DATE OF ISSUE 27-08-2024

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



NOTE:
1.SS SPIRAL STAIRCASE 800 WIDE (AS SPEC BY FABRICATION Drgs.)

SECOND FLOOR BEAM CUM SLAB LAYOUT

SECOND FLOOR BEAM REINFORCEMENT DETAILS

BEAM NUMBERS	SIZE		BOTTOM REINFORCEMENT		TOP REINFORCEMENT			SHEAR STIRRUPS		REMARKS
	B (mm)	D (mm)	STRAIGHT	EXTRA MID SPAN	STRAIGHT	EXTRA LEFT SUPP	EXTRA RIGHT SUPP	STIRRUPS @ SUPPORTS (ST1)	STIRRUPS @ MIDSPAN (ST2)	
SB1	200	300	2-T12	---	2-T16	---	---	2L-T8@60C/C	2L-T8@60C/C	---
SB2	300	300	3-T16	---	4-T16	---	---	2L-T8@60C/C	2L-T8@100C/C	---
SB3	300	450	4-T16	---	3-T25	---	---	2L-T8@75 C/C	2L-T8@75 C/C	---
SB4	300	600	4-T16	---	3-T25	---	---	2L-T8@75C/C	2L-T8@100C/C	---
SB5	300	600	4-T20	---	4-T20	2-T16	2-T16	4L-T10@75C/C	4L-T10@75C/C	---
SB6	450	600	5-T20	---	4-T25	---	---	4L-T8@100C/C	4L-T8@100C/C	---

SECOND FLOOR SLAB REINFORCEMENT DETAILS

SLAB NUMBERS	THK	TYPE	BOTTOM REINFORCEMENT		TOP REINFORCEMENT AT SUPPORTS		DISTRIBUTION	REMARKS
			SHORT SPAN	LONG SPAN	SHORT SPAN	LONG SPAN		
SS1	150	1-WAY	T8@150	-	T8@300	-	T8@150	-
SS2	150	2-WAY	T8@150	T8@150	T8@300	T8@300	T8@150	-

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SIGNATURE OF DEPARTMENTAL OFFICER

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INDIAN NAVY

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DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 8/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

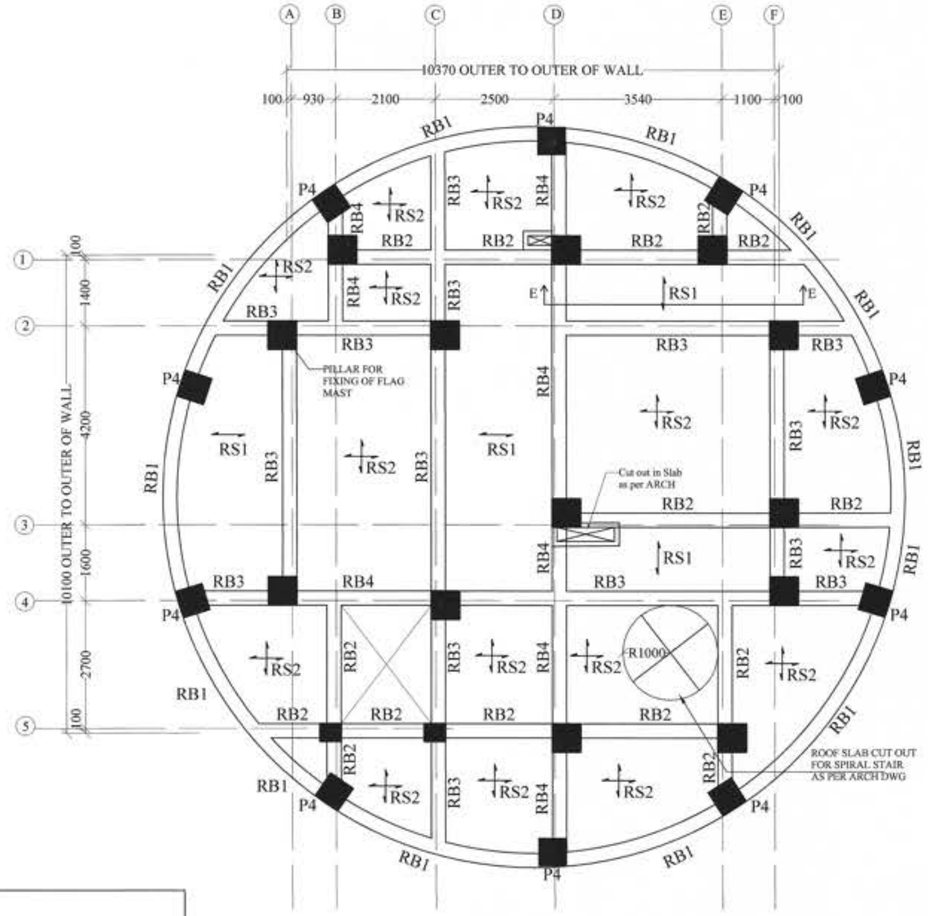
DRAWING TITLE : SECOND FLOOR BEAM & SLAB LAYOUT AND REINFORCEMENT DETAILS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

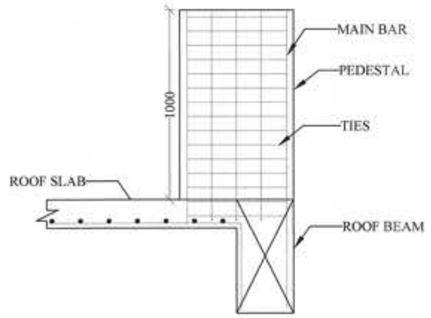
☐PRELIMINARY ☐TENDER ☐INFORMATION
☐APPROVAL ☑CONSTRUCTION
DATE OF ISSUE 27-08-2024

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



ROOF BEAM & SLAB LAYOUT

NOTE:
1.SS STAIR 900 WIDE (AS SPEC BY FABRICATION Drgs.)



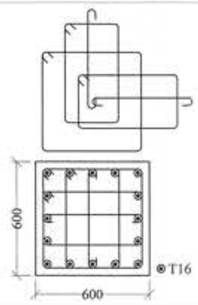
TYPICAL PEDESTAL DETAIL

FLOOR BEAM REINFORCEMENT DETAILS

BEAM NUMBERS	SIZE		BOTTOM REINFORCEMENT		TOP REINFORCEMENT			SHEAR STIRRUPS		REMARKS
	B (mm)	D (mm)	STRAIGHT	EXTRA MID SPAN	STRAIGHT	EXTRA LEFT SUPP	EXTRA RIGHT SUPP	STIRRUPS @ SUPPORTS (ST1)	STIRRUPS @ MIDSPAN (ST2)	
RB1	300	450	4-T12	---	4-T12	2-T12	2-T12	4L-T8@70C/C	4L-T8@100C/C	---
RB2	300	450	4-T12	---	3-T16	2-T12	2-T12	2L-T10@70C/C	2L-T10@125 C/C	---
RB3	300	450	4-T16	---	4-T20	2-T16	2-T16	2L-T10@70 C/C	2L-T10@125 C/C	---
RB4	300	450	4-T20	---	4-T20	2-T16	2-T16	2L-T8@70 C/C	2L-T8@70 C/C	---

ROOF FLOOR SLAB REINFORCEMENT DETAILS

SLAB NUMBERS	THK	TYPE	BOTTOM REINFORCEMENT		TOP REINFORCEMENT AT SUPPORTS		DISTRIBUTION	REMARKS
			SHORT SPAN	LONG SPAN	SHORT SPAN	LONG SPAN		
RS1	150	1-WAY	T8@150	-	T8@300	-	T8@150	-
RS2	150	2-WAY	T8@150	T8@150	T8@300	T8@300	T8@150	-

SECTION	
TIES	T8 @ 75 C/C
MAIN REINFORCEMENT	16-T16
PEDESTAL DEPTH	1000
PEDESTAL SIZE (X x Y mm)	600 x 600
PEDESTAL	P4 (10)

NOTES:
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SAFETY AND STRUCTURAL STABILITY CERTIFICATE

Certified that the structural designs and drawings have been perused by me keeping in view the relevant IS codes and Sound Engineering practice these structural drawings are good for construction.

For Proof Checking

Dr. S.R. SATISH KUMAR
Professor
Department of Civil Engineering
Indian Institute of Technology Madras
Chennai - 600 036, INDIA

SIGNATURE OF DEPARTMENTAL OFFICER

REV NO:	DETAILS	DATE	DRAWN	CHECKED BY	APPROVED BY

CLIENT: DIRECTOR GENERAL OF NAVAL PROJECT VISHAKHAPATNAM (DGNP)

INDIAN NAVY

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

EPC CONTRACTOR:

इंजीनियरिंग प्रोजेक्ट्स (इंडिया) लि
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Module No.6C, 6th floor, Phase II Building,
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Phone No: 044-61210901, Web: cubeiitm.org
Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 SHEET NO : 9/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

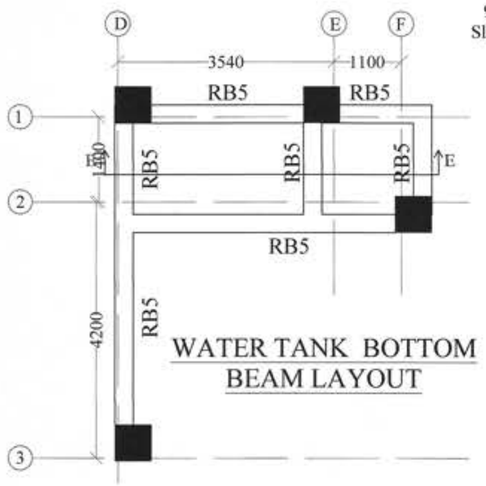
DRAWING TITLE : ROOF BEAM & SLAB LAYOUT AND REINFORCEMENT DETAILS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

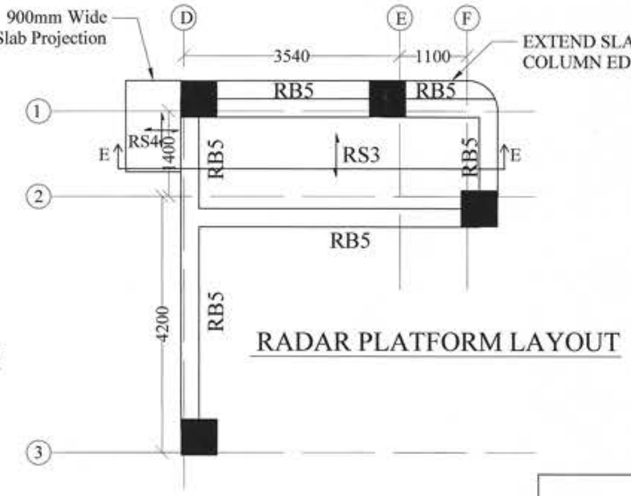
ISSUED FOR: SCALE: SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION ☐APPROVAL ☑CONSTRUCTION DATE OF ISSUE 27-08-2024

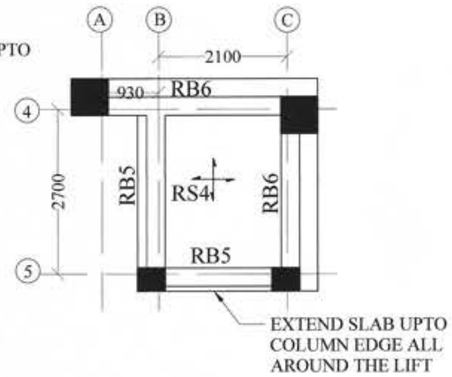
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



WATER TANK BOTTOM BEAM LAYOUT

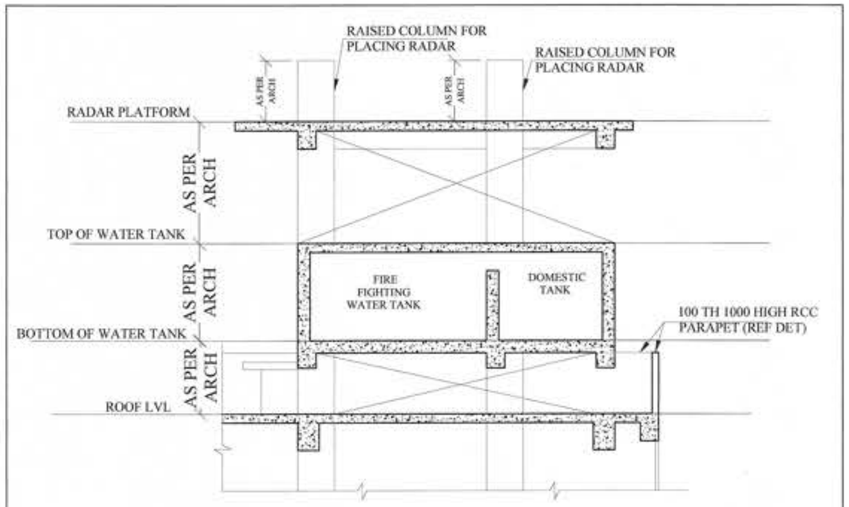


RADAR PLATFORM LAYOUT



LIFT TOP BEAM & SLAB LAYOUT

NOTE:
ALL THE COLUMNS HAVE BEEN DESIGNED FOR THE RAISED HEIGHT OF 1000 MM FROM RADAR PLATFORM LEVEL TO PLACE RADAR. PLACE THE RADAR AT REQUIRED LOCATIONS.



SECTION E-E

BEAM REINFORCEMENT DETAILS

BEAM NUMBERS	SIZE		BOTTOM REINFORCEMENT		TOP REINFORCEMENT			SHEAR STIRRUPS		REMARKS
	B (mm)	D (mm)	STRAIGHT	EXTRA MID SPAN	STRAIGHT	EXTRA LEFT SUPP	EXTRA RIGHT SUPP	STIRRUPS @ SUPPORTS (ST1)	STIRRUPS @ MIDSPAN (ST2)	
RB5	300	450	4-T12	---	4-T12	---	---	2L-T8@70C/C	2L-T8@100 C/C	---
RB6	300	450	4-T12	2-T12	3-T16	---	---	2L-T10@70C/C	2L-T10@150C/C	---

SLAB REINFORCEMENT DETAILS

SLAB NUMBERS	THK	TYPE	BOTTOM REINFORCEMENT		TOP REINFORCEMENT AT SUPPORTS		DISTRIBUTION	REMARKS
			SHORT SPAN	LONG SPAN	SHORT SPAN	LONG SPAN		
RS3	150	1-WAY	T8@150	-	T8@300	-	T8@150	-
RS4	150	2-WAY	T8@150	T8@150	T8@300	T8@300	T8@150	-

NOTES:
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Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 SHEET NO : 10/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

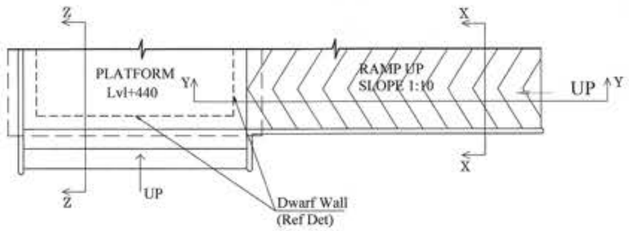
DRAWING TITLE : WATERTANK BOTTOM BEAM, LIFT BEAM & RADAR PLATFORM BEAM & SLAB LAYOUTS AND REINFORCEMENT DETAILS

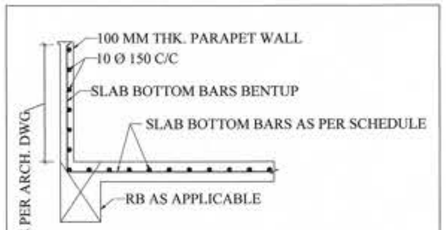
PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: SCALE: SIZE OF SHEET: A1

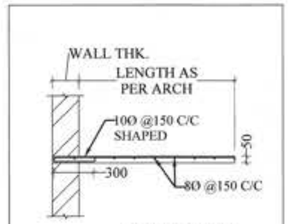
☐ PRELIMINARY ☐ TENDER ☐ INFORMATION
☐ APPROVAL ☑ CONSTRUCTION
DATE OF ISSUE 27-08-2024

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ

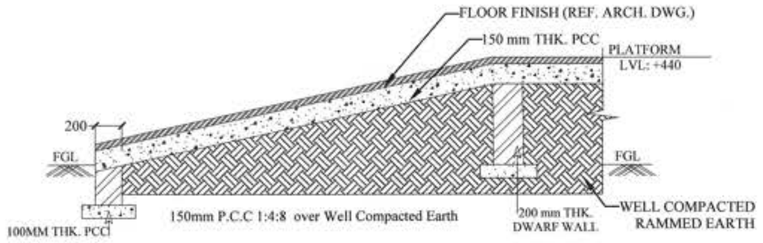




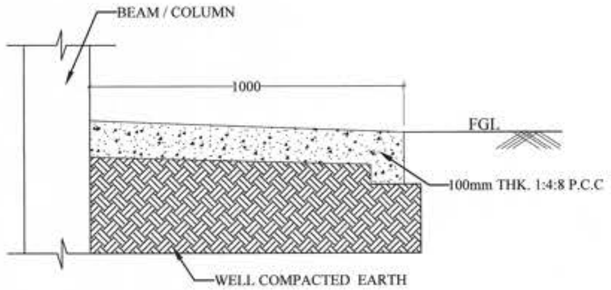
RCC PARAPET WALL OVER ROOF BEAM



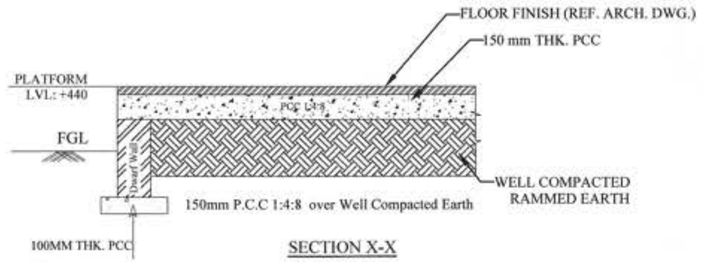
TYPICAL RCC SHELF PLATFORM



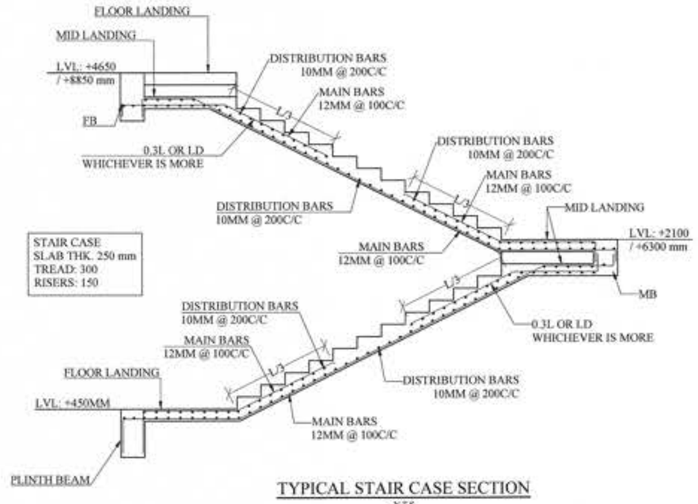
SECTION Y-Y



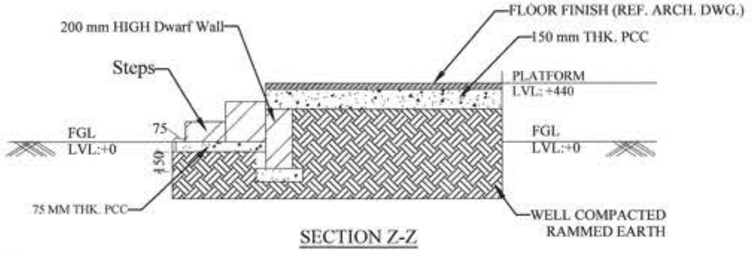
PLINTH PROTECTION
N.T.S



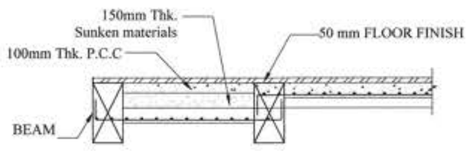
SECTION X-X



TYPICAL STAIR CASE SECTION
N.T.S



SECTION Z-Z



TYPICAL SUNKEN DETAILS

BEAM REINFORCEMENT DETAILS

BEAM NUMBERS	SIZE B (mm)	SIZE D (mm)	BOTTOM REINFORCEMENT STRAIGHT	BOTTOM REINFORCEMENT EXTRA MID SPAN	TOP REINFORCEMENT STRAIGHT	TOP REINFORCEMENT EXTRA LEFT SUPP	TOP REINFORCEMENT EXTRA RIGHT SUPP	SHEAR STIRRUPS STIRRUPS @ SUPPORTS (ST1)	SHEAR STIRRUPS STIRRUPS @ MIDSPAN (ST2)	REMARKS
MB	300	450	3-T20	---	3-T16	2-T20	2-T20	2L-T10@70C/C	2L-T10@70C/C	---

NOTES:
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For Proof Checking

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Chennai - 600 036, INDIA

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Phone No: 044-61210901, Web: cubeiitm.org
Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 11/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

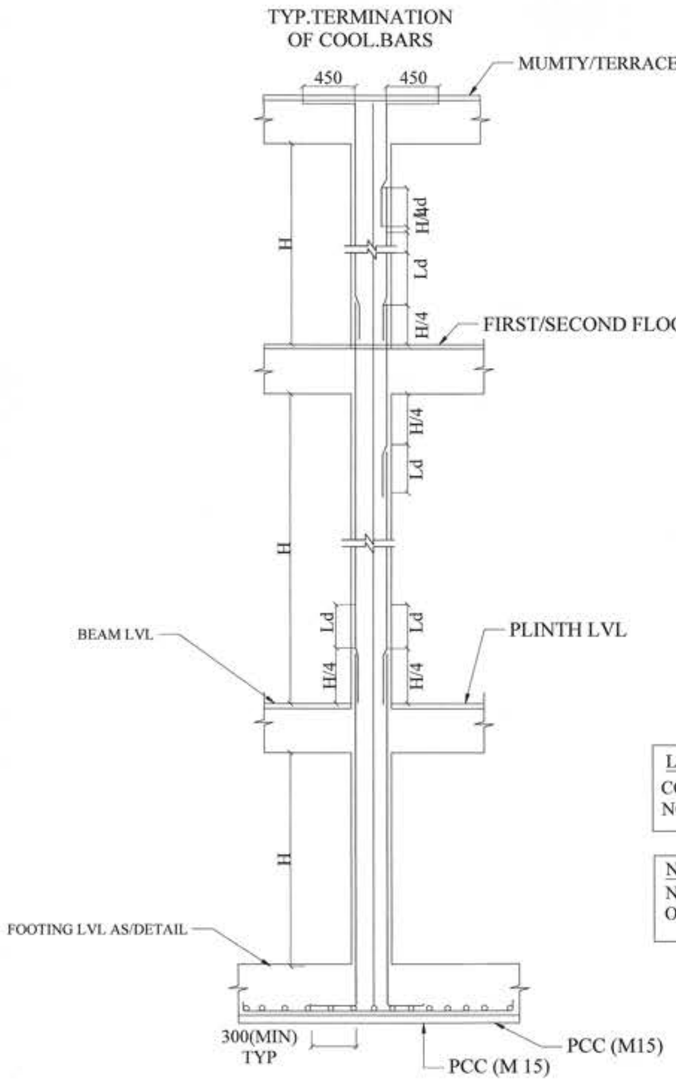
DRAWING TITLE : RAMP, PLATFORM, STAIRCASE AND TYPICAL REINFORCEMENT DETAILS

PROJECT CODE: CUBE/H&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION ☐APPROVAL ☒CONSTRUCTION | DATE OF ISSUE 27-08-2024

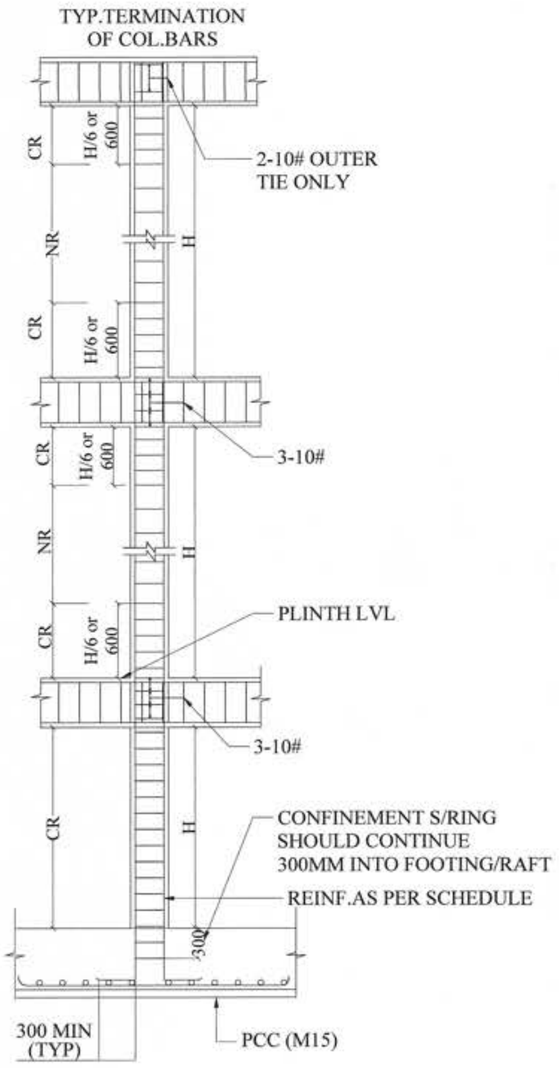
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



LEGEND:
CONFINING REINFT (CR)
NORMAL REINFT (NR)

NOTES:
NOT MORE THAN $\frac{1}{2}$ BARS TO BE OVERLAPPED AT ONCE LOCATION

TYP.SPLICING DETAIL FOR COLUMN REINF.AT INTERMEDIATE LEVELS



TIE SPACING DETAILS

NOTES:
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SIGNATURE OF DEPARTMENTAL OFFICER

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VISHAKHAPATNAM
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EXECUTING AGENCY:
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Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 12/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

DRAWING TITLE : TYPICAL DETAILS OF COLUMNS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION
☐APPROVAL ☑CONSTRUCTION
DATE OF ISSUE 27-08-2024

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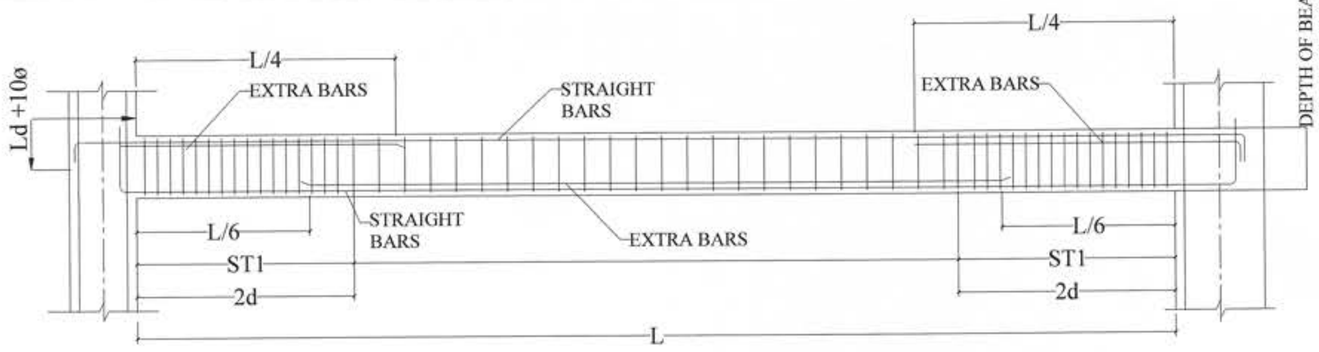
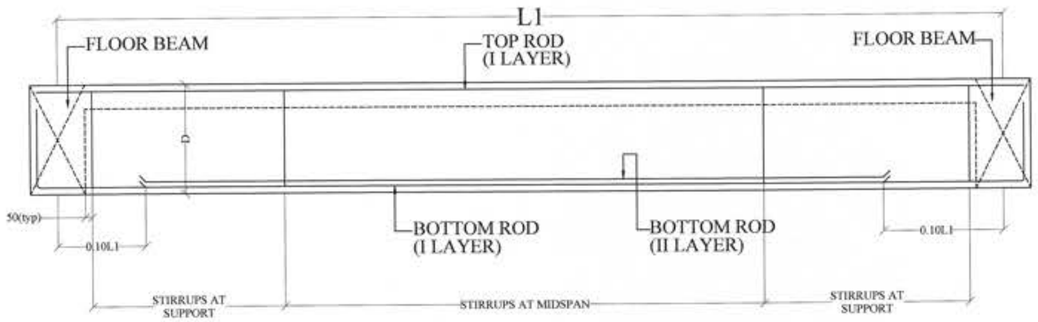


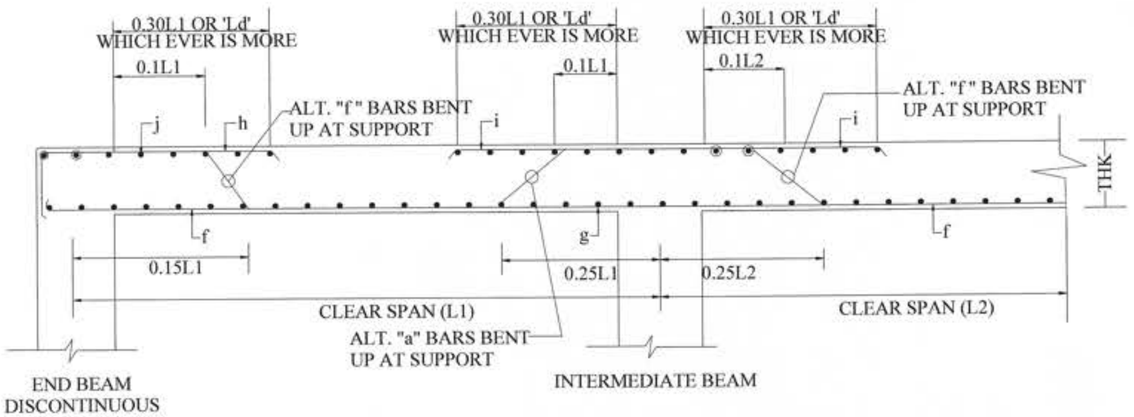
TYPICAL DETAILS OF RCC BEAM

d- EFFECTIVE DEPTH OF BEAM
L- CLEAR SPAN OF BEAM
2d-CONFINING ZONE



(N.T.S)

TYPICAL DRAWING OF SECONDARY BEAM



f- Bottom Main Bar
g- Bottom Main bar(for two way slab) /Distribution bar (for one way slab)
h- Top extra bar at supports
i- Top extra bar at continuous support
j- Distribution bar

TYPICAL DETAILS OF RCC SLAB

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INDIAN NAVY

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

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DRAWING NO: EPIL/WP07/PCT/STR/013 | SHEET NO : 13/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

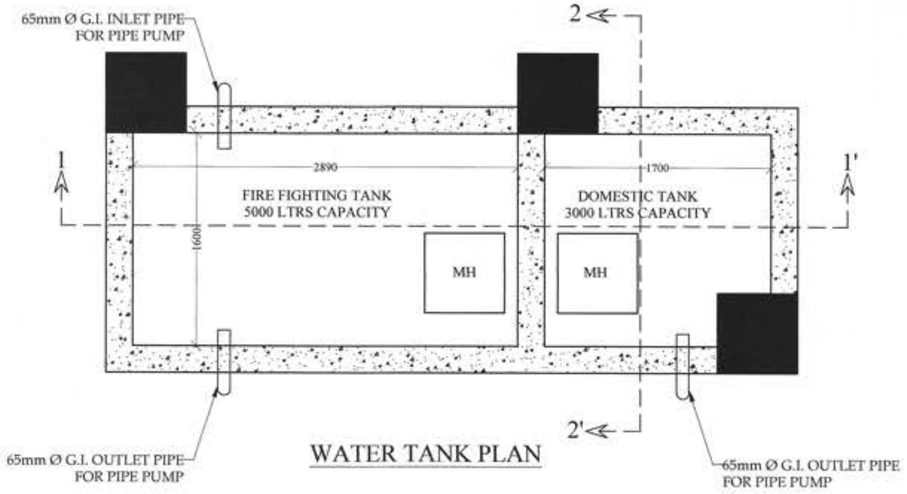
DRAWING TITLE : TYPICAL DETAILS OF BEAMS, SLABS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

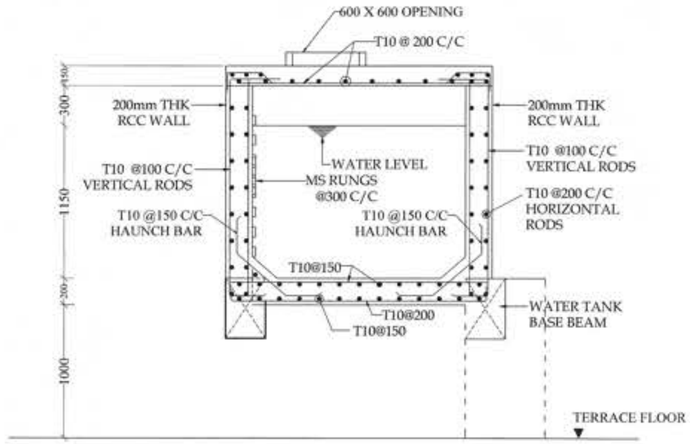
ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION
☐APPROVAL ☑CONSTRUCTION
DATE OF ISSUE 27-08-2024

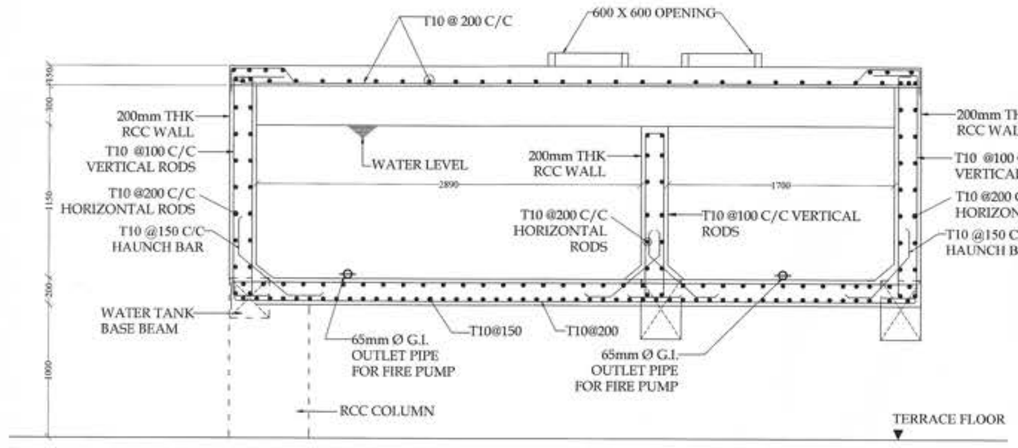
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



WATER TANK PLAN



SECTION 2-2'



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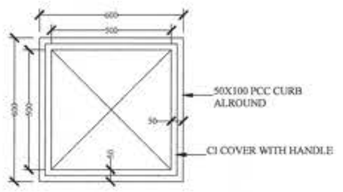
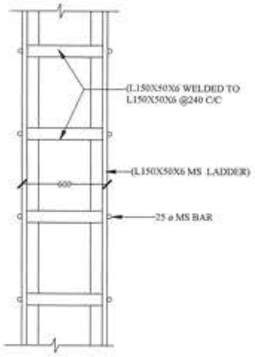
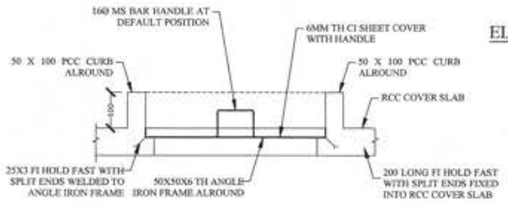


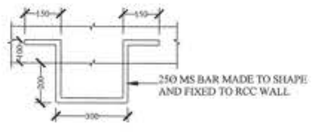
DETAILS OF 600X600 OPENING



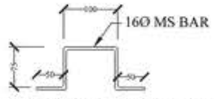
ELEVATION OF LADDER



FIXING DETAIL OF CI COVER



DETAIL OF MS RUNG



DETAIL OF MS HANDLE BAR

NOTE FOR WATER PROOFING:

1. AFTER SIDE WALLS ARE CONSTRUCTED, WATER PROOF CEMENT PLASTER 1:3 MIX WITH SUITABLE PROPORTION OF AN INTEGRAL WATER PROOFING COMPOUND SHOULD BE APPLIED IN TWO COURSE, THE FIRST COAT BEING 12MM THICK AND NEXT 10MM THICK. THIS SHALL BE APPLIED ON BOTH FACES.
2. PROVIDE BITUMEN FELT/BITUMEN MASTIC AT ALL JOINTS AND BELOW THE BASE IF REQUIRED.

NOTE :

1. INLET AND OUTLET PIPE LOCATION AND DIA NEED TO PROVIDED BY CLIENT.
2. ADDITIONAL REINFORCEMENT HAS TO BE ADDED IN INLET AND OUT LET PIPE.
3. SLOPE OF THE INNER BOTTOM P.C.C WITH WATER PROOFING SHALL BE DECIDED BASED ON PIPE LOCATIONS.
4. WATER STOPPER SHOULD BE PROVIDED IN THE CONSTRUCTION JOINT LOCATION.
5. BOTTOM SLAB REINFORCEMENT MAY CURTAILED TILL OTHER END OF BEAM.

NOTES:

SAFETY AND STRUCTURAL STABILITY CERTIFICATE

Certified that the structural designs and drawings have been perused by me keeping in view the relevant IS codes and Sound Engineering practice these structural drawings are good for construction.

For Proof Checking

Dr. S.R. SATISH KUMAR
Professor
Department of Civil Engineering
Indian Institute of Technology Madras
Chennai - 600 036, INDIA

SIGNATURE OF DEPARTMENTAL OFFICER

REV NO:	DETAILS	DATE	DRAWN	CHECKED BY	APPROVED BY

CLIENT: DIRECTOR GENERAL OF NAVAL PROJECT VISHAKHAPATNAM (DGNP)

INDIAN NAVY

EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

EPC CONTRACTOR:

इंजीनियरिंग प्रोजेक्ट्स (इंडिया) लि
(भारत सरकार का उद्यम)
ENGINEERING PROJECTS (INDIA) LIMITED (EPI)
(A GOVT OF INDIA ENTERPRISES)

PRINCIPAL CONSULTANT:

CENTRE FOR URBANIZATION BUILDING ENVIRONMENT [CUBE]
(An Outfit of IIT Madras & Centre of Excellence of Govt of Tamil Nadu)
Module No.6C, 6th floor, Phase II Building,
IIT Madras Research Park, Kanagam Road,
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Phone No: 044-61210901, Web: cubeiitm.org
Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 14/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

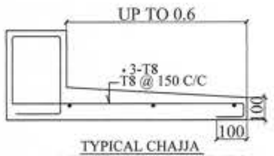
DRAWING TITLE : WATER TANK REINFORCEMENT DETAILS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

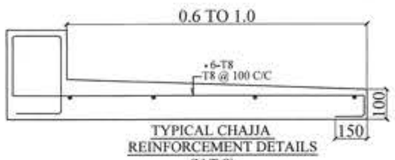
ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION ☐APPROVAL ☑CONSTRUCTION | DATE OF ISSUE 27-08-2024

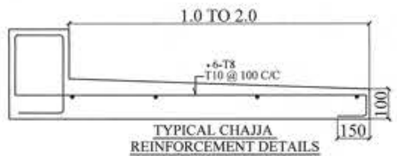
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
PSK	SB	NK	SM	JJ



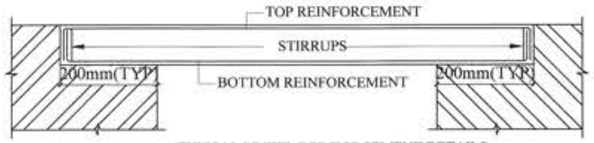
TYPICAL CHAJJA REINFORCEMENT DETAILS
(N.T.S)



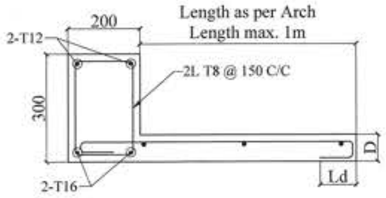
TYPICAL CHAJJA REINFORCEMENT DETAILS
(N.T.S)



TYPICAL CHAJJA REINFORCEMENT DETAILS
(N.T.S)



TYPICAL LINTEL REINFORCEMENT DETAILS
(N.T.S)



TYPICAL R.C.C SLAB FOR PLATFORM / COUNTER TOP / SHELVE
N.T.S

SCHEDULE OF RCC SLAB FOR PLATFORM / COUNTER TOP / SHELVE						
S.NO	CLEAR SPAN	BEARING IN WALL (mm)	SLAB THICKNESS (D)	REINFORCEMENT		REMARKS
				SHORTER SIDE	LONGER SIDE	
1	UPTO 600	200	120	8 @ 100 C/C	8 @ 100 C/C	WIDTH OF THE SLAB NOT BE MORE THAN 2M, PROVIDE A WALL SUPPORT IF IT IS EXCEEDING 2M.
2	UPTO 1000	200	150	10 @ 100 C/C	10 @ 100 C/C	

SCHEDULE OF R.C.C LINTELS

S.NO	CLEAR SPAN	BEARING IN mm	DEPTH IN mm	THICKNESS OF WALL IN mm	REINFORCEMENT (BOTTOM BARS)	TOP BARS		STIRRUPS	REMARKS
						THROUGH	EXTRA SUPPORT		
1	UPTO 1200 OPENING	150	250	100/115	2- T8	2- T10	-	T8 @150 C/C	-
2	UPTO 1500								
	(a) OPENING W/O CHAJJA (UPTO 1500)	150	200	200/230	2- T8	2- T10	-	T8 @100 C/C	-
		150	200	300/345	3- T8	2- T10	-	T8 @100 C/C	-
		150	200	380/450	4- T10	2- T10	-	T8 @100 C/C	-
	(b) OPENING WITH CHAJJA (UPTO 1500)	150	200	200/230	2- T10	2- T10	-	T8 @100 C/C	-
		150	200	300/345	4- T8	2- T10	-	T8 @100 C/C	-
		150	200	380/450	3- T10	2- T10	-	T8 @100 C/C	-
	(c) OPENING WITH CHAJJA AND FACIA(UPTO 1500)	150	200	200/230	3- T10	2- T10	-	T8 @100 C/C	-
		150	200	300/345	3- T10	2- T10	-	T8 @100 C/C	-
		150	200	380/450	4- T10	2- T10	-	T8 @100 C/C	-
3	FROM 1501 TO 2150								
	(a) OPENING W/O CHAJJA (FROM 1500 TO 2150)	200	200	200/230	3- T12	2- T10	1- T12	T8 @100 C/C	-
		200	200	300/345	2- T16	2- T12	1- T12	T8 @100 C/C	-
		200	200	380/450	2- T16	2- T12	1- T12	T8 @100 C/C	-
	(b) OPENING WITH CHAJJA (FROM 1500 TO 2150)	200	250	200/230	3- T12	2- T10	1- T12	T8 @100 C/C	ALSO APPLICABLE IN CASE OF CHAJJA WITH FACIA
		200	250	300/345	2- T16	2- T12	1- T12	T8 @100 C/C	
		200	250	380/450	2- T16	2- T12	1- T12	T8 @100 C/C	
4	(a) OPENING W/O CHAJJA (FROM 2150 TO 3000)	250	250	200	2- T20	2- T12	1- T12	T8 @100 C/C	-
		250	250	300	2- T20	2- T12	1- T12	T8 @100 C/C	-
		250	250	380/450	2- T20	2- T12	1- T12	T8 @100 C/C	-
	(b) OPENING WITH CHAJJA (FROM 2150 TO 3000)	250	300	200/230	2- T20	2- T10	1- T12	T8 @100 C/C	ALSO APPLICABLE IN CASE OF CHAJJA WITH FACIA
		250	300	300/345	2- T20	2- T12	1- T12	T8 @100 C/C	
		250	300	380/450	2- T20	2- T12	1- T12	T8 @100 C/C	

NOTES:
1.ALL DIMENSIONS ARE IN "mm" UNLESS OTHERWISE SPECIFIED.
2.THIS DRAWING SHOULD BE READ WITH ALL OTHER RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWINGS.

4. REFER GENERAL NOTES FOR DETAILED INFORMATION.

SAFETY AND STRUCTURAL STABILITY CERTIFICATE

Certified that the structural designs and drawings have been perused by me keeping in view the relevant IS codes and Sound Engineering practice these structural drawings are good for construction.

For Proof Checking
Dr. S.R. SATISH KUMAR
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Department of Civil Engineering
Indian Institute of Technology Madras
Chennai - 600 036, INDIA

SIGNATURE OF DEPARTMENTAL OFFICER

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EXECUTING AGENCY: GE (ATV) VISAKHAPATNAM

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Module No.6C, 6th floor, Phase II Building, IIT Madras Research Park, Kanagam Road, Taramani, Chennai, Tamil Nadu -600113. Phone No: 044-61210901, Web: cubeiitm.org Mail : office@cubeiitm.org

DRAWING NO: EPIL/WP07/PCT/STR/010 | SHEET NO : 15/15

PROJECT TITLE:
PROVISION OF ADMINISTRATIVE AND LOGISTICS INFRASTRUCTURE INCLUDING SCHOOLS, HOSPITALS, AUDITORIUMS, AND SPORTS FACILITIES (BUILDINGS/STRUCTURES ON EPC MODE) INCLUDING SERVICES UNDER WP-07 AND PROVISION OF SEWAGE TREATMENT PLANT UNDER WP-5B AT NAVAL STATION RAMBILLI, VISAKHAPATNAM.

BUILDING NAME : PORT CONTROL TOWER

DRAWING TITLE : DETAILS OF RCC LINTELS & RCC CHAJJAS

PROJECT CODE: CUBE/B&C/2023-24/042/EPIL_WP07

ISSUED FOR: | SCALE: | SIZE OF SHEET: A1

☐PRELIMINARY ☐TENDER ☐INFORMATION ☐APPROVAL ☒CONSTRUCTION | DATE OF ISSUE 27-08-2024

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PSK	SB	NK	SM	JJ